UNIV. OF
TORONTO
LIBRARY

BINDING LIST MAY 1 5 1922

UNIVERSITY OF TORONTO
NOV 8 1922
DEPT OF
MINING ENGINEERING

DEPARTMENT OF MINING ENGINEERING
Library Number 1263
Return this book to
Cupboard: 1
Shelf x 2
All books are to be signed for in the loan book when borrowed, and when returned.
Books must be returned within One Week, unless special permission is given for a longer time.

Digitized by the Internet Archive
in 2010 with funding from
University of Toronto

http://www.archive.org/details/emjengineeringmi112newy

~~Techmet~~
~~E.~~

Engineering and Mining Journal

INDEX TO VOLUME 112

July 1 to December 31, 1921

173033
20/7/22.

McGRAW-HILL COMPANY, INC.
10TH AVENUE AT 36TH STREET
NEW YORK

TA
1
E42
V.112

Engineering and Mining Journal

INDEX TO VOLUME 112

July 1 to December 31, 1921

EXPLANATORY NOTE

Illustrated articles are denoted by an asterisk (*); book notices and technical papers by a dagger (†).

This index is made comprehensive but concise. Pains are taken to bring together matter belonging to same subject so that when a reader looks up an article he will be cited to related data. Series of simple page numbers following names of mines or companies usually refer to news notes. With a major entry or series of entries may be placed several minor ones, relating to the same subject in order that its history may be followed. If the author's name be known it is the simplest means of reference. Productions are indexed under names of metals and countries or states. The mere juxtaposition of a mineral and geographical name usually signifies an output but may cover other statistical or news matter.

Following is a list of the pages included in the several numbers of the volume by date:

July	2	Pages	1-40
"	9	"	41-80
"	16	"	81-120
"	23	"	121-160
"	30	"	161-200
Aug.	6	"	201-240
"	13	"	241-280
"	20	"	281-320
"	27	"	321-360
Sept.	3	"	361-400
"	10	"	401-440
"	17	"	441-480
"	24	"	481-520
Oct.	1	"	521-560
"	8	"	561-600
"	15	"	601-640
"	22	"	641-680
"	29	"	681-720
Nov.	5	"	721-760
"	12	"	761-800
"	19	"	801-840
"	26	"	841-880
Dec.	3	"	881-920
"	10	"	921-960
"	17	"	961-1000
"	24	"	1001-1040
"	31	"	1041-1080

A

Page

Abbe, C., Jr. 224
Abbott, C. E. 383
Abolish Extralateral Rights. Editorial 841
Abrasives—motion pictures 190
Absentee Capitalism. Editorial 522
Acacia, Colo. 474
Accidents .... †24
—Anaconda's percentage 217, 603
—Industrial Accident Commission of California Engineer Member 803
—Metal Mines, 1920 .... 787, 904
—Tri-State District Statistics 871
—Utah ore-dressing plants 409
Activity of Mr. Rice. Editorial 43
Adams, A. K.—Death 64
Adams, C. L. 266
Adargas, Chih. *631, 432
Admiral, Wash. 194
Admiralty Zinc Co., Mo. 715
Aerial Transportation—Diamonds 645
African Mining Laws .... †545
Afterthought Copper Co 267, *286, 287
—vs. G. C. Carson 207, 314, 391, 427
Against Engineer Licenses. Editorial 161
Ageton, R. V.—Socketing hoisting ropes with zinc .... 2 p. *219
Agnew, G. B. 987
Agnew, J. C. 867
Ahumada Lead, Chih. 388, 831, 1032
Aichan Bee, Wash. 433
Ainsworth, W. F. 188
Air-compressor operation .... †422
Air-lift calculations (Young) 861
Air Lift—Chino Copper Co. (Anderson) .... 6 p. *806
Air receiver calculations 244, 885
Air under pressure 535
Ajax, B. C. 149
Ajax, Colo. 514, 874
Alabama—Industrial conditions 553, 627, 751, 872, 954, 955
Alabama Land Syndicate 1035
Alabama University—Fellowships 223
Alaska—Appropriation inadequate 470
—Bureau work reorganization 148
—Copper production 629
—Map .... †825
—Mineral resources and output, 1920 .... 213, 1027
—Mining activities .... †143
—Mining conditions 949
—Mining (Rice) 588
Alaska Gastineau Mng. Co. 402
—Editorial 242
Alaska-Juneau, Alaska 748, 871, 992
Alaska (Lyon) 866
Alaskan mineral resources .... †422
Albany, Minn. 232
Alberta mineral resources .... †264
—Petroleum 62
Alcaparra, Chih. 431
Alchemy 124, 284, 484, 605
Aldridge, W. H. 426
Algerian phosphate industry 290
Algunican Co., B. C. 69
Allan, T. H. 26, 145
Allen, C. E. 1066
Allen, G. L. 28, 743
Allen, R. C. 547
Allied Chemical & Dye Co., Utah 433, 788
Allied Porcupine, Ont. 230, 431
—La Palme Porcupine Mines 671
Alling, G., Dr. 626
Alred, N. C 114, 952
Alsace—Draining oil reservoirs (de Chambrier) 103
Alsatian potash .... †985
Alta, Col. 389
Alta, Utah 673, 714, 749, 795, 833, 875
Aluminite, Alunite and Cadmium 179
Aluminum—Muscle Shoals 995
—World's output 10
Alunite .... †662
Alvarado M. & M. Co. Oreskip *20
Amalgamated Asbestos Corp. *367
Amalgamation—Dressing plates (Flury) 578
Amazon-Dixie, Ida. 153
Amber—Discovery Coalmont, B. C. 1070
Ambler, J. O. 987
Ambrose, A. W. 346
American Association for the Advancement of Science—Toronto Meeting 1065
American Brass Co., Mont. 749, 953, 989, 1028, 1067
—Anaconda Merger. Editorial 1041
American-Commander M. & M. Co. 153
American Eagle, Ida. 71
American Engineering Council. See Federated American Engineering Societies.
American Flag Mine, Utah 231
American Frenchman, Colo. 673
American Gem Mng. Syndicate, Mont. 390
American Geographical Society — Latin American Research 707
American Institute of Mining & Metallurgical Engineers—Boston 625, 1026
—Charlston, W. Va., section 223
—Columbia section 105, 304, 387, 584
—Committee Plan. Editorial 42
—Convention 1922 1068
—Membership. Editorial 481
—Mixed Copper Ore Treatment Discussion 1065
—*Mining and Metallurgy* 85, 404, 405
—*Mining and Metallurgy*. Editorial 82, 401
—Nevada meeting 105
—New sections authorized 27
—New York Section 986, 1002
—Presidency 429
—Revival of Mining Industry Discussion 1041
—San Francisco 425, 546, 625
—St. Louis Section 945
—Support. Editorial 401
—Tulsa Section 584
—Wilkes-Barre .... 423, 7 p. 485
American Iron & Steel Institute Annual Report .... †702
American Manganese Mfg. Co. 871, 948, 953
American Metal Co. 793
American Mineral Production Co. 28
American Mining Congress—Annual convention 345, 703
—Committee on Metal Mine Regulations. Editorial 2
—Dept. of Mines Bill 144
—October meeting 265
American Petroleum Institute—Chicago meeting 986
American Smelters—Dividends 279, 756
American Smelters Securities Co., Chih. 7 p. 1050
American Smelting & Refining Co., Cal. 868, 912, 952, 989
—Dividends 39, 639
—Half Yearly Report, 1921 679
—Mexico department 69, 150, 353, 553, 712
—Mont. 875
—Utah 432
American Trona 950
American Zinc Institute—Picher, Okla. 913
American Zinc Institute Pioneers. Editorial 1002
—Tariff 350, 428
—Tri-State Branch meeting 834
Amory Stevens, N. M. 912, 1033
Amparo Mng. Co., Jalisco 312, 1048
—Dividends 439, 959
—Report, 1920 72
Ampliacion de Palmira, Chih. 353
Anaconda Accident Rates. Editorial 603
Anaconda-American Brass Merger. Editorial 1041
Anaconda Copper Mng. Co., Mont. 113, 154, 231, 355, 555, 593, 672, 714, 749, 833, 875, 912, 948, 953, 993
—American Brass Co. 989, 1028, 1067
—Copper roofing 627
—Davidson Chemical Co., contract 1074
—Reports. Editorial 122
—Shares as Investment (Wolf) 1077
—Taxes 384
—vs. Goon 65
—Zinc 663
Anaconda Copper Shares as Investment (Wolf) 1077
Anaconda's accident percentage 217
Anantapur Gold Mines 830
Anatolian Mines 906
Anderson, B. G.—Mine sampling methods Tyrone, N. M. .... 4 p. 531
Anderson, H. G. S.—Tailing Air Lift of Chino Copper Co. .... 6 p. 806
Anderson, J. C. 112, 266
Anderson, L. D. Career *19
Andes, Ariz. 312
Andes Corporation, So. America 183
Anglo-American Corporation of So. Africa 718
Angora—French Exploitation Concession 788
Angst, R. A. 305, 666
Anita Copper Co., N. M. 272, 1033
Ankerite Extension, Ont. 387
Annapolis, Mo. 954
Annual Progress Number. Editorial 1044
Anselmo, Mont. 231, 555
Ansen, E. 112
Answer to Prospective Correspondents. Editorial 202
Antimony .... †344
—Durango 170
Apache Powder Co., Ariz. 272, 913
Apex Procedure Defended (Winchell) .... 2 p. 163
Apex Standard, Utah 71
Aporoma Goldfields, Peru 830
Appleby, W. R. 506
Application of National Defense Tariff Theory. Editorial 202
Applying cost sheet to mine operation. Editorial 122
Aragon, Mich. 434
Aramayo, Francke & Co., Bolivia 198, 711
Arbitration in Guanajuato 762
Arc Diamond, So. Africa 472
Arcadian, Mich. 715, 913, 1071
Archibald, R. S. 109, 188
Arcturus, Minn. 34
Arentz Bill. See "Mining Law Revision."
Argentina Mining (Walker) .... 4 p. *291
Argentina—Petroleum 262, 984
—Mendoza-Neuquen district (Redfield) 23
Argentine, Ida. 71
Argentine oil and labor conditions (Lamb) .... 2 p. 221
Argentite—Boom in Nevada 633
Argonaut, Cal. 994
Argonaut, Ont. 552
Arizona—Industrial conditions 955, 751
—Industrial conference 906, 1029
Arizona—Taxation 353
Arizona & New Mexico R.R. 794, 995, 1033
Arizona & Swansea R.R. 794
Arizona Asbestos Association 192
Arizona Barium Co., Ariz. 951
Arizona Commercial—Iron Cap 873, 989, 1068
Arizona Copper Co., Ariz. 192, 312, *332-3, 349, 630, 951, 988
—Reports, 1920-1921 639
—Sale 588
—vs. Coronado Mfg. Co. 591
Arizona Corporation Commission — Delinquent companies 669
Arizona Hercules 988
Arizona-Jerome Copper Co.—vs. Thos. Smart 69
Arizona-United Mng. Co., Ariz. 632
Arkansas—Phosphate survey 188
—Power 469
—Wildcat Wells 263
Arkansas Fuller's Earth Ref. Co., Ark. 555
Armour No. 2, Minn. 114
Armstead, H. H. 64, 224
Armstead, Ida. 193, 273, 714, 993
Armstrong Bay, Minn. 554
Arnett, W. D. 743
Arnold, E. C.—Death 1027
Arsenic—China—Smelting (Slessor) *695
Asbestos .... *143, †184
—Asiatic Russia 788
—Black Lake (Hummard) .... 4 p. *365
—Prices 1912-1929 559
—So. Africa 790
—Twine 965
Asbestos Corp.—Dividends 279, 756
Asbestos Crude & Fibre Corp. 368
Asbestos Mining in the Black Lake Area (Lindsay) 523
Ashland, Mich. 114
Assay reports (Sheldon) 331
Assaying—Low's analysis methods 376, 660
Assays and Assayers. Editorial 41
Assessment work 28, 226, 268, 308, 551, 698, 907
Assessment work and abandonment 577
—Editorial 121
Associated Gold Fields, Ont. 112, 831
Associated Lead Manufacturers 29
Association of American State Geologists 425
Asuncion Mine, Gto. 31
Atkins, C. T.—Death 787
Atlas, Ont. 69
Attitute of Mining Students. Editorial 561
Augustias, Gto. 31
Aurora, Gto. 271
Australia—Petroleum 991
—Silver-Lead 439
—Zinc situation 236
Australian data .... †464
Austria-Magnesite—Exports 350
Auxer Gold Mng. Co., Ida. 71, 714
Avalos, Chih. 271
Avery, E. H. B. 743
Avery Island, La. *6
Avery, W. W. 905
Awakening. Editorial 162
Ayan Corp., Ltd., Siberia 745
Ayer, F. 547

Page

B

Babcock, Prof. 145
Babine Bonanza, B. C. 149
Bacon, D. M. 506
Bacubarito Placer Mng. Co., Mex. 831
Bacubirito-Sinaloa Gold Placers, Inc., Cal. 591
Badger State, Mont. 512
Bailey Cobalt Co., Ont. 352, 590
Bailey, F. C. 826
Bailey Silver Mines, Ont. 591, 1032
Bain, H. F. 383
—Bureau of Mines and private investigations 3 p. 450
—Mining law revision 746
—Undeground developments 268, 321
—Zinc 148
Bajo, Japan 966
Baker, R. C.—Portable acetylene generator for welding 779
Balaklala Cons. Copper Co. 287
Baldwin, A. R. 1066
Balkan, Mich. 194
Ball, C. O. 26
Ball, S. H.—Mining as seen by Herodotus. 614
Ball and roller bearings †985
Ballard, S. M. 185
Ball mill—Laboratory (Fahrenwald) •579
—Liners (Lawler) 44
—Peripheral discharge (Hardinge) 683
—Rail linings 778, 899
Balls, maverick nature (Lawler) 5
Bamberger, E. 106
Banks, R. M. 787
Bantjes Consolidated 149
Barber, M. H. 666
Barbour, P. E. 26
Barnes, B.—Dignity of engineering 205
Barnes-King Dev. Co., Mont. 231, 714, 750, 875
—Quarterly Reports 397, 1039
Barry Webster, Ont. 387
Barstow, Colo. 70, 389, 952
Baruch, B. M. 110
Barytes—Preparation and Use 1061
—Tariff 227, 309
Bass, N. F. 585
Bastin, E. S. 266
Batchelder, B. W. 547
Bateman, A. M. 106, 506
Bateman, G. C. 826
—Water-tight underground dam 900
Bates, Mich. 194
Bauxite—Alabama 995
—Australia 907
—United States Production 294
Bawdwin, Burma 69
Bay Horse, Ore 833
Bayonne, B. C. 387
Beal, C. H.—Unjust taxation Calif. oil properties 2 p. 342
Beans to Bonus. Editorial 403
Beaver Cons. Mines Co., Ont. 747
—Report 1920-21 159
Beckett, P. G. 867, 987
Belanger Chrome Mines, Ont. 112
Belcher Islands iron ore deposits (Woodbridge) 4 p. •251
Belgian Congo—Radium 1010
Belgian metal market 225
Belgium—Zinc situation 236
Bell, J. W 426
Belle Baker, Ore. 194
Bell-Mankin, Ore. 512
Belmont, Nev. 434, 749
Belmont Shawmut M. Co., Cal. 513
Belmont-Wagner Mng. Co., Col.—Alta mine 389
Belt, gear and chain drives for grinding mills (Young) •3 p. 969
Belts—Side next Pulley 1063
Ben Hur, Nev. 391
Bendelari, A. E. 707
Bender, Ariz. 389
Bennett, C. A. 106
Bennett-Martin Asbestos Co., Ont. 112
Benson, Ariz. 312
Benson, W. T. 266
Bentonite 819
Berkshire, Mich. 434
Berry, E. S.—Mining Investments 837
Berry, E. W.—Limestones and marls, North Carolina †303
Bertha, Colo. 354
Best, B. G.—Curve chart for drift work. •101
—Handling ore and timber in removing shaft pillar 937
Best Friend, Colo. 474
Betts, Nev. 1073
Betty O'Neal, Nev. 953
Big Cottonwood Coalition Mines Co., Utah 832
Big Creek, Ida. 230
Big Dick, Mont. 672
Big Dyke, Ont. 352
Big Four Mng. Co., Nev. 32
Big Ledge Copper Co., Ariz. 151, 591
Big Missouri, B. C. 590
Bilharz, Okla. 913, 977
Bingham-Galena, Utah 27, 153, 312
—Editorial 162
Bingham Mines Co., Utah 433
Bingham & Garfield R.R. 795
Biographical Sketches. Editorial 762
Bird Creek Mng. Co., Colo. 952
Bisbee, D. W.—Death 743
Bisbee Deportation. Editorial 522
Bischoff, Tasmania 586
Bisichi Tin Co. Nig. 990
Bismuth—Determination (Critchett) 58
—Durango 172
—Prices 198
Biwabik, Minn. 474
Black Hawk Copper Co., Ariz. 192
Black Lake Asbestos Area (Hubbard) 4p., •365, 683
Black Lake Asbestos & Chrome Co., Que. 112, •365-6-8, 910, 992
—Comments 523, 564

Page

Black Metal, Nev. 1073
Black Prince Mng. Co., Nev 355
Black Rock, Mont. 113, 154, 474, 555, 672
Blackburn, W. H. 1027
Blacktail Mng. Co., Ida. 231
Blanton, Rep. 142
Blast Furnaces. See "Furnaces."
Blasting Mats 257
Blewett, Wash. 392
Blue Bell, Utah 70, 153
Blue Bird, B. C. 270
Blue Bird, Ida. 33, 273
Blue Horse Mng. Co., Nev. 473
Blue Mound, Okla. 674
Blue Mountain Mines Co., Ore. 71
Blue Nose, Ariz. 312
Blue Ribbon, Okla. 834
Blue-Sky Legislation 470, 950
Bluster Consolidated, Nevada 473
Boericke, W. F.—Mule Haulage in Metal Mines 853
Bohemian Mng. Co. 432, 713, 912
Boleo, Baja, Cal. 225, 511
Bolivia—Tungsten—Unique Deposits (Hess) 6 p., •492
Bolshevism. Editorial 321
Bonanza Gold Mng. Co., Nev 473
Bonanza King, Cal. 911
Bonanza Mines Co., Col. 354
Bonardi, J. P. 266
Bonneville Dev. Co., Utah 107
Boom Derrick—Air Cylinder Operation •462
Boras Leasing Co., Ariz. 34, 312
Borax—Arizona 995
—Callville Wash (Gale) 7 p. 524
Borcherdt W. O.—National Geographic Society 205
Borden, R. 506
Borg, J. 224
Boston—American Mng. Co., Wash 512
Boston & Ely Cons. Mng. Co., Nev 314, 953
Boston & Montana Dev. Co., Mont. 71, 113, •193, 273, 390, 433, 512, 633, 714, 750, 795, 993, 1074
Boswell Extension, Ore. 392
Boswell mine, Ore. (Parks) 2 p. •107
Boulder County Metal Mng. Association 952
Bourkes, Ont. 831
Bowles, O. •305
Bowman, R. E. 547
Boyd, J. T. 346, 905, 987
Boyd, W. T. 192
Boydell, H. C.—Euboean Magnesite Field 771
Boyle, E. D. 466
Brackman, H. D. 150
Braden Copper Mines Co.—Report, 1920 119
Bradley, F. W 224, 346, 426, 743
—Career •980
Bradshaw, F. 707
Bramlette, M. N. 585
Brandes, C. H. 826
Brandy City Mng. Co., Cal. 749
Branner, J. C. 45
Brayton, C. C. 64
Brazil as Mining Country (Packard) 8 p. •45
Brazil—Copper 51
—Diamonds 51
—Gold 48, †702
—Iron Ore Mining (Geissel) 729
—Manganese 48
—Oil Shales 47
—Potash 47
Briar, J. 106
Briber, F. E. 506
Bridgeport Iron & Metal Co 269
Bristol Silver Mines Co., Nev. 112, 1073
Britannia M. & S. Co., B. C. 628, 744, 991, 1069
British America Nickel Corp., Ont. 30
British-American Mfg. Co. 1029
British Columbia Chamber of Mines 149
British Columbia—Industrial Conditions 828
—Minerals †24
—Radium discovery 68
British Columbia Mng. Association 871
British Columbia Ore Deposits †344
British Columbia Prospectors Association. 68, 191
—Radium discovery 68
British Malaya—Mining 469
British Opinion of America (Leo) 325
Brock, R. W 26
Broken Hill—Labor 868
—Zinc Concentrates 790
Broken Hill Proprietary, Ltd., Austr. 306, 471, 508, 589, 746, 947
Broken Hill South, Ltd •830, 947
—Report, 1920-21 879
Brooks, A. H. 383
Brown, H. L. 585
Browne, W. F. 224
Bruce, E. L. 905
Bruce, J. L. 666
Bruce, Minn. 314
Brunne Oil & Gas Co., Man 740
Brunton, F. K.—Copper Blast Furnaces 404
Bryce, R. A. 266, 506, 546
Buck, S. M. 186
Bucket Elevator Improvement (Labbe) •380
Bucket Lips—Gold Dredge •932
Bucketshoppy (Wolf) 697
Budd, C. 25
Buena Tierra Mng. Co., Chih 271
—Report, 1920 29, 119
Buffalo, Ont. 150
Buley, T. M. 106
Bulgarian Mining Conditions (Cook) 564
Bulgarian Mining Law (Cook) 817
Bull King, Colo. 592
Bull Raven, Colo. 874
Bullfinch, Austr. 909
Bullion, B. C. 1070
Bullion Beck, Utah 231
Bullwhacker, Nev. 833
Bully Hill Smelter •286, 287
Bunker Hill, Cal. 151

Page

Bunker Hill & Sullivan Co., Ida. 33, 225, 349, 869, 1074
—Dividends 279, 439
Burch, A.—Career •258
Burchard, E. F. 64, 145, 666
—Field Work in Philippines 4 p. •334
Burden of Taxation. Editorial 961
Bureau of Mines—Alaska work 148
—Appropriations
—Coloring Gems 965
—Co-operative Agreements Research 550
—Experiment Stations 380, 450
—Explosives Investigation 979
—Latin American Research 707, 722
—Lean Iron Ores Study 1059
—Petroleum Industry 665, 901
—Precious Metals Station, Nevada •214
—Separation problems study 1065
—Yearly Report 944
Bureau of Mines and Private Investigations (Bain) 3 p. 450
Bureau of Mines, War Minerals Investigations (Spurr) 500, 570, 651
Bureau of Standards Activities †184
Burma—Tin 1048
Burma Corp., India 29, 191, 350, 909, 973
—Reports, 1918-19-20 958
Burr, W. H. 63
Burroughs, A. H., Jr. 64, 186
Burrows, A. G. 230
Burton, T. E. 189
Bush, E. G. 867
Bush, J. M. 266
Business Survey †344
Buskett, E. W.—Zinc Blast Furnace 409
Butcher Boy, Utah 832
Butler Bros., Minn. 793, 953
Butte & Plutus, Mont. 33
Butte & Superior, Mont. 231, 433, 593, 633, 714, 750, 833, 912, 953, 1034
—Minerals Separation 33, 66, 349, 548, 875, 907
Butte Main Range 433
Butte & Western, Mont. 231
Butterfly, Colo. 313
Butternut, Ariz. 151
Buwalda, J. P. 185
Buyers' Market. Editorial 161
Bwana M'Kubwa 510

C

C. O. D., Ariz. 913, 1072
Caaba, Wash. 230
Cadman, Sir. John 1066
Cadmium 179
—Germany—Production 38
—U. S.—Production, 1910-20 38
Cain, O. 826
Calaveras Copper Co., Cal.—Matte ladles •261
Calaverita, Coah. 311
Caledonia Mng. Co.—Report, 1920-21 879
California—Industrial Conditions 955
—Metallurgical Progress, Shasta County (Young) 4 p. •286
—Oil—Taxation (Beal & Moran) 342
—Petroleum Production 1064
—Talc Production 338
California, B. C. 310, 387, 552
California Rand Silver, Inc. 32
California Rock Salt Co., Ariz 354
Calkins, F. E. 426
Callahan Zinc-Lead Co. 71, 313, 989
Callbreath, J. F. 383
Callow, J. M. 64, 145
Callville, Wash., Colemanite Deposit (Gale) 7 p. •524
Calumet & Arizona, Ariz. 34, 151, 591, 672, •785, 913, 951
—Copper market expansion 627
—Dividends 39, 639
Calumet & Arizona Mng. Co., N. M. 33, 432, 713, 873, 1072
Calumet & Hecla, Col. 713
Calumet & Hecla, Mich. 72, 113, 154, 194, 274, 314, 355, 391, 634, 750, 792, 827, 834, 872, 913, 1035, 1070
Calumet & Sonora 31
Cam & Motor, Rhodesia 386, 747
Campbell, A. A. 194
Campbell, D. G. Death 1066
—Graphite (Miller) 6 p. •207
—Mineral Production 791
—Petroleum 463
—Tariff—Copper Rods 387
Canada. Editorial 43
Canadian Institute of Mining & Metallurgy. 105, 304, 546
Canadian Mineral Deposits †344
Canadian Oil Fields †344, †545
Cananea Cons. Copper Co., Sonora 31, 951
—History of Reverberatory Furnaces 856
Candelaria Mines, Nev. 833, 948
Canterbury Hill—Colorado Tunnel 793
Cantley, Col. T. 585
Canton, W. R.—Kirtley Iron Riffle •180
Caples, R. B. 787
Capps, S. 106, 585
Carambola, Chih. 388
Carbonero, Colo. 673
Cardiff, Utah 193, 749
Cards on the Table. Editorial 441
Caribou Mng. Co., Ida. 33
Carlisle, Ariz. 389
Carlisle, H. C. 585
Carmelita, Chih. 831
Carmi, Minn. 314
Carmi Mng. Co., B. C. 831
Carmichael, N. 266, 987
Carnahan, J. S.—Metric Scale for Surveyors •101
Carpenter, J. A. 506
—Sagebrush Silver Producer 4 p. •132
Carpenter, Mich. 194, 274
Carpie Mng. Co., Ida. 231
Carrier—Diesel Ore •52
Carroll, F. 305
Carson, G. C., vs. Afterthought Copper Co. 267, 314, 391, 427

Page
Carson Hill, Cal.—Gold Mining (Young) 4 p. *725
Carson Hill Gold Mng. Co., Cal. 112, 177
Cary, Mich. 194
Casados, Jalisco 311, 1048
Cascade Silver M. & M. Co., Mont. 154, 433
Casey Mountain, Ont. 229
Cash Boy, Nev. 873, 953
—vs. Tonopah Extension 434, 988
Cassidy, M. E. 305
Castle, Ont 310
Castleton, A. W. 191
Cat Creek, Mont. 740
Catching the Wicked Smelter Trust Red-Handed. Editorial 362
Catern, B. C., death 186
Cavalier, M. J. 585
Cavanaugh, A. F. 266
Cave City, Ark. 984
Cawley, H. E.—Reclaiming Silver Tailing at Coniagas 890
Cedar Creek M. & D. Co., Idaho 1074
Celtic, Ariz. 389
Census Statistics. Editorial 162
Centennial Eureka, Utah 231
Centennial, Mich. 792
Centennial, Ore. 392
Central Consolidated Mines, Cal. 873
Central Copper Co., Ariz. 1033
Central Eureka, Cal. 151, 513, 673, 1073
—Lubricating hoisting rope *140
Central Mascot, Ariz. 632
Central Mng. & Investment Corp.—Report, 1920 319
Cerro Santa Rosa, Chih. 431
Chaffin, C. E. 145, 1027
Cham, B. K. 346
Chambers, A. R. 743
Champaign, Col. 514
Champion, Mont. 273
Champion Reef Gold Mng. Co., India 711
Chandler, O. K. 954
Channing, J. P. 794
—Copper, Before, During and After War 999
Chanute Spelter Co., Kan. 554, 715
Chapin, Mich. 434
Chapman, I. A. 106
Chapman, L. C. 145
Chapman, T. L. 826
Chappell, A. L. 905
Charcoal Iron—Missouri 427
Charlton, D. E. A.—Comin' h'off Shif' 218
—Iron Ore Mining in Latin America 5 p. *454
Charters Towers, Queensland 910
Chase, E. E. 826
Chase, R. L. 826
Chemical & Metallurgical Corp. 351, 386
Chemical Industries—Exhibition 519
Chemical Mining & Metallurgical Society of So. Africa 945, 1008
Cherbbono, C. B.—Profitable Mill (Godfrey) *578
Chester, Minn. 34, 154
Chicago-Boston, Ida. 230, 433
Chief Consolidated, Utah 70, 152, 832, 875, 911, 952, 1034
—Dividends 439, 639, 959
—Shaft Sinking Record 146, 188, 267, 306, 376, 587
Chihuahua & Orient R.R. 992
Chihuahua y Oriente, Chih. 1032
Chihuahua Schools 989
Chilberg, J. E.—vs. Davidson 353
Chile—Copper production 97
—Nitrate 16, *136, *378, 1005
—Small-scale mining and smelting (Strache) 97
Chile Exploration Co. †264
—Reports, 1921 119, 679
Chillagoe State Smelter, Queensland 29, *147, 350
China—Sulphur and Arsenic Smelting (Slessor) *695
Chino Copper Co., N. M. 912
—Report, second half 1921 439
—Tailing Air Lift (Anderson) 6 p. *806
Chipart M. 106
Chipeta, Colo. 389
Chisholm, A. D. 145, 666
Chisholm, Minn.—Tax Controversy 674
Chisholm, Ore. 230, 650
Chisos, Tex. 951
Chloridizing Volatilization (Layng) 5 p. *765
Chope, T. J., death 547
Christner, D. D. 585
Chrome Ores †464
Chromite—Deposits †344
—U. S., 1920 290
Chromium—Low's Analysis methods 375
Chronology of Mining 514, 274, 795, 954
Churn Drilling, Disseminated Copper Deposits—II. (Rice) 8 p. *11
Chutes—Protection 20
—Safety Cutout for Trolley Wires 18
Cigarrero, Chih. 271
Cinco Minas, Jalisco 312, 510, 1048
Cinema and the Earth Secrets. Editorial 282
City Deep, So. Africa 829
Claims Against Mexico (Desvernine) †104
Clapp, C. H. 346
Clarinda, Ida. 875
Clark, C. C. 230
Clark, W. A. 113
Clays—Durango 173
Clayton, C. Y. 145
Cleary, E. P. 426
Cleave, Mont. 907
Cleveland-Cliffs Iron Co., Mich. 793, 1071
Cleveland Iron Mines, England 308
Cleveland, Wash. 875
Clevinger Prophet, Ont. 112
Climax, Wis. 114
Clough, W. O.—Deserted Mining Camp 298
Clover Leaf, So. Dak. 474
Coal—Production. Editorial 481
—Pulverizing Plant—Michigan Smltg. Co. 673
Coarse Ore Transfer (Kemp) 1062
Coates & Tweed, Minn. 953

Page
Cobalt—Durango 172
—Low's Analysis Methods 375
—Queensland 791
Cobalt, Ont. 1032
Cobalt in Jackson Co., Ore. (Kellogg) 650
Cobb, H. McL. 69
Cobban, H. B. 946
Cochrane, J. L., death 266
Cockrell, L. M. 466
Cockshutt, H. 1003
Codd, J. W. 153
Coeur d'Alene District—Ore-Dressing Methods Meeting 223
—Welfare (Power) 2 p. *295
Coggin, N. C. 434, 952
Cohen, S. W. 585
Colbert, C. L.—Nodulizing at Chrome 2 p. *255
Colburn, C. L.—Career *576
Colemanite—Callville Wash (Gale) 7 p. 524
Collier, A. J. 626
Collins, E. J. 987
Colorado—Industrial Conditions 513, 751, 955
—Industrial Conference 948
—Mining & smelting situation (Walter) 125
—Smelting Situation 989
Colorado Delta Oil Co., Ariz. 903
Colorado Fuel & Iron Co., Colo. 474, 912, 995, 1068
—Dividends 439, 959
Colorado Metal Mng. Association 1071
Colorado Metal Mng. Board, Col. 912
Colorado, Mont. 71, 154, 231
Colorado Power Co., Colo. 713, 1034
Colorado River Commission 1068
Colorado & Southern 1071
Colowyo Gold Mng. Co., Wyo. 114
Columbia Mines Corp., Nev. 32
Columbia Oil & Gas Co., Ark. 984
Columbian Mountain M. & L. Co., Colo. 273
Columbus Mining Co., Ida. 153
Comfort Kirkland, Ont. 229, 712
Comin' h'off Shif' (Charlton) 218
Commerce Mng. & Royalty Co., Okla. 554, 674, 913
Committee of Mineral Imports and Exports (Leith) 6 p. 570
Commonwealth Co., Mo. 715
Commonwealth M. & M. Co., Ariz. 951
Commonwealth Silver Mines Co., Col. 593
Compensation—Accidents—Utah 473
Competition Among the Metals. Editorial 1042
Competition of Japanese Mining. Editorial 602
Compressed Air (Simons) †422
Compressed Air—Ventilation Doors 616
Comstock—Interest Revives. Editorial 362
Comstock Lode, Nev. 592
—Sampling Middle Group 434
Concentrating Tables—Covering 399
Concentration by Flotation (Rickard) †184
—Place of Jigs in Roughing. Editorial 322
—Sorting, Jigging and Tabling (Wiard) 326, 369, *411
Concrete †741
Concrete Storage Bins †545
Concho, Chih. 432
Conditions in Mexico. Editorial 641
Conference at Washington. Editorial 881
Confusion Over Assessment Work. Editorial 121
Congress and the Tariff. Editorial 201
—Comment 325
Coniagas, Ont. 229, 747, 792, 831
—Reclaiming Silver Tailing (Cawley) 890
Consolidated Arizona Smltg. Co., Ariz. 70, 669, 713, 1067
Consolidated Gold Fields Co., Yukon 191
Consolidated Gold Fields of South Africa 950
Consolidated Langlaagte, So. Africa 630
Consolidated Main Reef 149
Consolidated M. & S. Co. 111, 270, 629, 671
—Ore cash settlements 1067
—Smelting Rates 587
Cons. Spanish Belt Silver Mng. Co., Nev. 32, 434, 911
Consolidated Virginia, Nev. 151, 274, 473
Consolidated Wilshire Mng. Co., Cal. 151
Converting Dolomite into Magnesite (Eyoub) 619
—Comment 884
Conveyor Belts—Draining Water (Poston) 822
—Indicator *220
Cook, P. R. 64
—Bulgarian Mining Conditions 564
—Bulgarian Mining Law 817
—Experts for Mining Society Business 285
—Profit Sharing 325
Cooley, M. E. 585
Co-operative Experiments with "Gunite." Editorial 323
Co-operative Milling Co., Ariz. 432
Co-operative, N. M. 951, 1072
Copper—Alaska 629
—Analysis—Iodide Method 16
—Brazil 51
—Canada—Tariff 111
—Chile 97
—Churn Drilling (Rice) 8 p. *11
—Commercial Shapes 738
—Conductivity Standard 299
—Consumption 359
—Converting 738
—Durango 173
—Germany—Market Support 118
—Hardening Process (Middlemiss) 827
—Investments (Wolf) 677
—Italy—Export financing 108
—Leaching †985, 1025
—Market 998
—Market Editorials 203, 561, 751, 843
—Market Expansion Suggestions 400, 627, 674, 724, 748, 763, 884, 924, 948, 963, 1012
—Michigan 474, 792, 1070
—Montana 875
—Osaka—Production, 1920-21 228
—Prices, 1921 559, 838, 1078
—Producers Opportunity. Editorial 601
—Production, 1920 †184
—Roofing 604, 627, 663

Page
Copper—Continued
—Sneets 359
—Shetland Islands 385
—Sizing Blast-Furnace Charge (Gillis) 175
—Smelter production 1910-21 118
—Specifications †143
—U. S. Market 638
—Warren District (Mitchell) 4 p. *246
Copper, Before, During and After War (Channing) 999
Copper Giant, Ida. 875
Copper Group, B. C. 149
Copper Mountain Mines Co., Ariz. 672
Copper Queen, Ariz. 713, 748, *785, 977
—Mine blacksmith shop *611
Copper Queen "Congress" 306
Copper Range, Mich. 113, 593, 834, 1070
Copper River & Northwestern R.R. 949
Copper & Brass Research Association 345
Corbould, W. H. 29
Cornejo Blanco, Oaxaca 312
Cornish Relief 144
Coronado Mng. Co.—Vs. Calumet & Arizona 591
Correspondence School, see "Engineering Education."
Corrosion †786
Corry, A. V. 905
Cottrell, F. G. Career *338
Cottrell Processes—Phosphoric-Acid Recovery (Landolt) 167
—Recent Applications (Hesson, Landolt, Heimrod) 4 p. *446
Cowan, W. W. 145
Cox, S. E. J. 945
Creative Chemistry (Slosson) †303
Cresson Consolidated, Colo. 313, 995
Cripple Creek, Colo. 193
Critchett, O. A.—Determination of Bismuth 58
Criticism of Mining Schools. Editorial 842
Crocker, W.—Competition solution of industrial problems 443
Cronin, B. C. 712
Crosby, G. H. 471, 605
Crowfoot, A. 987
Crowe, T. B. 905
Crown Mines, So. Africa 190, 829
Crown Reserve, Ont. 591
Crushers—Driving Laboratory *177
—Gyratory—electric vibration used 135
Cubo M. & M. Co., Gto. 31, 388
Culross Island M. & M. Co., Alaska 748
Cunningham vs. Insinger 188
Curie, M. S. 26
Curley, Mont. 154
Cushman, J. S.—Limestones & Marls of North Carolina †303
Cutout for Trolley Wires at Loading Chutes (Gardner) 18
Cutting Mng. Co., S. D. 555
Cuyuna-Duluth 948
Cuyuna-Mille Lacs, Minn. 114
Cyanidation—Silver (Cawley) 890
Cyanide—Duty urged 351
Cyanide Gold Mng. Co., Idaho 833
Cyaniding—Rand 1012
Czechoslovakia—Pyrites 550
—Radium 350, 427

D

Daly, P. Premier Mine suit 744
Damon, Colo. 272
Dardanelles, Ariz. 192
Darwin Silver Co., Cal. 151
Davenport, L. D. 787
Davidson Chemical Co.—Anaconda contract 1074
Davidson Consolidated, Ont. 352, 387, 748, 991
Davidson, J. M. vs. Chilberg 353
Davila, M. 64
Davis, Ariz. 748
Davis Daly Copper Co., Mont. 231, 390, 512, 593, 633, 749, 869, 912, 953, 1034
—Reports 1920-21 679, 1039
Davis, J. A. 148
Davis, Mich. 34
Davis & Dunkirk, Ariz. 748
Dawson, E. 106, 466
Day, R. J. Mine Blacksmith Shops 5 p. 609
De Chambrier, Paul. Draining Oil Reservoirs by Shafts and Tunnels 103
Dead Horse, Calif. 31
Dead Sea. Petroleum Drilling 505
Dean, Ariz. 794
Decay of timber in return air courses (Harrington) 4 p. *565
Decreasing costs of production. Editorial 921
Deep oil wells in Texas (Wolf) 141
Deer Trail, Utah 633
Defense of apex procedure (Winchell) 2 p. 163
Del Mar, A. Filter notes 821
Delury, J. S. 186
Denis, T. C. Black Lake Asbestos Mining 564
Dennis, G. 826
Dennis, H. B. 313
Denton, F. W. 145, 266, 905
Department of Mines Bill 870
—American Mining Congress Recommendation 144
—Editorial 681
—Shortridge on 28
Depths of molybdenum ores (McIntyre) 125
Derby, E. L. 266
Derrick mast top *58
Desert prospector (St. Clair) 139
Desert ranges in Mexico. Editorial 483
Deserted mining camp (Clough) 298
Desvernine, R. E. Claims against Mexico †104
Detecting small quantities of petroleum (Erickson) 4 p. *59
Diamond digging †667
Diamond drilling †24, 599
—Oil exploration 984, 1064
—Tagging holes (Poston) *659
Diamonds, Brazil 51
—So. Africa, 1920 131
Dickerman, A. L. Death 547

Page

Diesel engines .... †741, 873
—Ore carrier .... •52
Differential flotation .... †464
Dignity of engineering (Barnes) 205
Diller, J. S. 383
Dinkey, A. C. 867
Disarmament Conference. Editorial .. 801, 881
Disarmament and the Metals 879
Discrepancy between drilling and dredging results (Smith) 812
Divide Extension, Nev. 72, 434, 592
Divining rods 577, 590, 910
—Editorial 963
—German. Editorial 1042
—Hartford Man's Invention. Editorial 1043
Dixon, J. Relining a Hardinge mill 1022
Djambi Oil Field of Sumatra (Redfield) .. 5 p. 939
Dobbs, G. G. 298
Dodge, C. A. 383
Dolbear, S. H. 1069
Dolly Varden, B. C. 149, 229, 387, 628-9
Dolly Varden, Col. 713
Dolomite. Converting into Magnesite (Eyoub) 619
Dolores Esperanza, Chih. 149, 270, 353, 388, 591
Dolores, Sa. Eulalia 388
Dome Lake, Ont. 512
Dome Mines, Ont. 230, 270, 310, 472, 590, 792, 951, 1032
—Dividends 279, 756
Dominian, L. 346
Donaldson, S. Death 1027
Donohue, E. J. 666
Donohue vs. Tonopah Oriental Mng. Co. .. 32
Doubleday, B. Alchemy 605
Douglas Channel Mines, Ltd., B. C. 68
Douglas Lake Indian Reserve 229
Dowell, G. H. 306, 383
Dragline Excavator 890
Dragon, Utah 231
Draining oil reservoirs by shafts and tunnels (de Chambrier) 103
Drake, N. F. 188
Drayer, C. E. 466
Dredge. Bucket lips 932
—Construction at Dayton, Nev. (Young) 6 p. •91
—Transportation at Dayton, Nev. (Young) 2 p. •374
Dredging. Editorial 642
—California operators meet 625
—Discrepancy between results 812
—Results and dredging returns .... •646-8
Drift work—curve chart (Best) .... •101
Drill hole results and gold dredge recovery. Editorial 642
Drill steel. Breakage and heat treatment (Perkins) .... †184
—Changes (Young) .... •461
—Engineers study treatment 429
—Tariff 429
Drilling—Churn. Editorial 3
—Disseminated copper deposits (Rice) .. 8 p. •11
Drilling—diamond drill .. †24, •659, 399, 984
—Discrepancy between results (Smith) .. 812
—Review (Young) .... 340, 379, •420, 538
—Rock drill bits. Editorial 361
—Rock-drill machine standardization. Editorial 682
—Rock-drill tests on Rand 671
—Rock Drill Tests, Tri-State District 977
—Rock-drill moving pictures 190
Drilling results and dredging returns (Gardner) .... •646, •688
—Comments 845
—Correction 805
Drives—Belt, gear and chain .... 3 p. •969
Driving laboratory crushers .... •177
Drum Lummon Mines, Ltd., B. C. 69
Drumheller, J. 787
Drury, Ontario Premier 285
Dumping irons .... •140
Duncan, D. C. 194
Duncan M. & M. Co., Ariz. 232, 272
Dundee-Arizona, Ariz. 632, 832, 951
Dundee leaching process 69
Dunwoody, Minn. 274
Durango—iron, tin, antimony, quicksilver, sulphur, zinc, silver, gold, lead, copper, nickel cobalt, bismuth, clays, lime, gypsum (Terrones & Rangel) .... 6 p. •168
—Mining map .... •168
Durham, E. B. 305, 310
Dust prevention in mine development .. 747, 968
Dutch East Indies—Tin output 669
Dwight, A. S. Career 178

E

E. & E., Ore. 71
Eagle Bird, S. Dak. 474
Eagle, Col. 514, 1072
Eagle, Wash. 433
Eagle Picher Lead Co., Mo. 708
—Dividends 279, 756
Eagle, Utah 70, 153
Early records of Michigan copper industry (Keyes) 776
—Comment 884
East Butte Copper Co., Mont. .. 113, 231, 512, 593, 633, 672, 749, 869, 912, 953, 1034
East Kootenay Prospectors Dev. Co., B. C. 228, 270
East Pool & Agar 149, 225, 788, 870
East Rand Proprietary 110, 830, 868, 909
East Washington Oil Co. 1064
Easton, S. A. .... 223, •503
Eaton, S. F. 145, 466
Eaton, W. J. 547
Eby, J. B. 266
Echoes. Editorial 521
Echoes from the Fraternity. Weekly Feature.
Economic aspects of geology (Leith) .... †303
Economic situation of iron-ore mining in Latin America (Charlton) .... 5 p. •454

Page

Economics. Editorials 401, 961
—Standard Mine Cost Statement .... 5 p. 126
Economy in Washington. Editorial 121
Eden Creek, Nev. 633
Education. See also "Engineering."
—Chihuahua 989
—Federal Universities (Palmer) 85
—Mining students' attitude. Editorial 562
—Vocational Mine. Editorial 602
Mng. & Met. Society of America 584
Education of the Mining Engineer (Ropes) 844
Eddy, A. E. 64
Edward, M. Witwatersrand Power 667
Edwards, J. W.—death 987
Edwards, Ont. 950
Effect of sizing copper blast-furnace charge (Gillis) 175
Efforts to widen copper market still meager. Editorial 203
Egleston, O. J. 987
Eighty-five Mine—see Calumet & Arizona Mng. Co., N. M. 713
El Bordo, Hidalgo 353
El Capitan, Ariz. 272
El Consuelo, Coah. 228
El Favor Mng. Co., Jalisco 312, 748, 1048
El Oro Gold Dredging Co., Calif. 32
El Oro Mng. Co., Mex. 748, 1032
El Paso & South Western Railroad .. 995, 1033
El Rosario, Dgo. 1033
El Salvador Mines Co. 146, 1067
El Tiro Leasing Co., Ariz. 96
Elbow Lake, Manit.—Gold discovery ... 229
Elder, R. B. 223
Electric prospecting for gold (Kelly) 1044
Electric prospecting in Australia ... 590, 910
Electrolytic recovery of zinc in Tasmania. 499
Electrolytic Zinc Co. of Australasia, Ltd., Tas. 191, 508, 830, 992
Elementary qualitative analysis of metals and acid radicals (Reeve) .... †184
Elephant Butte Dam 745
Elephant Deep, Calif. 151
Elevator Data—Santa Barbara 1050
Elk Hills, Calif.—Petroleum 863
Elkhorn, Colo. 312, 593
Elliott, E. C. 64
Elliott, R. H. 506
Elliott, S. R. 305
Elliott, W. W. 192
Ellis, E. E. Fair play for graphite 364
Elm Orlu, Mont. 474, 512, 833
Elton, J. A. 787
Ely, F. B. 506
Emancipation, B. C. 149, 628
Emerald, Ariz. 672
Emery, Mont. 672
Emma, Utah 313, 1034
Emmons, W. H. 506
Empire, Cal. 226, 232, 402
Empire Trust Co. 988
Empire Zinc Co., N. M. 1033
Employee representation at Bisbee. Editorial 81
Engels Copper Co., Calif. 592, 873
Engineer. Editorials 441, 922
Engineer, B. C.—Suit 587
Engineer (Hammond) .... †104
Engineer Member, California Industrial Accident Commission. Editorial 803
Engineering and Mining Journal — News Service 483
Editorial 442
Engineering Council. See "Federated Amer. Eng. Societies."
Engineering. Dignity (Barnes) 205
Engineering Education—American Mining Congress on 704
—Commercial application 125
—Correspondence School (Graupner) 44
Comment (Eyoub) 245
—Editorials 562, 802, 842
—Mng. & Met. Society of America on 742
Comment (Ropes) 844
—Mining schools' function (Holbrook) ... 706
—Pennsylvania State College Plan 625
—Practical use of theoretical knowledge (Lloyd) 53
—Princeton mining school 144
—Seven year course 245
—Society for promotion of engineering education meeting at Yale 63
Engineering Index (A. S. M. E.) .... †422
Engineering Progress. Editorial 402
Engineers—International meeting 425
Engineers—Registration in Minnesota 308
Engineers, Licensing—Boston Section A. I. M. E. 625
—Editorial 161
Comment (Smith) 324
—Mng. & Met. Society of America on 382
—Opposed (Eyoub) 484
—Utah 905
Engineer's Luck, Colo. 273
Engineers à la Mode (Walker) 84
Enos, G. M. 64
Enriques, E. 305
Erickson, E. T.—Detecting small quantities petroleum .... 4 p. •59
Erupcion Mng. Co., Chih. 228, 311, 388, 431, 911, 1032
Escuadra, Oaxaca 312
Espada Mines Co., Nayarit 312
Esperanza, Coah. 353
Esperanza, El Oro 311, 870
Estabrook Dredge, Calif. 911
Estes, F. M. 867, 905
Esthonian oil-shale industry 544
Ethics. Editorial 883
Etowah Coal & Iron Co., Ala. 1035
Euboean magnesite field (Boydell) ... 5 p. •771
—Comment 885
Eurades Mng. Co., Colo. 232
Eureka, B. C. 511
Eureka Croesus, Nev. 833
Eureka Hamilton M. Co., Nev. 513
Eureka Hill—Dividends 959
Eureka Holly, Nev. 833

Page

Eureka, Lilly, Utah 231, 832, 911
European Conditions (Mathewson) Editorial 1
Euterpe Mng. Co., Kans. 834
Eveland, A. J. 266
Evening Star, Calif. 592
Examining Minerals in Ore Pulp (Fry) 1063
Existing vertical boundary regulations on American soil—Editorial 842
Expanding News Service. Editorial 483
Experiment Stations—Bureau of Mines (Bain) .... 386, 3 p. 450
Exploration (Williams) 645
Explosives 979, 1020
—Keeping qualities 1061
—Ontario competition 590
—Size of powder 862
—Standard specifications 626
—Storing carbide 972
Export Trade—Altering depression. Editorial 243
Comment (Lawler) 324
Exports. See also names of minerals, etc.
—Domestic classification 1030
—Minerals discussion 870
—Ores and metals .. 38, 198, 359, 559, 799, 959
Eyoub, D. Converting dolomite into magnesite 619
—Licensing engineers 484
—Why the Mining Engineer 604
—Work vs. Rainbow Chasing 245

F

Factors of safety. Editorial 883
Fahrenwald, A. W. 223, 826
—Convenient laboratory ball mill .... •579
Fairbanks, Alaska—Bureau work reorganized 148
Fairlie, M. F. 826
Fake assays and assayers. Editorial 41
Falcon Mng. Co., Alaska 30
Fall, A.—on War Minerals Relief Act 148
Falls Creek, Ida. 33, 273
Famatina Copper Mines .... •291
Fath, A. E. 305
Fatigue of Metals (Kreuzpointner) 216
Faulds, A. Death 106
Fay, A. H.—Career .... •657
Febles, J. C. 905
Federal Board for Vocational Education—Mining education. Editorial 602
Federal Iron & Steel Corp., Wash. 992
Federal M. & S. Co., Idaho 1074
Federal M. & S. Co., Okla. 750, 988
—Dividends 39, 639
—Star Mng. Co. suit 869
Federal Reserve System .... †24
Federated Amer. Eng. Societies. Committee on Foreign Relations 144
—Industrial accident commission engineer member 803
—Licensing. Editorial 161
—Loyalty to. Editorial 1011
—Minerals relief procedure 585
—Service 866
Federated Malay States—Tin 950, 1048
Ferguson, H. G. 188, 346
Ferguson, Ont. 950
Ferro-alloys .... †143
Fettling 857
Field, T. E. 585
Field work in Philippines (Burchard) . 4 p. •334
Filer & Innes 553
Filter notes (Del Mar) 821
Filtering flotation concentrates 217
Finance. Editorial 642
Fink, G. J. 145
Finland—Iron ore 656, 896
Finlay, J. R. .... 106, •946
—Permian Revolution in North America .. 1058
Finley, R. W. 194
Finnie, O. S. 707
First aid and rescue work in mining (L. G. Irvine) .... †741
First Thought, Wash. 433, 512
Fish Creek, B. C. 387, 511, 910
Fitch, W., Jr. Co.—Shaft sinking record. 146, 188, 267, 306, 376, 587, 832
Flagg, A. L. 305, 466
Flin Flon 69
Florence Silver Mng. Co., B. C. 352, 1032
Florence, Nev. 152, 355
Florida—Phosphate mining (Lloyd) ... 5 p. •86
Florida Mng. Co. 88
Flotation .... †741
—Acid and slimes in (McLeod) 213
—Colloidal pitch as reagent 56
—Gröndal Process .... •215
—Wolf's invention 789, 827
Flotation experiments. Editorial 643
Flotation Froth (Sundt) 983
Flotation of pyrite .... †464
Flotation Research .... †344
Flotation testing .... †422
Flotsam and jetsam. Editorial 203
Flow Sheet—Santa Barbara 1050
Fluid, mud-laden under pressure (Steiny) . •182
Fluorspar .... †344, †464
—Separation of zinc from 1065
Flury, C. Dressing amalgam plates 578
Foote, A. B. 506
Foote, F. W. 585
Force, Ore. 230
Ford, H. Editorials 323, 441
—Imperial Mine 267, 586
—Muscle Shoals 146, 1035
Editorial 961
Fordney Bill. See "Tariff."
Foreign vs. domestic business (Ropes) 167
Foreign Exchange. Conference proposed. 629, 669
—Editorial 761
Foreign Trade. Editorials 123, 961
—Hoover address 150
Ft. Payne Coal & Iron Co., Ala. 1035
Forum River Tin Co., Nig. 990
Foss, M. H. 506

[illegible]
—Southwestern States 672
[illegible]
[illegible] mine (Hubbell) ..2 p. 1069
[illegible]
Furnace—New [illegible]
—Reverberatory (Thum)
[illegible]

G

[illegible]
Galena Mng. Co., Utah ....
[illegible]
Gardella, L. 191
[illegible]
Gases in rock strata East Tintic district....
[illegible]

[illegible]
—Ontario. Ont.
[illegible]
—Manitoba ...
—New Mexico [illegible]
[illegible]
—Ontario ....
[illegible]
—Toronto [illegible] Mont.
[illegible]
[illegible] Mng. Co., S. D. 555
[illegible]
[illegible] 226 274
[illegible]
[illegible] ....†741
[illegible]
[illegible] Editorial ..
[illegible]
Crest Mng. Co., S. D. [illegible]
Cycle M. & R. Co. [illegible]
[illegible]
[illegible] S. D. 1072
[illegible]

[illegible]
[illegible] (Redfield) ..4 p.
[illegible]
Gulley, M. B. [illegible]
"Gunite" Editorial
—Experiments ..
[illegible]
Gunning—Verde Extension ..
[illegible]
Guyer, R. 953
[illegible]

H

[illegible]
Hamilton, H. [illegible]
[illegible] 787
[illegible]
Hard To [illegible]
[illegible] 1020
[illegible]
Hardshell, Ariz. [illegible]
Hardwood, Col. [illegible]
[illegible]

Page
995
Hibbing Minn. ... 789
—Removal suit ... 1034
Hibschle. Colo ... 748
Hickey Copper Co Ariz ... 628
Hidden Creek B C ... 389 673
Hidden Treasure Colo ... 952
Hiddenite N C ... 243 266
Higgins E ... 434
High Five Mo ... 794
Highland Mng Co. [illegible] ... 511
Highland Valley Mng Co B C ... 869
Hill Top Metals Mines Co ... 274
Hill Trumbull [illegible] ... 114
Hillcrest [illegible] ... 987
Hillsdale P ... 466
Hindley W E ... 145
Hines P R ... 191
Hirst Chichagoff Alaska
Hirtman J Made gold before Dr Davis-
son ... 124
History of [illegible]charging reverberatory fur-
naces ... 3 p. 856
—Comment ... 924
Hixon. H. W Inorganic origin of petro- ... 622
leum ... 305. 743
Hobert. E. N ... 514
Hockins Col ... 64
Hodge. E. T. ... 987
Hodgson J P ... 506
Hodgson. S P. ... 26
Hofman. H. O. ... 186
Hofstrand. O. B. ... 243
Hoist Engineer. Editorial ... 539
Hoisting—Device for indicating level.*504. 938
—Safety device ... 862
—Shaft capacity ... 1071
Hoisting at Pabst mine ... *140
Hoisting rope compounds ... 1030
Hoisting ropes ... 2 p. *219
—Socketing (Ageton) ... 936
—Taper ... 925. 1014
Hoists ... 922
Editorial
Hoists—Compressed air—scraping and load-
ing (Royce) ... 973
... 26. 426. 706
Holbrook. E A. ... *176
Holden, E. C. Mining Odyssey ... 911
Holland, Cal
Hollinger Consolidated Gold Mines Ltd ..
330, 352 431, 511, 552 631 712, 831 1032
—Dividends ... 279 439, 639 756, 959
879
—Report, 1920 ... 1 p 1049
Hollinger Mine (Gray) ... 30
Holmes Township—staking rush ... 313
Homestake, Idaho ... 474, 1072
Homestake Mng. Co., So. Dak. ... 959
—Dividends ... 39 279, 439, 639 756
—Geological methods (Wright & Hosted)
3 p. *886
146
Honduras Petroleum Co. ... 585
Hoots H W ... 105
Hoover H C ... 1068
—Colorado River Commission ... 123
Hoover speech. Editorial ... 305
Hopkins E W ... 111
Horn Silver. B. C. ... 994
Hornet. Cal. ... 506
Hoskin. A. J.
Hosted. J. O. Geological methods of the ... 3 p. 886
Homestake ... 151
Houghton. S. ... †662
How land grows ... 62
How to get back to hard money Editorial. 232
Howard Copper Co Ariz ... 39
Howe Sound Co—report 1920 ... 832
Hoyland H B—vs H A Smith
Hubbard W D Black Lake asbestos area
4 p. *365. 683
Hubbell. A. H. French Creek iron mine ... 1009
387
Hudson Bay Ont ... 792
—Annual report ... 354
Hudson. H.—vs. Sunset Co ... 1073
Hudson Mng Co. Nev ... 673
Hudson M & M Co Cal. ... 192
Hughart. H. H. ... 474
Hull City. Col. ... 145
Hull. M. R. ... 474
Hull-Rust. Minn. ... *579
Hunner. H. H. Altering incline skip. ... 383
Huntoon L D ... 106
Hurst G L ... 724
Hussey C G & Co
Hutchens J P Traveling in Morocco ..
3 p 1006
Hutchins. R. J. ... 905
[illegible] W S ... 64
[illegible] Lead & Zinc Co Joplin District 871. 954
... 106
Hyde G. E.

I

I X L. B C ... 712
I X L. Ore ... 512
I. X. L., Utah ... 633
Iceland Spar—B. C.
Discovery ... 511
Idaho (Coeur d'Alenes) Industrial condi-
tions ... 751 828 955
... 185
Idaho—Survey work ... 1074
Idaho Copper Corp. Idaho ... 993
Idaho Gold & Ruby Mng Co. Ida ... 313
Idaho Mines Syndicate Ida ... 71
Idaho-Montana Amalg Mng Co. Ida ... 27
Illinois Mine Inspection Act ... 2
Editorial
Imogene Leasing Co., Colo. ... 952
Imperial Iron Mine, Mich ... 793 267
381 434 586 1071
Imperial Mineral Resources Bureau. Edi-
torial ... 241
Imperial Oil Co ... 505. 661. 701
Imperial Ore ... 71
Importance of the Mineral Industries. Edi-
torial ... 681
Index—See names of minerals etc
ores and metals 38 108 350 550 799.
959

Page
Improvements in nodulizing chrome N J
(Colbert) ... 2 p *255
Income Tax See Taxation
Independence B C ... 671
Independence Mng. Co., Ark. ... 871
Independence & North Star Mines, Ida ... 33
Indicator for belt conveyor ... *220
Indooroopilly. Queensland ... 910
Ingalls Committee See also "Mining Law
Revision"
—Bill on new mining code ... 110. 148. 308
Ingersoll-Rand Co—on Tariff drill steel .. 429
Inglaterra Chih ... 271
Inglis J F Copper roofing ... 604 787
Inland Steel Co Minn ... 948 953
—T Keating Co ... 948
Innes. M. ... 64
Inorganic origin of petroleum (Hixon) ... 622
—Comment (Thayer) ... 724
Insinger vs. Cunningham ... 188
Inspiration Consolidated, Ariz. .. 70. 150. 913
Instruments—Mineral locating ... 577
Interest in the Comstock revives Editorial 362
Intermountain Development Co., Cal ... 1073
International Chamber of Commerce meet 223
International Nickel Co., Ont 225 384
430 948 992
76
—Annual report ... 439. 959
—Dividends ... 263
Internatl. Oil & Ref. Co., Ariz.
International Smelting Co. ... 33 70. 150.
794 832. 951
Interstate Commerce Commission—Freight
rate hearing ... 226 674. 1069
Interstate Iron Co. Minn ... 114 793 872
Introduction to the study of minerals and
rocks (Rogers) ... †702
Investments (Berry & Yeatman) ... 837
Iodide method for copper ... †422
Ireland—Gypsum ... 453
Ireland. J. D. Death ... 987
Iridium ... 981
Iron—Birmingham District ... 553 627. 872
—Durango ... *169
—Lean Ores Study by Bureau of Mines ... 1059
—Minnesota ... 869
—Upper Silesia. Poland ... 989
Iron and steel in Sweden ... †422
Iron and Steel Institute Great Britain—
Meet in Paris ... 465
Iron Blossom. Utah ... 231 875 952
Iron Cap Copper Co—Arizona commercial
suit ... 873. 989. 1068
Iron Creek. Wash. ... 194
Iron King. Utah ... 231
Iron Mask. Mont. ... 433
Iron Ore—Brazilian Mining (Geissel) ... 729
—Finland ... 656. 896
—France discovery ... 428
—Freight rates ... 667. 1028
—Great Lakes ... 674. 947. 1069
—Latin America
Economic situation (Charlton) .. 5 p *454
—Sweden ... 896
—World resources ... 889
Iron ore deposits on Belcher Islands (Wood-
bridge) ... 4 p *251
Iron ore—Prices ... 37
Iron ore resources of Europe (Roesler) . †184
Irvin D F New price levels in Chilean
nitrate ... 3 p *136
Irvine L. G. First aid and rescue work
in mining ... †741
Isabella Gold Mng Co Colo. ... 312
Isabella Mich ... 793
Ishikawa N Narukiyo Mng Co Ltd. .. 966
Italy—Copper—Export financing ... 108
—Leucite production ... 52
—Sulphur production (Geissel) 1913-20 138

J

Jack R L—Salt & Gypsum Deposits So
Australia ... †143
Jaegers. Nev. ... 391
Jalisco. Mex. — Recent Developments
(Payne) ... 3 p 1045
James. A. ... 106
Career ... *818
Jamison Gold Mng Cal ... 994
Jamm C ... 266 946
Janney F G ... 106
Japan—Minerals production ... 508
Japanese Mining Editorial ... 602
Jardine Mng Co Mont. ... 390
Jefferson Island Salt Co ... 348
Jenkins O P ... 186 383
Jenks T H ... 585. 987
Jennie A Nev ... 274
Jennings. S. ... 787
Jerome Superior Copper Co Ariz ... 951
Jerome Verde Copper Co Ariz ... 832
Jerome Verde Dev Co Ariz ... 995
Jerry Col ... 471
Jewel. B. C. ... 229
Jewell S ... 668
Jigging Roughing concentration (Ward)
326 369 *411
Jigs—Air ... 896
—Roughing concentration Editorial ... 322
—Station No. [illegible] ... *344
—Throwing device (Kemp) ... 900
Jim Butler Nev ... 391 633
Jim Crow Ariz ... 389
John Gould B C ... 387
Johnnie District Nev (Labbe) ... 895
Johnson B I ... 905
Johnson Matthey & Co Ltd ... 198
Johnson A D ... 305
Johnsons Co. Ont ... 112
Jones E. H. ... 506
Jones G H ... 867
Jones I O ... 547
Jones J R ... 946
Joplin-Miami District See also "Kansas"
"Missouri" "Oklahoma"
—Labor situation ... 554 793

Page
Journal" to Publish Annual Progress
Number. Editorial ... 1044
Judge M. & S. Co Utah ... *152-3. 231
Judson Land Co., Mich. ... 554
Julieta. Chih. ... 271
Juniper California Mines Co., Cal. ... 314
Jussen. H. C. ... 867

K

905
Kaeding. C D ... 707
Kaffer. S. L. ... 383
Kalagner. H. M. ... 715 750. 1035
Kanok Metal Co
Kansas Bureau of Mines Survey Milling
Problems ... 1065
Kansas (Joplin Miami)—Industrial condi-
tions ... 751. 955
Kaolin—Imported vs domestic ... 299
Karwer W. N M ... 34
Katanga, Union Minière ... 190
Katherine, Ariz. ... 995
Katherine Extension. Ariz ... 794
Katherine-Nevada. Ariz. ... 232
Keating. J. J. Death ... 224
Keating, P. H Slide rule in surveying cal-
culations ... 822
Keating Co T ... 948
Keech. V. ... 466
Keeley. Ont ... 230. 712. 792
Kelley. C. F ... 113
Kellogg. A. E Cobalt in Jackson Co., Ore. 650
—Sylvanite Gold Mine Ore. ... 548
Kellogg. L O National Geographic So-
ciety ... 484
—Profit sharing in mining ... 124
Kelly Mine. Calif. ... 391. 513
Kelly Mine Calif. (Carpenter) ... 4 p. *132
Kelly. S F. ... 266. 826
—Electrical prospecting ... 1004
Kelly. W. ... 266
Keltner Mng. Co.—Purchase Southern Lead
& Zinc Co. ... 834
Kemp. J. T. Coarse Ore Transfer ... 1062
Kennedy. Calif. ... 32. 112. 472 *504
Kennedy J B ... 383
Kennedy. Minn ... 114. 355. 553
Kennelly. A. E. ... 585
Keno Hill. Yukon ... 350
Kent. F. ... 905
Keora. Ont. ... 230. 352. 387
Kern. P. ... 867
Kerr Lake Mines. Ont. ... 150. 431. 630. 712
—Annual report 1921 ... 756
—Dividends ... 279. 756
Keyes C R Early records of Michigan
copper industry ... 776
Keystone Ariz ... 632
Kidder. S J ... 743
Kiddie J ... 987
Kilburn. G H. ... 426
Kiln—Nodulizing improvements (Colbert).
2 p. *255
Kimball. L. V. J., Romantic geologist. Edi-
torial ... 1003
Kimman H J Death ... 547
King Brand Kan. ... 871
King Kirkland. Ont. ... 748. 950
King Mica Co., S. D. ... 1072
Kingman Cons. Copper Co Ariz. ... 432
Kirby B C ... 68
Kirby Petroleum Co., Tex. ... 580
Kirk Gold Mines. Ont. ... 150. 552
Kirkham V ... 547
Kirkland Lake Gold. Ont. .. 150. 508. 631.
951. 1022
—Report 1920-21 ... 199
Kirtley Iron Riffle (Canton) ... *180
Kislingbury. G. D. Death ... 787
Kitamura. H. Narukiyo Mng. Co., Ltd. .. 966
Kitchner Mines. B. C. ... 910
Kittimac. Colo. ... 874
Kloman Mich ... 872
Knickerbocker. A K Swift growth of
manganese ore ... *770
Knight. C W ... 26. 1032
Knopf. E B ... 266
Knotts E K ... 69
Knox Divide Nev ... 152. 391
Knox. W K ... 383
Kreuzpointner P Fatigue of metals ... 216
Kriegh W McK ... 266
Kurz. F E ... 466
Kyner T ... 506

L

La Barranca Dgo ... 563
La Dorada Chih ... 1033
La Luz Zac ... 432
La Palme Porcupine Mines Ont Allied
Porcupine Gold Mines ... 671
La Perlita y Anexas, Coah ... 150
La Reina. Chih ... 271 388
La Rose. Ont. ... 387. 431. 512
La Rue Minn ... 232
La Salle Mich ... 750
Labbe C Bucket elevator improvement ... 380
—Placers of Johnnie District ... 895
—Telescope bar for narrow stopes ... 822
Labor—Alabama ... 954
—American ... 1030
—Arizona ... 748
—Broken Hill ... 868
—Burma ... 972
—California ... 31. 911
—Calumet and Hecla ... 827
—Coahuila Strike ... 311
—Colorado wages ... 995
Editorials ... 81. 282. 322. 441.
521. 602. 603 921
—Employee representation at Bisbee ... 65. 306
Editorial ... 81
—Employment situation in metals ... 269
—Guanajuato arbitration ... 385. 762
—Idaho wage scale ... 71
—Illinois union trouble ... 467

Page
Labor—continued:
—Japan and U. S. Editorial [illegible]
—Joplin-Miami [illegible]
—Lake Superior District Unemployment [illegible]
—Michigan wages cut [illegible]
—Minnesota [illegible]
—New Mexico—Wage reduction [illegible]
—Oliver Iron Mng. Co. wage scale [illegible]
—Ontario wage cut [illegible]
—Phosphate wage scale [illegible]
—Port Pirie [illegible]
—Queensland [illegible]
—Rand [illegible]
—Reemployment plan. Editorial [illegible]
—San Joaquin Valley strike [illegible]
—Townsville-Duluth strike ... 151 [illegible]
—Transvaal [illegible]
[illegible]
—Unemployment Committee [illegible]
—Unemployment [illegible]
—Wage problem solution (Crocker) [illegible]
—Wage scale [illegible]
—Wages and commodity prices. Editorial [illegible]
—West End, Nev. wages [illegible]
—Wisconsin wage scale [illegible]
Labor turnover at mines (Harrington) [illegible]
Labor's stake in industry. Editorial [illegible]
Laboratory instruction (Youtz) [illegible]
Labrador Exploration [illegible]
Ladder—Fixing [illegible]
Lacey, G. A. [illegible]
Lake, M. C. [illegible]
Lake Shore Mng. Co., Ont. ... 30 149 [illegible] 361 [illegible]
—Dividends ... 439 [illegible]
Lake Superior—Iron ore shipments 1920-21 [illegible]
Lake Superior iron ores ... 344
Lake Valley, Nev. [illegible]
Lake View, B. C. [illegible]
Lakeview Silver Mines Co., Idaho ... 33
Lamb, M. R. Argentine oil and labor conditions [illegible]
Lambert, B. H. [illegible]
Lamps, Carbide. Cleaning attachment [illegible]
Lancaster, H. M. [illegible]
Landolt, P. E. Applications Cottrell process ... 4 p. [illegible]
—Cottrell process phosphoric acid recovery [illegible]
Laney, F. B. ... 185
Lanza, A. J. Port Pirie Dept. of Health [illegible]
—Purifying small water supplies [illegible]
Larsen, E. S. [illegible]
Larson, A. G. [illegible]
Las Chispas, Mex. [illegible]
Las Dos Estrellas gold mine [illegible]
—Report 1920 [illegible]
Las [illegible] Club ... *311
Last Chance, N. M. ... 272 632 [illegible]
Latest in [illegible]. Editorial [illegible]
Latham, E. B. [illegible]
Latin America—Economic situation [illegible] ... 5 p. [illegible]
Latin-American maps. Editorial [illegible]
Launder—Supporting [illegible]
[illegible] Club [illegible]
Law. See also Legislation
Law—[illegible] meeting (Cook) [illegible]
—Iron-ore rate hearing Lake Superior ... [illegible] 674 [illegible]
—Mexican mining [illegible]
—Mexican mining titles (Meyers) [illegible]
Law Suits—[illegible] Copper Co. vs. [illegible] ... [illegible] 314 [illegible]
—Anaconda Copper Mng. Co. vs. [illegible]
—[illegible] Copper Co. vs. [illegible] Mng. Co. [illegible]
—[illegible] vs. [illegible]
—[illegible] vs. Michigan Land & Iron Co. [illegible]
—Arizona Commercial Iron Cap. ... 873 989 [illegible]
—[illegible] Jerome Copper Co. [illegible]
—[illegible] Mng. Co. [illegible]
—[illegible] & [illegible] vs. Minerals Separation ... 33 66 449 [illegible]
—[illegible] vs. [illegible] Mng. Co. [illegible]
[illegible]
—Hudson Bay M. & S. Co. vs. [illegible]
—[illegible]
—Minerals Separation vs. Miami Copper Co. [illegible]
[illegible]
—[illegible] Steel Corp. [illegible]
[illegible]
—[illegible] Engineering Co. vs. [illegible]
[illegible]
—United Verde Extension [illegible]
—Utah Apex vs. Utah Consolidated ... [illegible]
—Utah Copper Co. [illegible]
Law Suits—[illegible] vs. [illegible] Oriental Mng. Co. [illegible]
—[illegible] vs. Monte Rico Mng. Co. [illegible]
—[illegible] & [illegible] vs. [illegible]
—[illegible]
—[illegible] vs. Cunningham [illegible]
—[illegible] Five M. M. & R. Co. vs. [illegible]
—Minerals Separation vs. Butte & Superior [illegible]

[illegible] ... 744
[illegible] & Washington Mng. [illegible]
[illegible] ... 988
[illegible] ... 988
[illegible] ... 301 [illegible]
[illegible]
—Utah Copper Co. Suit ... 672
[illegible]
[illegible] W. [illegible] Oil [illegible]
[illegible] ... 44
[illegible]
[illegible]
[illegible] N. D. [illegible]
Lawyers and Geologists. Editorial ... 842
[illegible]
[illegible]
[illegible] J. M. [illegible]
[illegible] R. [illegible]
[illegible] P. B. [illegible]
Le Brun, Colo. ... 874
[illegible] ... 387 [illegible]
—Report 1920 ... 119
[illegible]
[illegible]
[illegible] ... 171 [illegible]
[illegible]
—[illegible] Editorial [illegible]
—[illegible] ... 1048
—[illegible]
—[illegible] 1921 ... [illegible] 1078
—Swatow District ... 1048
[illegible]
[illegible] from blast furnace slags ... 338
[illegible] Editorial ... 643
[illegible] (Griswold) ... 978
[illegible] Ores—Concentrating Mill ... **7 p. 1050**
[illegible] in Utah ... [illegible]
[illegible] Mines Co., Nev. ... 32 112 795 911
[illegible] ... 949
[illegible] earth product [illegible]
[illegible] Ont. ... 119
[illegible] ... 64
[illegible] ... 64
[illegible] Colo. ... 1034
[illegible] H. ... 46
Lee, W. ... 585, 987
Legislation—Blue Sky Bill ... 470, 950
—[illegible] Bill ... 144 681 870
—[illegible] See "Tariff"
—[illegible] See McFadden
—[illegible] ... 748
—[illegible] See Mining Law [illegible]
—[illegible] Bill. See also War [illegible] ... 828 870 908
[illegible] R. [illegible] ... 26
[illegible] aspects of geology ... 1303
[illegible] ... 6 p. 570
[illegible] ... 64
[illegible] M. [illegible] of America ... 325
[illegible] ... 605
[illegible]onard, F. Death ... 743
[illegible] ... 1035
[illegible] ... 271
[illegible]
[illegible] Ont. [illegible]
[illegible] ... 743
[illegible] ... 364
[illegible] Editorial [illegible]
Licensing of engineers. See "Engineers"
[illegible] M. ... 145
[illegible] ... 387 [illegible]
[illegible] P. [illegible]
[illegible] ... 173
Limestone ... [illegible]
[illegible] of North Carolina [illegible] & Cushman) [illegible]
[illegible] ... 383
[illegible] P. ... 626
[illegible]
[illegible] ... *305
[illegible] asbestos mining in Black [illegible]
[illegible] ... 72
[illegible]
[illegible] Colo. ... 513 714
[illegible]
[illegible]

[illegible]
[illegible]
[illegible]
[illegible] ... 119
[illegible]
[illegible]
[illegible]

M

McAllister, B. C. ... 430
[illegible] J. W. [illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
[illegible] ... 709
[illegible] N. M. [illegible]
[illegible] T. O. [illegible]
McGregor, A. G. [illegible]
McIntyre, Ont. [illegible]
McIntyre-Porcupine [illegible] Report 1920-21 [illegible]
—Dividends [illegible]
McIntyre, W. P. [illegible]
McIvor, Ont. [illegible]
McKean, R. H. Death [illegible]
McKenzie, P. A. ... 26
McKinley, Ont. ... 747
McKinney, R. T. [illegible]
[illegible]
[illegible] R. P. [illegible]
McLean, J. H. [illegible]
McLeod, [illegible] ... 214
McNair, J. ... 383
[illegible] A. J. [illegible]
[illegible] Nev. [illegible]
[illegible] Mng. Co., B. C. [illegible]
[illegible] E. ... 64, [illegible]
MacDonald, B. ... 626
[illegible]
[illegible]
MacKenzie, G. C. ... 188
[illegible]
[illegible]
[illegible] ... 14
[illegible]
[illegible] Copper Co., Ariz. [illegible]
[illegible]

Page
Marshall, S. B. ... 145
Martin, A. H. ... *244
Martin, G. C. ... 104, 195, 383, 585
Mary Charlotte, Mich. ... 194, 274, 431
M[illegible], Nev. ... 514
M[illegible] Dredging Co. ... 91, 94
Mascot Copper Co., Ariz. ... 432, 1033
Mason, F. H. Coloring Gems by Radium ... 965
Mason & Barry ... 634
Mason, N. vs. Houghton County ... 715
Mather, S. L. ... 224
Mather, W. G. ... 1066
Mathewson, E. P. ... 350, 666
—European Conditions. Editorial ... 1
Matte Converting—Mazapil (Merriss) ... 206
Matterhorn M. & M. Co., Col. ... 432
Maxson, W. L. ... 305
May Consolidated Mine—Tailings Retreatment ... 814
Mayflower, Mich. ... 593, 1070
Mayflower Old Colony, Mich. ... 674, 834
Maywood Chemical Co., S. D. ... 1072
M[illegible], M. S. Converting High Grade Matte ... 206
Mazapil, Mex. ... 712, 911
Mazata, Jalisco ... 311
Meacham, Minn. ... 154
Mechanical Loading Underground—Editorial ... 922
Medford M. & M. Assn., Wash. ... 230
Medina, C. Diaz de ... 787
Meeting Business Half Way. Editorial ... 82
Meinzer, O. E. ... 185
Mellon, C. W. Gold situation ... 629, 669, 709
Melones Mng. Co., Cal. ... *725
Mendenhall, W. C. ... *64
Mendha, Nev. ... 513
Merits and Demerits of the Mining Law Bill. Editorial ... 641
Merriss, M. H. Converting High Grade Matte ... 206
Merrie, J. B. Jr. ... 305
Mesabi Cliffs Iron Mng. Co., Minn. ... 593
Mesabi Iron Co., Minn. ... 708
Mesatas ... 1048
Metallurgy—Coarse Ore Transfer ... 1062
Metal statistics ... †104
Metal Statistics, monthly
Metallography—Steel (Kreuzpointner) ... 216
Metallurgical Progress, Shasta Co., Cal. (Young) ... 4p. *286
Metalurgica Mexicana Cia—Smelter Stock ... *257
Metallurgy of Copper ... †825
Metallurgy of Zinc ... †464
Metallurgy on Rand ... †741
Metals—Prices. Monthly feature
—Scrap sale ... 870
Metals Competition. Editorial ... 1042
Metals Exploration Co., Colo. ... 673
Methane in Mines ... 25
Method of Determining Nickel in Silverhorn Ores (Marriage) ... 174
Metric Scale for Surveyors (Best) ... *101
Metric System Bill. Editorial ... 682
—Hearings ... 385, 588, 1031
—Introduced ... 190
Mexia, Tex.—Petroleum ... 1064
Mexican conditions. Editorial ... 641
Mexican Corporation ... 1074
Mexican Natural Resources Co., Chih. ... 150, 431
Mexican Silver Market ... 325
Mexico—Desert Ranges. Editorial ... 483
—Finance. Editorial ... 642
—French Interests ... 868
—Industrial Conditions ... 345
—Labor ... 385
—Mineral production, 1919, 20-21 ... 265, 310
—Mining conditions ... 510
—Mining properties ... 1019
—Mining Titles (Meyers) ... 406, 685
—Petroleum
Mining Law ... 823
Prospective Production ... 82
—Recent Developments (Payne) ... 3 p. *1045
—Silver ... 353, 511
Exports ... 696
Production 1920-21 ... 479
Taxation ... 384
—Taxes on Import and Export ... 306, 382
—Transportation ... 311, 388
Mexico beginning to look attractive. Editorial ... 482
Mexico [illegible] ... 284
Mexico Tax Exemption. Editorial ... 562
Meyer, F. J. ... *897
Meyers, L. F. C. ... 34
Meyers, F. W. Regulation Mexican Mining Titles ... 406, 685
Meyers, W. A. ... 383
Miami Copper Co., Ariz. ... 70, 272, *794
—Dividends ... 439, 959
—Minerals Separation ... 146
Mica ... †865
—Occurrence and discovery ... 791
Michelson, A. ... 383
Michigan—Copper ... 474
—Copper industry, early records (Keyes) ... 776
—Industrial conditions ... 751, 955
—Taxes ... 314, 628, 715
Michigan Land & Iron Co.—vs. R. S. [illegible] ... 188
Michigan Minerals (Mich. Geological Survey) ... †104
Michigan Smelting Co., Mich. ... 673
Microscopic mineral determination ... †143, 903
Midas Mines, Nev. ... 597
Middleton, R. A. ... 426, 867
Midland, N. M. ... 874
Midvale, Utah ... 33, 152, 273, 399
Midwest Dev. Co., Utah ... 749
Midwest Refining Co., Mont. ... 661
Milam Power Co., Cal. ... 514
Mile Forty, Alaska ... 192
Miles, H. Death ... 145
Mill [illegible] Production ... *189
Mill Canyon, Nev. ... 32
Millard, B. F. ... 383
Miller, B. L. Graphite industry U. S. & Canada ... 6 p. *207
Miller, D. L. ... 98
Miller Independence, Ont. ... 150, 385
Miller, R. B. ... 114
Milling—Determining Magnetic Iron Concentrate ... 919
—Rand Tailings Retreatment ... 818
—Spillage and Dust Losses ... 938
—Throwing Device Hart Jigs (Kemp) ... 900
Mills, Grinding ... 3 p. *969
Mills, H. ... 345
Minas Nuevas ... 271
Mine Accounting. Editorial ... 122
—Standard Mine Cost Statement ... 5 p. 126
Mine Accounting and Cost Principles (McGrath) ... †464
Mine Blacksmith Shops (Day) ... 5 p. *609
Mine Gases ... †662
Mine Hygiene in Australia. Editorial ... 602
Mine Sampling Methods at Tyrone, N. M. (Anderson) ... 4 p. *531
Mine Shaft Telescope. Editorial ... 482
Mine Ventilation ... †545, †662
Miner Men (Heimbach) ... 377
Mineral Concessions in India ... †264
Mineral Deposits and Vegetation (Harper) ... *693
Mineral Industry During 1920 (Roush) ... †903
Mineral Policy Platform for World. Editorial ... 1
Mineral Resources †104, †264, †344, †464, †545, †662, †741, †865, †903, †1025
Mineral Resources of Durango (Terrones & Rangel) ... 6 p. *168
Mineral Resources of New York ... †422
Mineral Resources of Syria (Toll) ... 5 p. *846
Mineral Resources of U. S. ... †422
Mineral Statistics ... †545
Mineral Tariffs ... †662
Minerals in Ore Pulp. Editorial ... 283
Minerals Separation vs. Butte & Superior ... 33, 66, 349, 548, 875, 907
Minerals Separation vs. Miami Copper Co. ... 146
Mines Inspection Act ... 27
Mines Inspection Act in Illinois. Editorial ... 2
Mines Service Corp., Ont. ... 230
Mine Superintendents Meetings in California. Editorial ... 242
Mining—Future. Editorial ... 922
—Mechanical Developments (Bain) ... 268
—Removing Shaft Pillar ... 937
Mining & Metallurgical Society ... 1026
—Domestic & Foreign Mng. Policy ... 904
—Engineering Education ... 742
—Engineers Licensing ... 382
—Vocational Training ... 584, 602
Mining and Metallurgy ... 85
Editorial ... 82
Criticism ... 401
Mining and Smelting Situation in Colorado (Walter) ... 125
Mining as seen by Herodotus (Ball) ... 614
—Comment (Georgiades) ... *1044
Mining Association of Eastern British
Mining Association of British Columbia ... 950
Columbia ... 1070
Mining Catalog (Keystone Cons. Pub. Co.) ... †264
Mining Company in Japan (Ishikawa & Kitamura) ... 2 p. 966
Mining Conditions ... 678
Mining Corporation of Canada, Ont. ... 69, 747, 950
—Report 1920 ... 72
Mining Engineer's Education (Commerciante) ... 125
Mining in Alaska ... †903
Mining in Argentina (Walker) ... 4p. *291
Mining in Chile ... †1025
Mining in Colorado ... †545
Mining in Mexico (Cleland) ... †184
Mining in Quebec ... †464
Mining in South Australia ... †985
Mining in Tasmania ... †903
Mining Industry—Revival of. Editorial ... 1041
Mining Industries in Washington. Editorial ... 881
Mining Institute of Scotland—Meeting ... 665
Mining Law Revision ... 110, 148, 308, 641, 708, 788, 795, 947, 1004, 1005, 1031
—Bain on ... 746
—Editorials ... 641, 801, 841, 842
—Montana Mining Association ... 989
—Moulton on ... 804
—Northwest Mining Association ... 964
—Roos on ... 166
—Wallace, Idaho Board of Trade on ... 1073
Mining Laws (Wilson) ... †702
Mining Methods ... †1025
Mining Odyssey (Holden) ... *176
Mining Petroleum in Kentucky ... 505
Mining Stocks. See Weekly Quotations
Minnesota—Engineers Registration ... 308
—Industrial Conditions ... 751
—Iron ... 869
—Taxation ... 307
Minnesota Steel Co. ... 65
Mirasol Club ... 778
Missabe Mountain, Minn. ... 34
Mission of the Business Press. Editorial ... 1003
Missouri—Bureau of Mines Survey Milling Problems ... 1065
Missouri (Joplin Miami)—Industrial Conditions ... 751, 955
Missouri (Southeast)—Industrial Conditions ... 751
Missouri Iron & Steel Corp.—St. Louis Iron & Steel Co. consolidation ... 674
Mitchell, G. J. Replacement Copper Deposits Warren District ... 4 p. *240
Mitchelson, Sir A. ... 346
Mitke, C. A. ... 26, 946
Moctezuma Copper Co., Mex. ... 779, 951
Modderfontein B ... 588
Modderfontein, Rand ... 269
Modoc Cons. Mines Co., Colo. ... 112
Moffit, F. H. ... 100
Mogollon Mines, N. M. ... 13, 1033, 1072
Mohave Desert Co. ... †344
Mohawk, Mich. ... 194, 593, 715, 750, 792, 1035, 1070
Moisture—Blast Furnaces (Gillis) ... 250
Mollie Gold Mng. Co., Nev. ... 152
Molybdenum—Maine Test ... 1057
—Ore Depths (McIntyre) ... 125
Molybdenum Steel (Baughom) ... 325
Monas Queen, Colo. ... 70
Monazite—Tariff. Editorial ... 202
—U. S. Consumption ... 698
Mond Nickel Co., Ont. ... 587, 591
Moneta, Ont. ... 112
Money. Editorial ... 642
Montana—Industrial Conditions ... 751, 955
Montana Development Co., Ariz. ... 672
Montana Mng. Association ... 989
Montana Morning, Mont. ... 390, 714
Montana Silver Copper Co., Mont. ... 154
Monte Rico Mng. Co.—Fleming ... 874
Montreal, Mich. ... 34, 154
Moonlight Gold Mng. Co., Col. ... 1071
Moore, C. E. ... 987
Moore, P. N. War Minerals Relief Commission ... 7 p. 730
Moore, R. B. ... 186, 305, 867
Moore, R. C. ... 585
Moose, B. C. ... 1070
Moran, R. B. Unjust Taxation California Oil Properties ... 2 p. 342
More About those Copper and Brass Stores. Editorial ... 721
Morington, Cal. ... 673
Morley, W. S. ... 643
Morning, Idaho ... 433
Morning Star, Cal. ... 911
Morocco (Hutchins) ... 3 p. 1006
Morris, H. C. ... 346, *426
Morrison, G. A. ... 826
Morro Velho, Brazil ... 49
Morse, H. A. ... 230
Morton Salt Co., La. ... *684
Mosburg, L. G. ... 224, 266, 585
Moss Mines, Ariz. ... 192
Mother Lode, B. C. ... 639
Mother Lode, Cal. ... 31, 402, 673
—Superintendents meetings. Editorial ... 242
Motion Pictures. See "Moving Pictures"
Motors—Current Driven Water ... 537
—Santa Barbara ... 1050
Mougin, J. R. ... 426
Moulton, G. F. ... 585
Moulton, H. G. Mining Law Revision ... 804
Mount Boppy, Australia ... 830
Mount Cuthbert, Queensland ... 191
Mount Lincoln Cons. Co., Colo. ... 713, 1034
Mount Lyell, Tas. ... 191, 589
—Filtering Flotation Concentrates ... 217
—Report 1920 ... 958
Mount Morgan Gold Mng. Co., Ltd. ... 29, 111, 191, 270, 308, 552, 589, 828, 909
—Annual report 1920-21 ... 439
Mount Oxamby, Queensland ... 191
Mount Reid Rosebery, Tasmania ... 191
Mount Sullivan Mng. Co., Idaho ... 33
Mountain Copper Co., Cal. ... 194, 673, 1073
Mountain Top Mg. Co., Colo. ... 389, 673
Moving Pictures—Bureau of Mines ... 190, 452, 931
—Drilling Operations ... 919
—Editorial ... 282
Moynahan, A. E. ... 145
Muir, D. D., Jr. ... 787, 1066
Mule Haulage in Metal Mines (Boericke) ... 3 p. 853
Mulliken, H. S. ... 466
Multiplex, B. C. ... 871
Munger, C. H. ... 787
Munroe, H. S. ... 305
Murphy, A. ... 506
Murphy, J. G. Mining Law Revision ... 1004
Murphy, J. K. Death ... 686
Murphy, T. ... 230
Murray, M. D. ... 743
Murray, Utah ... 33, 152, 273
Muscle Shoals Nitrate Plant ... 146, 995, 1033
—Editorials ... 961
Mustang, Nev. ... 72
Mutual Doyle Mng. Co., Nev. ... 473
Mutt & Jeff, Mo. ... 1035
Myers, W. ... 547
Myles Salt Co., La. ... *9
Myrtle, Ore. ... 512
Mysore Gold Mng. Co.—Report, 1920 ... 199

N

Nabob Cons. Mng. Co.—vs. J. W. Codd ... 153
[illegible] Club ... 911
Nagel, F. J. ... 585, 867
Namaqualand, S. A. ... 1032
Naraguta Tin Mines, Nig. ... 747
Narukawa Mng. Co., Ltd. (Ishikawa & Kitamura) ... 2 p. *966
Nason, F. L. Freedom of the Press ... 364
National Geographic Society. Editorial ... 42, 681
Comments ... 205, 295, 404, 484, 724
National Lead Co.—Cottrell Installation ... *446
—Dividends ... 39, 639
National Safety Council—Annual Congress ... 3 p. 581
National Silver Mng. Co., Miss. ... 194
National Tuberculosis Association. Editorial ... 923
National Vigilance Committee ... 945
Natomas Co., Cal. ... 112, 625, *688, 690, 691
Navajo Copper Co., Ariz. ... 1033
Navojoa, Mex.—Recent Developments (Payne) ... 3 p. 1045
Necessity of Taking Part. Editorial ... 401
Nechi Mines Ltd.—Report 1920 ... 199
Negociacion Minera Jesus Maria, Coah. ... [illegible]
Neighborly Chats with Foreman ... 861, 899, 937, 1021, 1062
Neill, J. W. Obtaining Suction in Jigs ... 641
Neuman, E. F. ... 224
Nellie Gray, N. M. ... 70
Nettie L., B. C. ... 149

[illegible]

Nitrates at Muscle Shoals. Editorial

[illegible]

Noonday Mines, Cal. ...316

[illegible]

O

[illegible]

Ore. 392

[illegible]

Ore. ....2 p. 548

[illegible]

Colo. 389 95

[illegible]

P

[illegible]

J. C. ....

[illegible]

Perini, Cal. 391

[illegible]

Editorial

[illegible]

Page
Platinum—continued
—U. S.
  Market 1900-1921 478
  Production, 1920 98
Platt, J. M. 266
Platte River Dg. Co., Colo. 1034
Plumas Eureka Annex, Cal. 473
Plymouth Cons. Gold Mines, Cal. *102, 226, 873
—Shaft sinking *181
Poderosa Mng. Co.—Dividends 279
—Report 1920 279
Poland—Silesian [illegible] distribution 989
Politics and [illegible] in Asiatic Turkey. Editorial 761
Polkinghorne, W. C. 626
Pope, F. 266
Porcupine Crown Mines, Ont. 748
Porcupine Davidson Gold Mines 387
Porcupine V. N. T., Ont. 387
Port Pirie 429, 589
Porteus, J. P. 106, 1066
Portland Gold Mng. Co., Colo. 713, 952
Poston, R. H.—Drafting room weights 739
—Draining water from conveyor belts 822
—Safety Device for Station Gate 1063
—Tagging diamond-drill holes *659
—Transit tripod leg clamp 739
Potash .... †903
—Alsace-Lorraine—Production 215
—Brazil 47
—German Syndicate contract 670
—Southwest discovery 789
—Utah 433
Potash tariff. Editorial 202
Potero Mn. Co., Sin. 553, 831
Potosi-Caribou, Col. 514
Potts, C. W. Tariff on minerals 4
Powdered coal .... †985, †1025
Powell, H. 111
Power—Arkansas 469
—Colorado River 708
—Porcupine, Ont.—Control 712, 792
Power, H. W. Welfare work in Coeur d'Alenes .... 2 p. *295
Power plants—Chihuahua 270
Power rates—Utah 225, 273
Power supply Witwatersrand (Edward) 667
Practical use of theoretical knowledge (Lloyd) 53
Pratt, J. H. 145
Precious stones .... †741
Precipitating copper .... †702
Precipitation—Cottrell process phosphoric acid 167
Precipitation—United Verde 621
Preliminary roughing concentration by sorting, jigging and tabling (Wiard) 326, *369, *411
—Comment (Neill) *644
Premier, B. C. 68, 229, 511, 628, 831, 910
—Patrick Daly 744
Presler, M. S. Cheap and efficient rod mill lining *301
Prestea Block A, W. A. 1031
Price, J. M. 305
Prince Consolidated, Nev. 112, 194, 473
Princeton, Mich. 434
Princeton Mining School 144
Problem of the Publication Society. Editorial 681
Production of coal. Editorial 481
Profit sharing (Cook) 325
Profit sharing in mining (Kellogg) 124
—Criticism (Crocker) 443
Progess of rock-drill bits. Editorial 801
Promontorio, Dgo. 712
Properties of slate .... †903
Proposed Mining Law. Editorial 801
Proposed Monazite Tariff. Editorial 202
Prospecting—Drilling and dredging (Gardner) *646, *688
—Electrical (Kelly) 1004
—Washington 499
Providence, B. C. 111
Providencia, Gto. 31
Providencia, Sin. 558, 831
Prowell, W. J. 64
Psyche, Ore. 313
Pueblo Leasing Co., Ariz. 672
Pulaski Inv. M. & P. Co., Col. 514, 1071
Pump sinking—Substitute *660
Purington, C. W. 426, 707
—Career 737
Pyrite in South Carolina .... †741
Pyrites—Czecho-Slovakia 550
—Spain export 1028
Pyrometry .... †24

Q

Quantitative microscopic determination of minerals in ore pulp. Editorial 283
Quartz—Uses 100
Quayle, W. J. 547
Queen, Col. 389, 1071
Queen Creek Copper Co., Ariz. 1033
Queen & [illegible], Wash. 313
Queensland—Sapphire marketing scheme 191, 910
—State mineral enterprises 910
Queensland [illegible] .... †24
Queensland [illegible] .... †786
Quesnelle [illegible] Corp. *207, 211
Quicksilver—[illegible] 170
Quigley, W. J. 666
Quincy, Mich. 7, 113, 154, 274, 593, 834, 1070
Quinn, C. K. & Co., Minn. 593, 952

R

Radioscope Laboratories Co. 963
Radium .... †545
—Belgian Congo 428, 1010
—Cornwall mine 1028
—Czecho-Slovakia 350, 427
[illegible] Canada 68

Page
Radium Co., Colo. 33, 432, 592
Radium Luminous Materials Corp., Col. 592
Radium supply (Staver) 405
Ragsdale, W. 33
Raible, C. M. 232
Raick, J. 787
Rail linings for ball mills (Hardinge)—Comment 1005
Railroads and trucks. Editorial 722
Ralston, J. C. 666
Ralston, O. C. 466
Rambler-Cariboo, B. C. 30, 352, 430, 831
Rambler, Wyo. 473
Ramlow, W. C. 547
Rampolla, B. C. 229, 871
Rand—Costs 386
—Far East conditions 790
—Labor situation 309, 510, 788, 868
—Mining practice 1008, 1012, 1019
Rand, C. F. 26
Rand Mines—Central 195
Rand Refinery, Ltd. 747
Randall, H. B. S.—Death 145
Randfontein 868
Randfontein Central 149, 269
Randfontein Estates 149
Randolph Gold M. & M. Co., Colo. 151
Randsburg Silver Mng. Co., Calif. 32, 391, 513
Rangel, M.—Durango mineral resources .... 6 p. *168
Ransome, F. L. Career *99
Rare and precious metals station Bureau of Mines (Young) *214
Rawley, Colo. 307
Ray Consolidated Copper Co.—First quarterly report 76
—Report second half 1921 397
Ray-Hercules, Ariz. 988
Raymond, R. M. 106
Reavis, H. S. 106
Recent advance in design of gold-dredge bucket lips (Young) 932
Recent applications of Cottrell processes (Hesson, Landolt & Heimrod) .... 4 p. *446
Recent Developments in Mining in Jalisco and Nayarit, Mexico (Payne) .... 3 p. *1045
Reception of the mine law revision. Editorial 841
Rechtersveld 991
Reclaiming silver tailing at Coniagas (Cawley) *890
Reclamation of Mexican mining titles (Meyers) 406, 685
Reconstruction. Editorial 82
Red Oak, Ore. 993
Red Ribbon, Ore. 392
Redfield, A. H. Djambi oil field of Sumatra 939
—Petroleum in Mendoza-Neuquen District, Argentina 23
—Petroleum possibilities of Guatemala .... 4 p. 540
—Venezuelan petroleum industry 1920 .... 4 p. 780
Rees, C. 905
Reeve, F. C. Elementary qualitative analysis of metals and acid radicals .... †184
Refining lead-bullion (Griswold) 978
Refinite Co., S. D. 1072
Reid, J. T. 346
Reid, W. L. 26
Reigart, J. R. 743
Reinhardt, A. P. 33
Reorganized Belcher Divide, Nev. 72
Replacement copper deposits in Warren District (Mitchell) .... 4 p. *246
Replogle, J. L. Hapsburg Estate Interests 469
Republic Iron & Steel Corp., Ala. 628, 793, 954, 995, 1035
Republic M. & M. Co., Ala. 995
Republic of Canada. Editorial 43
—Hannay's comment 605
—Reply (Leo) 325
Requa, M. L. 26
Research—Bureau of Mines Co-operation 550
—Latin American 707, 722
—Utah School of Mines 424
Reservation, N. M. 70
Revenue Mines, Ariz. 794
Reverberatory furnaces 856
Reverberatory furnaces (Thum) 924
Reynders, J. V. W. 826
Rhodes, M. E. 227, 309, 509, 465
Rhodesia Broken Hill Dev. Co. 228
Rice, E. R. 426
—Churn Drilling Disseminated Copper Deposits—II .... 8 p. *11
Rice, G. G. 27, 151, 153, 187, 313, 468, 935
Editorials 43, 162
Rice, G. S. 148, 346
—Alaska mining 588
—Mine ventilation 1021
Richards, A. E. 626
Richards, J. V. 905
Richards, J. W.—Death *666
Richards, W. J.—Death 26
Richards Jig 329
Richardson, A. 145, 346, 383
Richardson, C. A. 64, 224
Richardson, D. A. 707
Rickard, T. A. Concentration by flotation .... †184
Ricketts, L. D. 1029
Ridge Valley, Utah 1073
Riffle—Kirtley (Canton) *180
Rigby, Ariz. 272
Right and wrong of churn drilling. Editorial 3
Right of Way, Ont. 591
Rigney, P. S. 351
Rill stoping .... †344
Rimu Gold Dredging Co. 831
Rinehart, W. 194
Rio Plata, Chih. 431
Rio Tinto, Spain 349, 628, 711
Riotous taxation. Editorial 683
Rising Star Mine, Cal. *288
Ritter, E. A. 987

Page
Riverside, B. C. 387
Roasting—Nine-Hearth Furnace 491
Roberts, M. 346
Robinson & Sands, Ariz. 995
Roby, L. 905
Rochester combined 948
Rochester Silver Corp., Nev. 32, 833, 948, 1073
—Dividends 39, 639
Rock drill, see "Drilling."
Rock temperatures—East Tintic District 852
Rod mill lining (Presler) 301
Rod Mills—Design of Liner and Application 1056
Rogers, A. F. Introduction to study of minerals and rocks .... †702
Rogers-Brown Ore Co., Minn. 114, 474, 948, 952
Rogers, R. P. 64
Rogers, T. S. 506
Role of acid and slimes in flotation (McLeod) 213
Role of criticism. Editorial 401
Role of sampling in mine operation. Editorial 522
Roll, G. 305
Roodepoort plan. Editorial 603
Roodepoort United, Rand 551, 747, 909
Roos, A. T. Revision of mining laws 166
Roosevelt deep drainage, Colo. 874
Rope drive .... †702
Rope strength 891
Ropes, L. S. 266
—Education of mining engineer 844
—Foreign vs. domestic business 167
Ropp Tin, Ltd., Nigeria 471
Rosario, Guanajuato 31
Rosario, Honduras—shutdown 146
Roscoe Conklin, Colo. 952
Rosebery-Surprise, B. C. 831, 959
Rosedale, N. M. 34
Rosendenia, Mex. 831
Roses Gulch Placer Gold, Ltd., B. C. 629
Ross, C. P. 106
Ross, F. A. 826
Ross, H. M. 273
Ross, J. G. 266
Rossland, B. C. 270, 628
—Production 30
—Transportation 30
Round Mountain Mng. Co., Nev. .... 72, †903
—Report 1920 319
Roush, G. A. Mineral industry during 1920 .... †903
Rowley Copper Mines, Ariz. 748
Rowntree, B. S. 921
Roy, R. O. Co., La. 984
Royal Dev. Co., Wash. 512
Royce, W. 1014
—Scraping and loading in mines 925, 973
Royer, F. W. 666
Royston, Nev. 795, 833, 869
Rubidge, F. T. 106
Ruby, Wash. 230
Rumania Petroleum — Production May-June 1921 421
Rumanian Association of Mining Engineers first meeting 144
Russia—Great Communistic Experiment. Editorial 321
—Metallurgical Industries 696
—Petroleum—Production 463
Russia Consolidation Mng. Co., Col. 514
Russo-Asiatic Consolidated, Ltd. 111, 588, 711, 744
—Report, 1920 199
Ruth, Nev. 152, 254
Ruth, N. M. 33, 272
Rutherford, F. 224
Ryan, J. D. 186
Rypinski, J. E.—Seven year mining course 245

S

Sabanagrande, Honduras 146
Saben, W. M. 987
Safety. Editorial 883
Safety—Carbide with explosives 972
—Gas Masks Bureau Test 613
—Guarding chute lips of shaft pockets *659
—Hoist engineer. Editorial 243
—Hoist signaling in metal mines 665
—Hoisting device 938
—Mines Inspection Act 2, 27
—Old workings dangerous 924
—Regulations on use of telephone 185
—Station Gate Device 1063
Safety Device for Station Gate (Poston) 1063
Sagamore, Minn. 114, 355
Sagebrush silver producer (Carpenter) .... 4 p. *132
St. Anthony, Ont. 748
St. Clair, M. M. Desert prospector 139
St. John del Rey Mng. Co. 49
—Dividend 279
—Report 1920-21 159
St. Joseph Lead Co., Idaho 1074
St. Joseph Lead Co., Mo. 954
—Dividends 639
St. Louis Iron & Steel Co.—Missouri Iron & Steel Corp. Consolidation 674
Salduro Chemical Co. 107
Salida Smelter, Col. 307
Salmo, B. C. 111
Salt and gypsum deposits of So. Australia (Jack) .... †143
Salt Creek Field, Wyo.—Petroleum 62
Salt in Nova Scotia .... †24
Salt mining in Louisiana (Wolf) .... 5 p. *6
Salvator, B. C. 1070
Sampling in mine operation. Editorial 522
Sampling methods—Tyrone, N. M. (Anderson) .... 4 p. *531
San Diego, Chih. 271
San Francisco Mines 870
San Joaquin Valley—labor 381, 580, 661, 701
San Jose de Gracia, Sinaloa 553
San Juan, Chih. 431

San Juan de Mata, Dgo. [illegible]
San Luis Gonzaga, Sin. [illegible]
San Luis Mng. Co., Dgo. [illegible]
San Manuel y Anexas, Zacatecas [illegible]
San Martin, Chih. [illegible]
San Patricio, Chih. [illegible]
San Pedro Analco, Jalisco [illegible]
San Rafael Mng. Co., Dgo. [illegible]
San Sebastian Mines [illegible]
Sanders, L. [illegible]
Sanderson, Ont. [illegible]
Sanger, Nev. [illegible]
Sangre de Cristo, Colo. [illegible]
Sanitation — Purifying water [illegible] (Lanza) [illegible]
—[illegible] commission [illegible]
Santa Barbara 500-Ton Mill for Concentrating Lead Carbonate Ores (Heidelberg) [illegible]
Santa Cruz Mng., Dgo. [illegible]
Santa Eulalia, Chih. [illegible]
Santa Eulalia, Chih. 431, 631
Santa Gertrudis—Report 1920 [illegible]
Santa Rosa, Chih. [illegible]
Sapphire field—Arizona 191 [illegible]
Sapphires—Montana [illegible]
Saunders, T. S. [illegible]
[illegible] J. A. Co., Mass. 114, [illegible]
Sawyer, E. M. [illegible]
[illegible], O. M. [illegible]
[illegible], C. Q. [illegible]
Schlumberger, Prof. C. [illegible]
[illegible], F. L. [illegible]
[illegible], C. J. [illegible]
Schumacher, Ont. [illegible]
[illegible], M. [illegible]
Science, Journalism and Hypocrisy (Editorial) [illegible]
—Comments [illegible]
Scott, W. G. [illegible]
Scranton, Utah [illegible]
Scrapers [illegible] 3 p. [illegible]
Editorial [illegible]
Scraping (Editorial) [illegible]
Scraping and loading in mines (Rover) [illegible]
Seaman, A. E. [illegible]
Seeber, R. R. [illegible]
Seelig, J. C. [illegible] for ball mills [illegible]
Sells Mng. Co., Utah [illegible]
Seneca, Mich. [illegible]
Sensitiveness of modern economic system (Editorial) [illegible]
Service information (Editorial) [illegible]
Setting Europe up in business again (Editorial) [illegible]
Setter Tap [illegible]
Shackelford, W. B. 186
Shaft [illegible]
Shaft pillar Removal [illegible]
Shaft sinking—Plymouth Mine [illegible]
Shaft sinking record—Walter Fitch, Jr. Co. [illegible]
Shaft surveying—North Star Mine [illegible]
Shafts—Locking guides ....*304 [illegible]
[illegible]
Shasta Zinc & Copper Co., Cal. [illegible]
[illegible]

[illegible] Ranch, Ariz. [illegible] 188
[illegible]
—Report 1920–21 [illegible]
[illegible] Silver-Lead Mines, Nev. 267, 391, 673, 907, 994, 1073
[illegible]
Sister, Ida. 71
[illegible] Zinc & Lead Co. [illegible]
[illegible]
[illegible]—Zinc Recovery from lead blast furnace 338
[illegible], J. F. [illegible]
[illegible], R.—Smelting sulphur and arsenic in China *695
[illegible]
Sloss Sheffield Steel Iron Co., Ala. 628, 1035
[illegible]
Slump in Humanitarian Market? Editorial 442
[illegible] Verde, Ariz. Jerome Copper Co. [illegible]
[illegible]
[illegible] 1003
[illegible]
[illegible] on Rand 1019
Smelting rates—Trail, B. C. 587
[illegible] ores in China [illegible]
[illegible]
Smith, P. [illegible] on minerals and [illegible]
Smith, R. G.—Discrepancy between drilling [illegible]
[illegible]
[illegible] of Chemical Industry — Montreal [illegible]
[illegible]
[illegible] Mines, S. A. [illegible]
[illegible]

[illegible]
Standard Silver-Lead Mng. Co., B. C. 68, 633
[illegible]
Stearns, C. E. 346
[illegible]
Sterse, R. C. 383
[illegible]
Stevens, N. M. [illegible]
Stewart, J. A. [illegible]
Stewart Mng. Co. [illegible]
Stewart, N. L. [illegible]
Stewart, R. H. 828
[illegible]
Stoddard, C. [illegible]
Stone, R. W. [illegible]
Stoping [illegible]
—Record [illegible] in South Africa [illegible]
[illegible]
Strode, Cal. 911
[illegible]
Sullivan, B. C. 111, 671
[illegible]
—Upper Silesia, Poland 989
[illegible]

Page
Tacoma, Wash. 512
[illegible], B. C. 229
Tailing dam of Chino Copper Co. (Anderson) 6 p. *806
Tailings—Silver at Coniagas (Cowley) 890
Tailings retreatment on Rand 815
Tajo, Chih. 271
Talamantes, Chih. 271
Talc †464
—California production 338
—Domestic production 373
Talisman Cons., Ltd., New Zealand 348
Talley, R. E. 1029
[illegible], M. 314
Tamarack & [illegible] *874
Tam O'Shanter, B. C. 149
[illegible] conditions 381
[illegible] (Gallis) *300
[illegible], Utah 749
[illegible] 833
Tariff—See also names of Minerals, etc.
—Copper [illegible] 11, 387
—[illegible] in Editorials 564
—[illegible] Editorial 201
—[illegible] 429
—Fordney Bill 28, 67, 109, 142, 147, 189, 273, 470
Hayden on 226
Rhodes on 227
Sheldon on 84
—Tungsten (Stoddard) 445
[illegible] stocks (Wedekind) 165
Tariff for National Defense. Editorial 202
Tariff on Minerals (Pawle) Comments 1, 165, 204, 404, 445
Tariff on minerals and metals. Editorial 81
Tariff on monazite. Editorial 202
Tasmania—Osmiridium 55
—Zinc—Electrolytic recovery 499
Tata Iron & Steel Co. 909
Tawara, K. 383
Tax exemption in Mexico. Editorial 562
Tax situation. Editorial 41
Taxation—American Mining Congress viewpoint 703
—Arizona 353
—Bill introduced 551
—British Columbia 791, 871, 991
—Burden. Editorial 961
—California—Oil ([illegible] & Morant) 342
—Chisholm, Minn. 307, 674
—Gold—Excess profits 429
[illegible], R. M. on 2 p. 1011
—Hibbing, Minn. Editorial 683
—Mexico import and export 306, 382
—Mexico—Silver 384
—Michigan 314, 628, 715
—New Mexico 749
—Oklahoma 750
—Ontario 285, 791
—Petroleum Bill 551
—Revision of Bill 908
—State and Local. Editorial 382
—U. S. Mining Bill revision 746
—Utah 389
Taylor, A. Death 145
Taylor Engineering Co.—vs. G. Wingfield 511
Technical Societies and Journalistic adventure. Editorial 82
Teck-Hughes, Ont. 229, 552, 590, 991
Tecolotes, Chih. 271
Tehidy minerals 870
Teller, Colo. 952
Temiskaming Mng. Co., Ont. 310, 552
—Annual report 1920-21 756
Temiskaming & Northern Ont. Commission 1032
Tennessee—Industrial conditions 751, 955
Tennessee Coal, Iron & R. R., Ala. 628, 954
Tennessee Copper & Chemical Corp.—report 1920 39
Terrible Edith, Idaho 230
Terrones, A. Mineral resources Durango 6 p. *168
Terry, J. T., Jr. 186
Texas—Petroleum
Deep Wells (Wolf) 141
Pierce Junct. 421
—Red River boundary settled 1064
Texas Gulf Sulphur Co. 66, 179, 607, 869, 1070
—Union Sulphur Suit 868
Texas Production Co. 142
Textbook of Geology (Grabau) †662
Thacher, A. 585
[illegible], N. M. 34
Thawing Device for Harz jigs (Kemp) *900
[illegible] petroleum 724
[illegible], Idaho 1074
Thomas, K. 106, 743, 905
[illegible] 69
[illegible], W. B. 64
[illegible] Co., Ont. 748
[illegible], S. C. 64
Thompson, W. B. 787
Thomson, E. 905
Thomson, F. A. 185, 223
[illegible] 1035
[illegible] 787
Thunderbolt Copper Mng. Co., Ariz. 312
[illegible] laboratory [illegible] 924
Tiebaghi, New Caledonia 69, 150
[illegible] 951
[illegible] 114
Timber Butte Mng. Co., Mont. 953
Timber [illegible] its relation to [illegible] (Harrington) 4 p. *565
Timber [illegible]—Framing 539
Timber [illegible] (MacGregor) 1021
Tin—Bolivia 1018
—[illegible] 587, 789, 870
—[illegible] 170
—Dutch East Indies 669
—Federated Malay States 950, 1018
—Market. Editorial 561
—Straits settlement 154
Tin Boom, So. Dak. 174
Tin resources of British Empire (Penzer) 421
Tintic District, Utah—Shaft sinking record *376
Tintic Milling Co., Utah 231, 952
Tintic Standard, Utah 33, 152, 273, 555, 664, 714, 875, 952, 1073
—Dividend 279
Tioga, Minn. 154
Tiro Lease, Ariz. 672
Titaniferous ores. Use 577
Tobelmann, H. A. 987
Toby Creek Mng. Co., Ltd., B. C. 310
Tod, F. 383
Tod-Stambaugh Co., Minn. 34, 948
Toll, I. M. Mineral resources in Syria 5 p. 846
Tom Reed, Ariz. 192, 272, 832, 1072
Tomboy Gold Mines Co., Ltd.—Report 1920-21 1039
Tombstone, Ariz. 347
Tombstone Co-operative Mill Co., Ariz. 389
Tonopah Belmont, Nev. 32, 873, 953, 1073
Tonopah Divide, Nev. 232, 434, 595, 795, 873, 911, 994, 1073
Tonopah Extension, Nev. 32, 72, 151, 232, 391, 592, 953
—Cash Box Suit 434, 988
—Dividends 279, 756
Tonopah Mng. Co., Nev. 795
—Annual Report 1921 1079
—Dividends 756
Tonopah Oriental Mng. Co. vs. Donohue 32
Tonopah Placers Co.—Report 1920 1079
Tool waste (MacGregor) 861
Toole Field, Mont.—Gold rush 993
Torie, B. C. 511
Torreon Cia. Metalurgica, Chih. 1069
Torreon, Coah. 631, 1033
Tough Oakes, Ont. 229, 951
To what information is the stockholder entitled? Editorial 122
Townsite, Mich. 154
Townsite, Ont. 631
Toya Valley Sulphur Co., Tex. 951
Trail Mng. Co., B. C. 387
Training the miner to mine. Editorial 602
Transportation—Arizona and Sonora Railway project 226
—British Columbia 111
—Chile 97
—Coeur d'Alenes 146
—Colorado 912
—Colorado & Southern 1071
—Duluth 1029
—Editorial 1001
—Idaho 231
—Mexico 311, 338, 1045
—Moffat Railroad, Colorado 1071
—Mule Haulage (Boericke) 853
—Nevada 187
—Ontario 112, 310
—Railroad tonnage 1920 67
—Railroads and trucks. Editorial 722
—Southwest 827, 1028
—Utah, Nevada and California 832
Transporting dredge material at Dayton Nev. (Young) 2 p. *374
Transvaal—Gold—Production 38, 198, 671, 879, 1069
—Labor 552
Transvaal, Chih. 431
Transvaal tin deposits †464
Traveling in Morocco (Hutchins) 3 p. *1006
Trethewey, Ont. 631
Trezona, C. 145
Tri-State District. See "Kansas," "Missouri," "Oklahoma."
Trinity, Ariz. 151
Triumphs of Journalism. Editorial 281
—Comment 364
Trojan, S. D. 1072
Truax Picketing Case 1030
True Yarn, A. Editorial 962
Tube milling, South Africa 1008
Tucson, Colo. 1034
Tucson & Amole Mountains †104
Tungsten †344
—Bolivia—Tungsten deposits (Hess) 60, *492
—Tariff 470
Tungsten-bearing deposits possibilities (Stoddard) 445
Tunnel driving †545
Tuolumne Copper Mng. Co., Mont. 154, 231, 593, 633, 672, 749, 833, 875, 993, 1034, *1074
Turkey—Politics and mines 761
Tuthill, S. S.—Zinc tariff 284, 350
Tyopa (McCarthy) 816
Tyrrell, J. B. 266, 707, 905

U

Underground Loading †903
Underground Mechanical Development. Editorial 321
Underwriters' Land Co., Okla. 514, 555, 715, 750
Unemployed. Editorial 521
Union, B. C. 831
Union Mng. Co., Ont. 352
Union Sulphur Co., La. 8, 606
—Government Tax Suit 591
—Texas Gulf Suit 868
United Comstock, Cal. 673
United Comstock Mines, Nev. 72, 151, 362, 473, 513, 673, 911
United Eastern, Ariz. 272, 1072
—Dividend 279, 756
United Gold Mines, Col. 514
United Gold & Silver Mng. Co., Ariz. 70
United Kingdom—Zinc situation 236
United Metals Co., Idaho 833
United [illegible] Co., [illegible] 31, 388
United States—[illegible] Production 294
—Cadmium Production 1910-20 38
—Chromite 1920 290
—Copper Smelter production 1910-1921 118
—Fuller's Earth production 1920 410
—Gold 1920 959
—Graphite (Miller) 6 p. *207
United States—
—Magnesium production. Uses 460
—Manganese ore production 1914-18 5
—Oil Shale. Status of Industry 183
—Petroleum Production 1920, 1921 222
—Platinum Market 1900-1921 478
—Platinum Production 1920 98
—Silver 1920 959
—Silver exports and imports 278
—Zinc Market Study 1921 158
—Zinc Production 1919-20-21 479
U. S. Geological Survey—Annual Report 946
—Appropriations 949
—Census Bureau Assistance 990
—Division of Geology 789
—Utah Work 1066
—World's Water Power Resources 908
U. S. Geological Survey in War (Smith) 3 p. 892
U. S. Gypsum Co., S. D. 1072
United States Metals Co. Ore 1074
U. S. Mineral Resources †143
U. S. Mining Co., Utah 152
U. S. Potash Producers Assn.—German Syndicate Contract 670
U. S. S. & R. Co., Hidalgo 310
U. S. S. R. & Exploration Co., Ariz. 951
U. S. S. R. & M. Co. 33, 151, 951
—Dividends 279, 756
U. S. Steel Corp., Ala. 954
—Pittsburgh Plus case 1030
United Verde, Ariz. 272, 713, 873
—Dividends 639
—Precipitation 631
United Verde Extension, Ariz. *609, 832, 873, 995
—Dividend 959
—Gallup, N. M., purchase 627
—Grouting 620
—Smelter Smoke suit 354, 639, 913, 951
United Zinc Smelting Co.—Manhattan mine 555
Universities and Commencements 802
University of Washington—Mines Laboratory *468
Unprofessional Practice. Editorial 883
Upside Down. Editorial 323
Urquhart, L. Russo-Asiatic Consolidated Negotiations 711, 744
Use of Powdered Fuel Under Steam Boilers †184
Utah—Accidents—Ore Dressing Plants 409
—Freight Rates 354
—Geological Survey Work 1066
—Industrial Conditions 751, 955
—State Geologist 947
—Taxation 389
Utah Apex, Utah 152, 1034
—vs. Utah Consolidated 390, 433, 467, 672, 947
Utah Consolidated, Utah 152, 1034
—vs. Utah Consolidated 390, 433, 467
Utah Copper Co., Utah 152, 354, 994
—Dividends 39, 639
—Report second half 1921 397
—Tailings dump dispute 193
—vs. Salt Lake County 672
Utah Metal Mine Operators Institute Meeting 625
Utah Mineral Resources †985
Utah Minerals †741
Utah Power Co. 398
Utah Sulphur Co. 433
Utah School of Mines—Research Work 424
Utah Society of Engineers 1065
Utah Steel Corp. 267, 473, 592
Utah Workmen's Compensation Act 473
Utica, B. C. 270, 831, 871
Utica, Minn. 232
Utley Zinc, Colo. 1034

V

Value of Gold. Editorial 83
Van Derlip, C. L. Death 1066
Van der Naillen, R. L. 192
Van Ness, Cal. 911
Van Ness, W. W. 305
Van Roi, B. C. 191
Van Ryn Deep, So. Africa 830, 1031
Vanadium †702
Vanadium in Arizona (Allen and Butler) †820
Vaughan, T. W. 266
Vaupell, C. W. 547
Vedler, W. R. 1066
Vegetation and Mineral Deposits (Harper) *693
Veins—Dip Determination at Depth *261
Venezuelan Petroleum Industry in 1920 (Redfield) 4 p. *780
Ventilation—Operating Doors 696
—Powder Smoke in Tunnels (Weeks & Wolflin) *699
Ventilation (Rice) 1021
Verde Apex Copper Co., Ariz. 232
Verde Central Mines, Ariz. 192, 432
Vermillion, Mont. 154
Verona Mng. Co., Mich. 1071
Vertical Boundaries in British and Latin **America. Editorial** 842
Victor, Utah 473
Victoria Falls & Transvaal Power Co. 667
Victoria, Utah 434
Victory Divide, Nev. 391
Victory, Ont. 712
View Concerning Licensing Business Man Editorial 363
Vindicator, Colo. 192, 272, 312, 874
Vinegar Hill Zinc Co. 834, 913, 1035
Vipond, Ont. 991
Volatilization Chloridizing (Layng) 5 p. 764
Volcano, N. M. 713, 951

W

Wages, see "Labor" 225
Wages and Commodity Prices. Editorial 563
Wagner, W. H. 64
Wahl, R. L. 660

[illegible]

Wasapika Ont 151

[illegible]

—Removing Powder Smoke in Tunnels

[illegible]

—Shocks on 40

[illegible]

Willis S. L. 787

[illegible]

Wilson Mng. & Smelt Co. Mont. 391

[illegible]

Wright L. A

Wright L. B [illegible]
Homestake

[illegible]

Y

[illegible]

—Gold Production

[illegible]

Z

[illegible]

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
CLEVELAND ABBE, Jr.
Assistant Editors
BENJAMIN L. MILLER
ROBERT [illegible]
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, July 2, 1921 *Number* 1

A World Mineral Policy Platform?

THE FRENCH DELEGATION to the Economic Commission of the Peace Conference passed the following resolution, which was again passed by the Raw Materials Committee of the International Chamber of Commerce on March 14, 1921:

"In order to diminish as much as possible rivalries between peoples in their search for raw materials and to suppress the numerous causes of economic conflicts which endanger the peace of the world, and to neutralize the natural inequalities resulting from the geological distribution of the riches of the world, the Allied Countries and Associates declare that henceforth raw materials destined for industry should be entirely free of duty both as to ingress and egress." . . . "Each of the Allied Countries and Associates reserves the right to regulate by interior rules the exploitation of its natural resources with a view to avoiding too rapid depletion."

It has been pointed out, of course, that this is a policy which would especially inure to the benefit of France, which is poor in natural resources of raw materials; and that it would be a disadvantage to those countries which have important sources of wealth in supplying such raw materials to the world. The point of view has been taken that a country like the Republic of Georgia (formerly in Russia), whose chief wealth is in her manganese deposits, should not be deprived of the right to levy an export tax and derive its chief resources therefrom.

The United States is not, like France, worrying over supplies of raw materials in general; but it is worrying about its future petroleum supplies, and has been working diplomatically on the theory of the international open door for the development of the petroleum resources of the world.

We do not know if any international raw material platform is possible. But in discussing the matter we should like to separate raw materials into two classes—those which form an eternal resource, which may be replenished annually, like the wool of Australia, the cotton of our own South, and the rubber of Asia, and those for which Nature has decreed there should be but one crop for all mankind. In this latter class—constituting indeed, practically the whole latter class—stand our mineral resources.

First, may we support the principle that there shall be in the world neither import nor export duties on minerals? It is true that Nature put these treasures where she chose, and that the chance inhabitants of the lands where they occur have not put them there, nor are they maintained by their industry or ingenuity. No careless uncivilized population can injure the mineral resources of a land, no population so thrifty and hardworking that they can produce their ores, if they live in a land where they are not [illegible]. Is it, then, true that the inhabitants have always a right to sit down on their mineral stores and levy tribute on the industrial world which comes to seek them? Is it true that the semi-civilized tribes of Georgia have the right to tax the steel industry of Europe and America for their manganese, in order that they may flourish without effort? They cannot use the ore themselves.

Coming nearer home, is it fair that Mexico should levy an increasing export tax on her petroleum, needed chiefly for American and British industries? Is it fair that the villagers of Upper Silesia should cast their stupid votes to determine whether the coal and zinc which lie under their feet should save the industries of Germany, or should shape the destinies of Poland?

Mr. Mathewson on European Conditions

E. P. MATHEWSON, on his return from a visit of several weeks to England, France, and Belgium, but chiefly to England, has much of interest to tell regarding the state of affairs in Europe. A return to normal conditions, he thinks, is slowly coming; sentiment and charity are not being considered in the rearrangement, which is following along strictly commercial lines; and Bolshevism is everywhere dying or dead, heed being taken of the horrible example of the practical application of the theories afforded by Russia. The people are continuing, though in a less degree, war-time economies and privations. In Germany particularly is this true, where sugar is still kept in the safe and white bread is rarely seen. War gardens are everywhere maintained, and agricultural activity in all countries is marked. The signs of the trenches are almost eliminated, except on barren hillsides, by the cultivation of the farms. America cannot expect, thinks Mr. Mathewson, to find the customary market in Europe for our surplus food supply.

Asked as to the feeling toward America and Americans, Mr. Mathewson said he found it one of tolerance rather than enthusiastic friendliness. In France, there is a feeling that Americans have profited vastly by the war, have almost all the money in the world, and that French prosperity depends on getting part of it away from them. No doubt many Frenchmen would be surprised to know that the average American seems to be no better off than before the war; in fact, many are not living so comfortably. We have the gold in this country, but it is in the vaults of the financial interests, and not in the pockets of the people. In Brussels, an extravaganza was running at the Alhambra Palace, something on the order of that given at the Hippodrome here in New York. In one number the costumes and flags of the leading nations of the world were exhibited, each being acclaimed by the audience with varying degrees of approval as expressed by applause. The American characterization, however, was received in solemn silence. This is a country which has received more kindly aid from America than any other, surprised Mr. Mathewson considerably.

Living costs in the continental countries are generally less than here. In the best Parisian hotels a dinner with wine can be obtained for the same price as a dry dinner in New York. Champagne is two dollars a bottle. If inclined to live simply, one can get good food at very reasonable prices. Often, however, a special price is asked of Americans, and of such, a general desire is manifested to demand all the traffic will bear. Americans can, of course, easily be spotted by their speech, carriage, clothing, and shoes.

England, as we know, has been in the throes of a serious coal strike, which has disrupted many industrial activities. That this had to come is the general opinion, and it is better to have it fought out during a time of comparative business stagnation, as at present. The coal miners had become inefficient, thousands more men being necessary to mine much less coal than before the war, which raised costs so that England could not compete with American coal. This condition could not continue without seriously affecting England's commercial standing. The coal miners, however, Mr. Mathewson thinks, have a real grievance in the abominable conditions under which they live and work. The strike will result, no doubt, in a higher efficiency of labor and better conditions for the workmen. It is likely soon to end, for funds are low; many miners are already back at work in certain districts.

Shipbuilding seems to be in a fair state of activity, despite the seeming surplus tonnage afloat in American ports. Mr. Mathewson went through one large shipyard, where he saw many vessels of various special types on the ways.

In France, the devastated towns and villages are being rebuilt with more regard for sanitary conditions. Formerly they were generally situated on low wet land along the streams, but now the higher hillsides are being utilized. Concrete is being generally used, and the buildings are surmounted by red-tile roofs. On completion, they are turned over by the government to former property holders who were victims of the war. The claims are adjusted something as an insurance claim for a fire loss would be handled in this country.

Germany was anxious to find out just what was to be demanded of her, and now that this has been for the most part decided, is likely to work hard to regain her former commercial position. She is, however, suffering from a dearth of raw material on which to work. The exchange rate is not a cause for worry, Germans desiring to keep it down so that their products will better be able to compete in the world's markets.

The Mines Inspection Act in Illinois

IN 1906 the American Mining Congress in session at Denver, Col., appointed a committee consisting of W. R. Ingalls, James Douglas, J. R. Finlay, J. Parke Channing, and John Hays Hammond to draft a model law covering "Rules and Regulations for Metal Mines." In 1909 this same committee was invited to act as a committee of the American Institute of Mining Engineers and the Mining and Metallurgical Society of America, and in 1911 as a committee of the U. S. Bureau of Mines. For the purpose of securing general discussion and criticism, preliminary drafts of a "Model Law," prepared by this committee, were published in *Engineering and Mining Journal* in 1909 and again in 1910. After about eight years of careful research and study, the final draft of the model law, as recommended, was published by the U. S. Bureau of Mines in 1915 in Bulletin 75.

It is interesting to learn that this law has just passed both houses of the Illinois Legislature. If the law is approved by Governor Small, of which there seems to be no doubt, the measure will be adopted in about the same form that was recommended by the committee and societies above mentioned. Some of the administrative features in the first sections of the draft were changed to make the law suitable to the existing statutes in Illinois creating its Bureau of Mines and in other particulars. A few unimportant changes were made in the rules and regulations on account of local conditions. This procedure follows the example set by other states which have already made use of the model law as a basis for their legislation, making exceptions, of course, to cover local conditions.

This bill, we understand, was introduced at the suggestion of the fluorspar operators of southern Illinois, and credit for its passage is principally due to Mr. James A. Watson, of Elizabethtown, Representative in the Legislature from the section of southern Illinois which embraces the fluorspar mining district. From our observations of the manner in which fluorspar mining is conducted in that section we have every reason to believe that the operators' advocacy of such a bill was not the result of snap judgment. Their opinions were reached after a careful consideration of their local problems, which include a sufficient diversity to warrant agreement or exception to the original reading of the bill. But no exceptions were taken save those made necessary by local conditions, so that again the stamp of approval is placed on the work of the original committee.

War Minerals Relief Anticlimax

TO CARRY OUT the provisions of the War Minerals Relief Act, Franklin K. Lane, Secretary of the Interior, appointed a tribunal composed of a former United States Senator and Governor of a great mining state, a former Chairman of the Mines Committee of the House of Representatives, and a former President of the American Institute of Mining and Metallurgical Engineers. On account of the untimely death of the second member of the commission, his place was taken by a prominent mining engineer of Arizona. The members of this tribunal worked hard and conscientiously, and no one has breathed any criticism of their honesty and fair intentions (although, of course, there are inevitably many personal views concerning their decisions, on the part of those interested). They have completed their work, and tendered their resignations, leaving of the eight million dollars outside limit appropriated by Congress, four and a half million to be turned back into the Treasury. Will Secretary Fall return four and a half million dollars to the Treasury? Will Japan return Shantung? At the present writing no yearnings in that direction are visible.

For a moment forget your own opinion concerning War Minerals Relief matters. We all of us have a tendency to "know better." We can run the Government better than the President. You could run the *Engineering and Mining Journal* better than we can. Up to a certain point, it is a healthy quality in us. But we must admit that in the long run the Supreme Court has a better chance to make the best decisions than we have, reading in our morning papers, and expounding thereafter: and that the Cabinet knows better how to handle the foreign situation than you do or we do. Looking at it this way, we must acknowledge that Franklin K. Lane constituted such an administrative machine or tribunal for the War Minerals Relief that we can trust, support, and abide by the decisions.

Secretary Lane's successor, Judge Payne, approved of the tribunal and its personnel, and strongly supported it. What does Secretary Fall do? Most of the cases before the commission had been settled, both by the commission and by the Secretary of the Interior: awards had been paid, and the rejected claimants advised by the Attorney General that they had been ruled out by the act of Congress. But there were a hundred claims or so left over for Secretary Fall's ratification of the commission's decision. These he did not ratify. He accepted the resignation of "Honest John" Shafroth, Ex-Governor and Senator for Colorado; of Phil. Moore, whose sometimes truculent honesty is his outstanding characteristic, and of the conscientious and judicial Pomeroy. And then? He appointed, in their place, one West Virginia lawyer, who had been counsel for one of the claimants, and who, somewhat singularly, hails from the town of Grafton.

But we are not superstitious. Further, Secretary Fall announced that he wanted to see whether the existing act could not be construed in a more liberal way, before Congress should be called upon to amend its provision so as to include those who have been ruled out. Evidently he knows that this can be done: in one case, for example, where the commission recommended the disallowance of a claim, the Secretary disregarded the recommendation and allowed $50,000. No, dear reader, it was not to a poor chrome miner of California; it was to a company of wealthy men from elsewhere; so do not be sentimental.

The commission which has terminated its work was restricted by the act of Congress, but within its powers and within the limits of the consciences of its members as public servants they could not be criticised as not liberal. We could cite a case of a Southern financier, engaged on a mining plan to make war profits, who formed his plan and drove it ahead before the Government asked for greater production. The Government never stimulated him; on the contrary, it was he that pestered the Government. It was agreed by all members of the commission that this financier had not changed his earlier plans in any way through later Government stimulation; yet they liberally handed him $60,000.

We remember another case where, after the combined talent of the corps of engineers, auditors, and the commission had figured out a just award to a claimant, the Secretary (not Secretary Fall), rising above mere figures, ordered an extra $50,000 added on general principle of liberality, and a $2,700 man was instructed to figure out to what parts of the claim it could best be distributed. Certainly, the impartial critic would say that these practices went further in liberality than if the dispensers had to do with their own money or that of their family friends. But their attitude is apparently niggardly when compared to the liberality that is contemplated by Secretary Fall and Judge Robinson of Grafton.

We should like to submit the proposition that if the taxpayers' money is loosely spent by public officials, it is all one to the taxpayer whether it goes into the public officials' pockets or is paid out to their friends or those to whose political and moral support they cater. Also, that the change from the tribunal that has resigned, to the one-man lawyer administration, is in the nature of an anticlimax, and a renegation of impartial government. Give Congress every chance that its members wish to change the provisions of the War Minerals Relief Act. Certainly they botched it the first time: let them try to see if they can mend it. But the executive branch of the Government should honestly and impartially and fearlessly perform its duty, which is simply to administer and carry out the mandates which Congress has laid upon it.

The Right and Wrong of Churn Drilling

IN LAST WEEK'S ISSUE we published the first installment of a most complete treatise on the subject of churn drilling, the second and last installment of which appears in this issue. The importance of this subject in its relation to the subsequent development of any mine cannot be too strongly emphasized, and its particular value is dependent largely on the amount of information on various operations that can be obtained. We feel that the presentation of the topic has been handled in a most able manner by Mr. Rice in his article, "Churn Drilling of Disseminated Copper Deposits," for he has not only considered the technical aspect of churn drilling, but has given us the benefit of his practical work as well, and a careful reading will reveal many points essential to the performance of such work that will be of value to those contemplating similar exploration, or, for that matter, those who are now pursuing drilling operations.

We have seen so many instances where drill work has been improperly done. In the first place, the drilling was done on contract; footage was regarded as the essential thing because it was on that basis that the contractor received his remuneration. Careful sampling was entirely foreign to the work; all that was necessary was to provide some sort of a sample from a certain depth, the chief consideration being that the cuttings were placed in a bag and provided with a label, regardless of whether or not the classification was correct. A haphazard scheme for locating the holes and a slipshod method of correlating results could end in nothing but an incorrect interpolation, so that the final outcome of the so-called "drilling campaign" was the collection of a lot of inaccurate information, secured at a heavy expense. We can recall one case where the drilling results were accepted in good faith, and after considerable money had been spent in carrying out an elaborate plan for mine development it was realized that improper sampling of drill cuttings had given a false estimate to the value of the property.

On the other hand, we know that several individual companies and contract concerns have made a practice of establishing and carrying out well-planned drilling campaigns, and the results obtained have been exactly what was needed for the furtherance of development work or, with negative findings, the discontinuance of operation on the property. Such conclusions only clinch the argument that in drilling, as in any enterprise, a well-planned scheme must be adopted with a regard for regularity and careful attention to detail from the beginning.

WHAT OTHERS THINK

The Tariff on Minerals

I have just read with considerable interest the article entitled "The Tariff on Minerals," which appeared in *Engineering and Mining Journal* of June 11. As a member of the mining profession and a constant reader of your publication I have learned to look upon it not only as a reliable disseminator of news of the mining industry, but also as the exponent of those fundamental principles of right and fairness that should always be maintained. I have assumed that statements and arguments appearing in its columns are literally and technically correct, and that its editorials are free from bias or special interest and that under no consideration would the *Journal* stand sponsor for a policy that is inimical to the mining industry in America, which it essays to support.

After reading the article carefully and analyzing it I am fully impressed with the fact that while it purports to be an unbiased discussion of the subject of a tariff on minerals, it does not state the situation fairly or correctly and should not be permitted to go unchallenged.

I will not attempt to dissect the statements made in the discussion of each of the minerals enumerated, but I take exception to some of the general statements regarding a tariff on minerals and particularly some statements made with reference to manganese.

The article opposing a tariff on minerals attacks the testimony and briefs presented to the Ways and Means Committee and charges distortion of facts, implying that these distortions of facts were peculiar to the proponents of tariffs. The most flagrant distortion of facts coming within my observation (and these distortions are now subject to inspection in the printed reports and the briefs on file) was displayed by opponents to a tariff on minerals. For instance: The opponents to a tariff on manganese ore at one hearing said there was no manganese in this country worth protection. Inside of thirty days these same people filed a brief attempting to prove that there were such large quantities of manganese ore in the West owned by a large copper company that if more than a nominal tariff was imposed on manganese ore it would give this company a monopoly and put all the other producers of ore and all other manufacturers of manganese alloys out of business. Another instance: An opponent of protection for manganese ore stated that the 305,869 tons of manganese-bearing ore produced in the United States in 1918 included the "manganiferous ores unfit for ferromanganese," whereas the truth of the situation is, as disclosed by reports of the U. S. Geological Survey, the domestic manganese ore produced, including the manganiferous ore, was 1.476,331.

What greater crime is there in an academic discussion of a subject than to impugn the motives of the opposition by alleging personal interest, while the author by implication hoists a banner of altruism and public interest; and then, with the reader's mind compliant, delivers in rebuttal a dissertation pregnant with subtle bias and prejudice?

The subtitle of that article "Tariff on Minerals" would indicate, together with the context of the opening five paragraphs, that the author, in launching his attack on the proponents of a tariff, is referring to the questions raised by the "pleaders" for a tariff on minerals. Therefore, one must assume that the following quoted statement refers to multifarious mining industries. "No man can know the conditions surrounding all the multifarious industries of this country, and no man can visualize the ramifying effects of a tariff." With this statement I heartily agree.

My mind fails to respond to the erudite elucidation of the next four paragraphs and accept as a result the statement, "perhaps no industry offers simpler conditions for weighing the application of a tariff than the mineral industry"; *quod erat demonstrandum.*

The mining men who ask for a tariff on their respective ores, *ipso facto* admit their financial interest. They play above board. They present their side of the case. They try to meet the arguments of the manufacturers who use, and the importers who import, and the brokers who deal in, the raw minerals, and who, first hand, are the ones who pay the duty imposed by a tariff on minerals. They very properly show what the cost of a particular duty would be on the consuming public.

The producers of domestic manganese ore, who have invested approximately $15,000,000 in this industry, very properly submit for the judgment of the public whether the tariff on manganese ore, which will increase the price of a hundred pounds of hay knives and similar hardware 2½c., for the protection of the American miner, or $16 for the benefit of the manufacturer, is the greatest straw that is likely to break the camel's back. In a less highly finished commodity like steel pipe the duty of 1¼c. per lb. on the manganese content of ore would increase the cost of pipe (assuming a 25 per cent loss of manganese in smelting this ore) 25c. per ton. The present duty under the tariff act of Oct. 3, 1913, now in force, for the benefit of the manufacturer, increases the price of steel pipe approximately $9 per ton.

It is indeed fortuitous for the sake of those who are opposed to a tariff on minerals that the author of that article opposing a tariff on minerals is a conservationist. For no one who believes in that fundamental principle enunciated by the founders of our Republic, which encourages the development of our natural resources, would otherwise single out for conservation that "wasting asset," manganese ore. I dare say he would advocate the closing down of our iron ore mines of the Lake Superior region, the copper mines of Montana, Utah and elsewhere, "less we rob our children" of their heritage. I cannot restrain from the use of that inelegant expression "bunk."

One is impelled to ask himself if the author of that article was not writing propaganda for the benefit of the users of raw materials, the importers and the brokers, rather than presenting an unbiased exposition on the subject for the benefit of the public.

I am gratified to note that he classifies manganese under that group "insufficient known quantity except at artificial prices." He did not have the temerity to pull out that phantom "no manganese to protect" that was so frequently displayed in the early opposition to a tariff on manganese.

I fully agree with him that this industry requires an artificial price for protection against ore mined with cheaper foreign labor. It is on this same ground that the manufacturer of hay knives, pipe, picks and shovels, and thousands of other iron and steel products demands protection against foreign labor.

The author mentions the large deposits of manganese (rhodochrosite) ores at Butte and Philipsburg, Mont., but he says "the mining is expensive." According to the reports of the Bureau of Mines and the evidence submitted to the Ways and Means Committee, nowhere in the United States was manganese ore produced more cheaply than in the Montana districts in 1918.

To illustrate the possible early depletion of his gamut of minerals he refers to the exhaustion of the Lake Superior iron ores. He deprecates the fact that beneficiation of these ores has already begun. Would not a true conservationist welcome the saving of our national resources? We are today wasting millions of tons of 40 per cent iron ore by gutting out the higher grades and caving in the lower grades and we are using immense quantities of these lower grades for building roads in the iron districts. Our present standards require an iron ore containing approximately 50 per cent natural iron content, and on the basis of 1,400,000,000 tons of ore reserves of this grade in Minnesota, and the anticipated yearly consumption, these reserves will last less than thirty years, but if we beneficiate these ores by washing, by magnetic separation, and by other proved means, it is estimated that our reserves in the Lake Superior region are sufficient to last this country for two thousand years.

There are enormous tonnages of manganese ore in the 1,181 districts examined and reported by the Geological Survey in the United States. A considerable proportion of the tonnage is of high-grade ore. With the proper beneficiation of the lower grades there are sufficient reserves, once they have been developed, to last for many years, and manganese would be an exception to the rule if mining operations on a substantial stabilized scale did not lead to the discovery of larger deposits and higher grades of ore than have been produced under the past erratic conditions of foreign competition.

Of the country's ability to produce manganese ore, we have only to refer to the achievement during the war period, when the price of ore was set by the Government at a higher value and the industry was stabilized by an attempt to regulate imports.

MANGANESE AND MANGANIFEROUS ORE [illegible] IN THE UNITED STATES 1914 to 1918 (IN [illegible])

Year	Ore Containing 35 per Cent of Manganese or More	Ore Containing 10 to 35 per Cent of Manganese	Ore Containing 5 to 10 per Cent of Manganese
1914	2,635	91,[illegible]	[illegible]
1915	9,613	180,[illegible]	[illegible]
1916	31,474	45[illegible]	[illegible],447
1917	129,405	7[illegible]	[illegible],844
1918	305,869	91[illegible]	[illegible]

In the program which produced such noteworthy increase of manganese ore no districts were exhausted. As a matter of fact, the manganese mines were only becoming fairly well opened up. Some districts in 1918 produced but little more ore than in 1917, due to the fact that most of the efforts were being put forth in mine development and the construction of beneficiating plants. Had the price and the demand remained another year, 1919 would have seen a production of double the amount of ore produced in 1918, with a capacity for production in succeeding years which would even meet the requirements for more than half of our annual domestic consumption.

The present schedule of tariff asked by the proponents of a tariff on manganese ore would establish a price of less than one half the war time price, and will protect an investment of American citizens in American industries of approximately $15,000,000. It will not exhaust our domestic reserves, but will lead to their development, so that should war again involve our land American victory would not again be jeopardized and the country confronted by the serious plight that existed in our recent war with the Central Powers, on account of the scarcity of manganese.

Deerwood, Minn. CHARLES W. POTTS.

On the Maverick Nature of Balls

In *Engineering and Mining Journal* of June 4, Mr. Stevens agrees with Mr. Wraight that home-made milling machinery parts are better than standard and then gives, as a contrast, the use of manganese steel camshafts (not home-made) as giving better results than home-made ones. Possibly this can be explained as follows:

Consider balls, as used in ball mills. Of what are they made? Who will dispute that a ball, to give good results, should be made of good material to begin with, and should contain the proper percentage of carbon, chromium, nickel, or other alloy to give it hardness and strength. But are all balls made in this way? What maker will step forth and guarantee that the balls he offers for sale (1) are made from iron bought for the purpose; (2) contain (here give the percentage of alloy); (3) are properly forged; (4) are not made of old steel, open-hearth car axles, or crop ends; (5) are not made of steel that was made for another purpose and rejected; (6) are not an outlet for his scrap and waste; and (7) are guaranteed always to be alike.

Old car axles are made of open-hearth steel containing a small amount of carbon, and are very soft. The tool steel that turns them contains almost twice as much carbon and is therefore hard enough to cut the soft steel. Balls usually contain from 0.6 to 1 per cent of carbon if they are of good-quality steel. Practically all steel mills sell alloyed steels on analysis: if the alloy or alloys called for are not present in the quantities specified, the steel is rejected. A large amount of this rejected steel is sold for the manufacture of balls or other forgings at a sacrifice. The owner of a small forge cannot support a steel furnace and must buy his steel wherever it may be had at the lowest price.

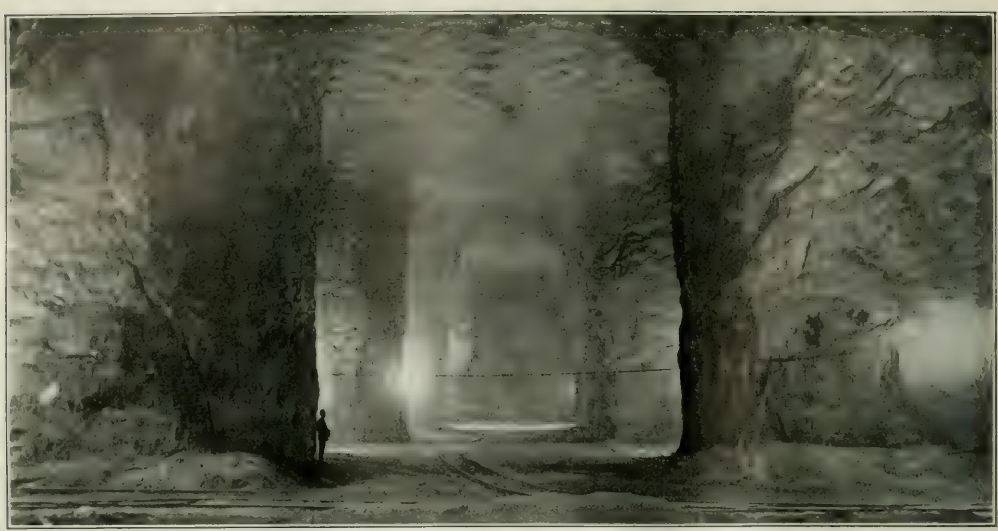
Shoes and dies for stamp mills are usually a little better made than balls; also liners for ball mills. But balls have been made from anything called steel, with a carbon content varying from 0.2 to 1 per cent; chromium in chrome-steel (?) balls from nil to 0.05 per cent; and in some balls, chromium, manganese, and nickel occur only as an impurity or accident.

Manganese steel can be made in only one way, and may easily be tested. Unless the manganese content is around 13 or 14 per cent, the steel is not non-magnetic. Therefore manganese steel is always the same and reliable, but has not proved successful for balls, although some has been used for shoes and dies. Under hammering shocks, manganese steel peens or flows, and this prevents its use for a great many purposes.

The point I want to make is that if the makers of steel other than manganese will standardize their products, sell on analysis, and tell the purchaser what he is buying, the competition of home-made and local material will largely be eliminated to the advantage of both buyer and seller.

EDWARD W. [illegible]

New York City



UNDERGROUND WORKINGS, AVERY ISLAND SALT MINE

Salt Mining in Louisiana

Peculiar Geological Formations Which Have Been Worked—Room-And-Pillar Method Used, Timbering Being Unnecessary—District Has Large Reserves, but Is Not Now an Important Producing Center

By Albert G. Wolf

Written for *Engineering and Mining Journal*

MUCH HAS BEEN WRITTEN about the production of oil from the coastal salt-dome fields, so that a person unacquainted with the subject is inclined to wonder why salt, too, is not a product of these queer formations. In Louisiana, salt *is* produced from some of these domes, and the method of extraction is unique, in the United States at least, not because of the fact that underground mining is employed, but on account of the nature of the deposits, which permits the methods of mining locally practiced.

Gulf Coast salt domes, roughly speaking, are irregularly distributed over an area about seventy-five miles wide, bordering on the Gulf of Mexico, and extending from the Atchafalaya River, in Louisiana, to the Rio Grande. By far the larger number of these domes is found within the portion of the strip between the Atchafalaya River and a point just west of the Colorado River of Texas. Within this belt are thirty or more proved salt domes. Of this number only two are producing salt, a third has produced a considerable quantity by underground mining, and a fourth is being developed. These four domes are all in the interesting group known as the Five Salt Islands of Louisiana.

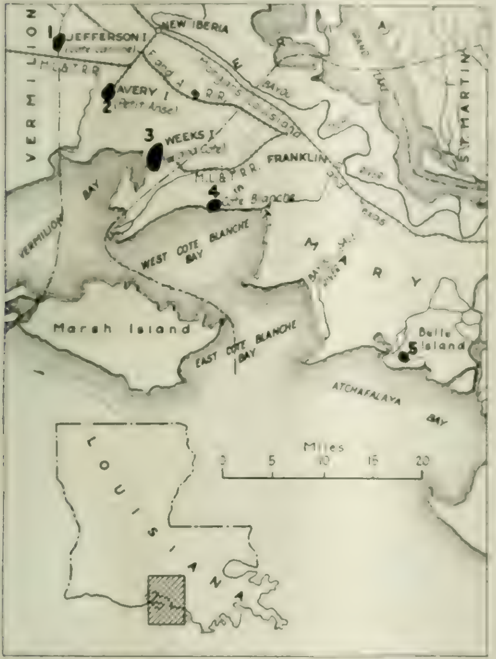
A brief description of salt domes in general is necessary to convey to the reader an understanding of the nature of these queer formations, and to show the difference between most of them and the salt-producing "islands." Two types of salt domes occur in Louisiana and Texas, those of the coastal region and those of the hill country, farther back from the coast. Only the former will be here considered.

The principal structural feature of each of these coastal domes is the immense central core of practically pure rock salt. In the different domes the core may vary in shape from roughly circular to somewhat elongated, and in size from one-half a mile to two miles across. The top of some of these cores extends within a few feet of the surface, and in others is buried under two or three thousand feet of recent sediments. Usually it is comparatively flat on top, sloping away from the center in all directions, dipping more steeply on the flanks, and in some formations standing almost vertically at the extreme outer limits that have been reached by drilling. The depths to which these cores extend is unknown. So far as I have been able to learn, the deepest well drilled in salt was at Humble, Harris County, Tex., where a well struck salt at about 2,000 ft. and was abandoned at 5,410 ft., still in salt.

Cap Rock of Gypsum, Limestone, Dolomite, and Anhydrite

Above the salt core there may or may not be cap rock, a layer of rock covering most of the upper portion of the salt core, and usually lying directly upon it, although in some instances a little sand intervenes. When present, it is composed of any one or all of the following minerals: Gypsum, limestone, dolomite, and anhydrite. Usually the portion of the cap rock composed of calcium sulphate is next to the salt, with the carbonate minerals above. The most peculiar feature of the cap rock is its lack of correlation with any stratum in the whole series of sediments in the coastal region, indicating that it is invariably of local origin and extent.

Surrounding the salt plugs are sediments of the Tertiary and Quaternary ages, with unconsolidated Quaternary sediments overlying them. The surrounding sediments have been broken through by the salt plugs, and bent upward, and the overlying sediments have been domed, the whole forming a quaquaversal fold. This structural dome may or may not extend to the surface, forming a topographic dome, although it does so in most of the formations here discussed.



MAP OF PART OF LOUISIANA SHOWING VERMILION, IBERIA, AND ST. MARY PARISHES

Oil and Sulphur of the Salt Domes

In addition to salt, other useful minerals found in these structures are oil and sulphur. Oil is found in the comparatively shallow sediments overlying the cap rock, in the cap rock itself, and in the abutting strata at greater depth. Sulphur is found in the cap rock, almost entirely in limestone and gypsum.

The origin of the salt domes is an unsettled question, too complicated to go into here.[1] The theories of formation vary from the evaporation of sea water to the intrusion of salt in a molten or plastic state, with various causes for the intrusion, and to the growth of salt crystals after primary deposition. None of these theories, however, satisfactorily accounts for all the features of the domes. It is quite evident that the salt penetrated some of the overlying strata and arched others. Compared with these strata the salt must be of secondary origin, and the cap rock of tertiary (with a small "t").

The major points of difference between the domes now producing salt and most of the coastal oil-producing domes is the much greater height of the topographic elevations of the salt domes, the slight depth of the salt cores, and the absence of cap rock.

Situation of the "Five Salt Islands"

The two salt structures which alone of all the coastal domes are producing salt in commercial quantity are arranged in practically a straight line forty-five miles long and extending almost due northwest and southeast near or on the Gulf coast in Vermilion, Iberia, and St. Mary parishes, La. (See the map.) Jefferson Island, or Côte Carline, the farthest one to the northwest, is on the boundary line between Vermilion and Iberia parishes, and just south of the thirteenth parallel and east of the ninety-second meridian. Then, in order named, and about seven to eight miles apart, in an air line, are Avery Island (Petite Anse), Week's Island (Grande Côte), and Côte Blanche, the first two in Iberia and the last in St. Mary parish. Belle Isle, also in St. Mary parish, lies about as far southeast of Côte Blanche as that place is from Jefferson Island.

Salt Mining Dates From 1791

So far as I am able to determine, the first salt produced in southern Louisiana was obtained at Avery Island, or Petite Anse, as it was then called. Apparently it is not known when the "island" was discovered, but it is stated that it was settled about 1791, and that the owner, one John Hayes, discovered on it salt springs. Salt was extracted from the waters and sold locally. Later, especially during the War of 1812, the production was increased, but was still from brine. In 1818 the "island" came into the possession of one Avery, from whom the now commonly used name of the locality was derived. Although the extraction of salt from brine still continued, no great effort was made to increase the production until 1861 or 1862, when the salt supply of the Confederate Army was cut off. An attempt was then made to increase the flow of brine by deepening a well, with the result that rock salt was discovered 16 ft. below the surface. The Confederate government then took possession and carried on underground mining operations until the Union forces destroyed the works in 1863. The mine was reopened in 1879, and somewhat later a branch of the Southern Pacific RR. was built in from New Iberia, ten miles to the northeast. Mining was carried on practically continuously until 1898, when the lessees, Myles & Co., surrendered their lease. In July of that year the owners of the property organized the Avery Salt Mining Co. and sunk a new shaft, which has been in operation since 1900.

Between 1895 and 1897 rock salt was found in drill holes sunk on Jefferson Island, Belle Isle, and Week's Island by Captain A. F. Lucas, an ardent student of salt-dome formations, and the first to advance and prove the theory that the coastal salt domes constituted formations favorable for the collection of oil. The main salt core has not been found by drilling at Côte Blanche, where it is either considerably deeper than in the other domes of this group, or else not under Côte Blanche Bay.

In 1920 the Jefferson Island Salt Co. began active operations to develop its deposit, and started shaft sinking. At Week's Island, the Myles Salt Co. began operations in 1898 after surrendering its lease at Avery Island, and that company has produced salt by underground methods ever since.

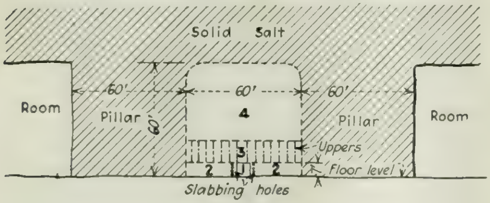
Attempts in the past to develop three different minerals at Belle Isle have made this island's history most varied and interesting, but little has been produced. After the discovery of salt late in 1896 or early in 1897, Captain A. F. Lucas, the discoverer, drilled three more wells. This drilling was followed by a series of thirteen by the Gulf Co. In August, 1898, this company started to sink a shaft to exploit the salt deposit proved by drilling, and completed it to 390 ft., striking the salt at 103 ft. Lateral development was carried too far, running beyond the salt into the unconsolidated formations, and quicksand and water filled the workings. A second shaft was abandoned on account of quicksand before reaching salt. Then, after considerable expenditure for evaporating equipment, storage, and shipping facilities, salt was produced from brine wells. These operations were soon given up, however, on account of impurities in the product, such as oil and iron stains, caving of overburden and escape of brine in the loose sediments.

---

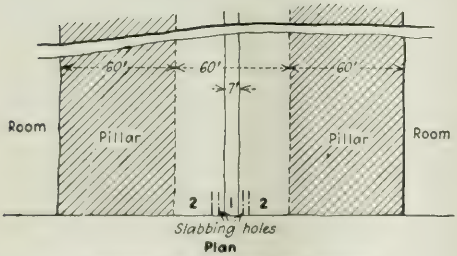
[1] [illegible]

OIL SOUGHT IN LOUISIANA DOMES FIFTEEN YEARS AGO

In 1906 more drilling was done, this time by the New Orleans Mining & Milling Co. Two wells were put down at the north end of the island, evidently with the idea of finding oil at depth. One of these wells, less than 1,000 ft. north of the old salt mine shaft, failed to reach salt at a depth of more than 2,400 ft. In 1907 and 1908, I. N. Knapp drilled three wells, with the hope, in one operation at least, of finding oil below the salt. This well, near the old shaft, struck salt at 140 ft. and continued in it to 3,171 ft., with some limestone and anhydrite reported to be scattered through the last few hundred feet. A little very light oil was found in this well. In 1916-17 Lucas drilled a second series of wells, this time to determine the extent of the sulphur-bearing horizon. The work done, according to Lucas, proved this to be of insufficient extent and commercially unimportant.



Section

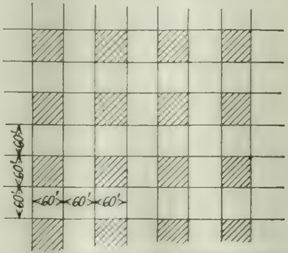


Plan

SKETCH OF METHOD OF MINING

Early in 1920 the Union Sulphur Co., of Louisiana, acquired title to the island, and began, according to rumor, what was to be a thorough test of the entire dome for sulphur. Drilling was under way in November, 1920. Belle Isle is the only one of the Five Salt Islands that is really an island, and the only one, so far as I know, upon which either sulphur or oil has been found.

The two operating salt mines are at Avery Island and Week's Island, operated, respectively, by the Avery Salt Mining Co. and the Myles Salt Co. The surface of the Avery Island dome is about ont and one-half miles in diameter and rises to a height of over 100 ft. above sea level, and nearly as much above the surrounding marsh land. The salt, at its highest point, is within 16 ft. of the surface, and although not at the highest point of the hill, it is near enough to bring the top of the salt core above sea level.



Cross-hatched areas represent pillars

GENERAL PLAN OF PILLARS

The surface is largely covered with yellowish or brownish loamy soil, with sand, gravel, and clay in places. The sediments encountered in shallow work are all believed to be Quaternary.

ROOM-AND-PILLAR METHOD OF MINING USED

The present shaft was put into operation in 1900. It is of two compartments, vertical, and about 500 ft. deep. The method of mining is simple. After providing for adequate haulageways at the bottom of the shaft, and leaving pillars of proper size to protect the shaft, parallel drifts are extended 60 ft. wide and 60 ft. high (these are probably more properly called rooms). Then half the remaining pillars are removed by driving break-throughs 60 ft. wide, leaving one-quarter of the original area in the form of pillars measuring 60 ft. in all three directions. (See accompanying diagram.)

The method of advancing the rooms is shown in detail in the sketch. First a central drift about 7 ft. x 7 ft. is driven any convenient distance, removing the portion marked 1. Then successive sets of slabbing holes are drilled and shot either side of this preliminary drift until the room is undercut its full width and the depth of the holes. As the broken salt is removed, further sets of holes are drilled, until the whole room is undercut; that is, until the portion 2-2 is removed. Then section 3 is broken by means of uppers, the first row being drilled just back of the open face of the room and pointing slightly toward it. Work is then continued from the top of the broken salt and from high ladders, and horizontal slices above 3 are shot down until the room has been raised to a height of 60 ft. in the center and a little less at the sides, forming a slightly arched roof. Sufficient salt, of course, is removed all the time to permit the continuance of work. Before clearing the rooms of broken material, the roof and walls are carefully trimmed to remove all loose pieces. The salt, being absolutely dry, will stand indefinitely without sloughing. The break-throughs are driven in the same manner as the rooms.

All this work is carried on without leaving a stick of timber anywhere in the rooms, and when a person, even

MAKING AN UNDERCUT

though acquainted with underground workings of nearly every description, first sees the sparkling, blue and white mottled walls and roofs of this series of immense corridors extending in all directions, absolutely free from support, he is astounded at the operations.

Drilling is done with air-driven augers, and great footages have been made, as much as 100 ft. per hour. Blasting is done with low-grade dynamite, detonated by means of fuse and cap. All shoveling is done by hand on contract, and mule tramming is employed.

The surface equipment is housed in one large building called the "breaker." It consists essentially of three sections, the engine room, the headframe and crushing plant, and the sacking department. The headframe is about 100 ft. high. Hoisting is done in counter-balance with steam. Single-deck cages are used, and the salt is hoisted in mine cars.

The cars are dumped at the top of the breaker over a grizzly and the oversize runs into a large set of toothed rolls. All the salt then passes through a second set of rolls, over coarse screens, and the oversize to a third set of rolls. The material next passes through a series of screens and disk grinders, where several sizes of salt are made, ranging from table salt to coarse sizes for packing and for ice cream, and having various technical names. The intermediate and medium fine sizes are used, but the very finest is rejected in order to clean the salt, as it carries with it all the powder-stained material. The color of this reject, where it is sluiced out of the mill, is a dark gray.

The process of cleaning is further aided by hand-picking. This is done at the first grizzly and in a traveling belt after the salt has been crushed to about one-half inch size. Foreign particles picked out consist mostly of pieces of powder, burned fuses and chips of wood from mine cars, ladders, and scaffolds.

The various sizes of screened salt fall into hopper-bottomed bins, from which the salt is drawn into sacks and weighed. Besides the classes of fined salt, a considerable quantity of rock salt in large lumps is shipped. All of this salt is of high purity.

It is planned to install electrical equipment throughout the mine and mill, which will be much more economical and efficient than the equipment now in use, especially simplifying the mill drive.

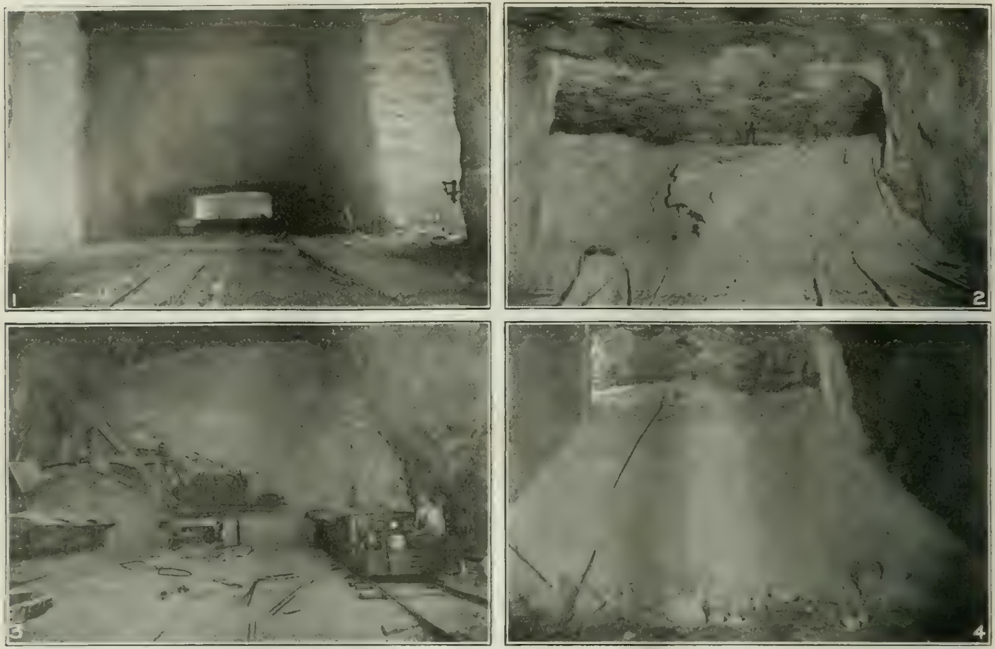
Mining operations have been carried on for twenty years from one level, and over a million tons of salt has been shipped. The salt core is said to be about one mile long and one-half mile wide, and has been drilled to a depth of 2,000 ft. without "striking bottom." This would indicate a reserve of approximately 200,000,000 tons. The present management is not worried about next year's supply of "ore."

OPERATIONS AT WEEK'S ISLAND SIMILAR TO THOSE OF AVERY ISLAND

Week's Island was originally called Grande Côte, because of its size, as it is the largest of this group of domes. The surface of the dome is roughly circular in outline, about two miles in diameter, and rising to an extreme height of 120 ft. above sea level. The strata overlying the salt, as at Avery Island, are all unconsolidated and all belong to the Quaternary. The chief structural difference between this and the Avery dome is that the salt core is somewhat deeper, being 90 to 100 ft. below the surface at the apex of the core. The top of the salt core does not correspond to the topography of the surface, as might be expected, the apex of the core being near the southwest side of the hill, with the steepest slopes to the south and west, and the most gentle to the north.

Mining operations began in April, 1898, when the Myles Salt Co. sank its first shaft. Considerable trouble was experienced in making a "tight seal" between the overlying strata and the salt, on account of quicksand. This seal is absolutely essential in salt mining, to exclude the surface waters from the salt mass. The methods employed by the Myles Salt Co. are, in general, similar to those used at Avery Island, except that electric power is used for all mining and milling operations other than hoisting. Electric-driven shoveling machines, and electric augers and locomotives are used, and the shots are fired by electricity. There is an unaccountable

THE BREAKER OF MYLES SALT CO., WEEKS ISLAND, LA.



1—INTERIOR OF A WEEK'S ISLAND SALT MINE. NOTE FIGURE OF MAN IN FOREGROUND. 2—ENLARGING A ROOM. 3—ELECTRICALLY DRIVEN SHOVEL AND STORAGE-BATTERY LOCOMOTIVE. MODERN UNDERGROUND EQUIPMENT. 4—SIMILAR TO FIG. 2. WORKING ON A SALT PILE

difference between the salts produced at Avery and Week's, the latter being crumbly on exposure, necessitating the shipping of compressed-salt bricks instead of lumps of rock salt, as at Avery Island.

Considering the large number of domes and the immense size of each salt deposit, the actual production of salt from coastal domes is a mere nothing. According to Bulletin 669 of the U. S. Geological Survey, the salt produced in Louisiana and sold averaged a little over one million barrels (of 280 lb.) per year from 1904 to 1907 inclusive. Since then the figures for Louisiana have been, unfortunately, included with the production of "other states" or with that of New York. Why with New York is a mystery. However, according to other statistics in this same volume, Louisiana, in 1917, ranked sixth in salt production and sixth in value of the salt produced, the average price being $3.37 per ton for rock salt. As equipped, both the Week's and Avery mines are capable of producing 500 tons per day.

There is an immense store of available salt in the domes of Jefferson, Avery, and Week's islands, and with the advantages of such large bodies of pure rock salt so close to the surface it is difficult to see why this salt cannot compete with Northern salt over a wider range in the South. Perhaps a comparison of the ratio of cost of production to railroad rates would explain the situation.

Aside from their scientific and economic interest, these so-called "islands," rising as prominent topographic features from their marshy surroundings and covered with semi-tropical vegetation, including immense live-oak trees draped with Spanish moss, appear to the visitor as gems of beauty—if he can forget the bugs.

The World's Output of Aluminum Greatly Increased

The importance of aluminum, particularly as a substitute for copper during the war, led to a marked increase in the output by the leading producing countries. According to an article in *Elektroteknisk Tidsskrift*, which has been abstracted by *Technical Review*, London, the following table gives the pre-war output and the increase during the war and the production as estimated for 1920, in tons, the pre-eminence of the United States in all of the periods for which figures are given being noteworthy:

WORLD'S ALUMINUM PRODUCTION

Country	Pre-War Production	Increase During the War	1920 Production
Germany	1,000	39,000	40,000
Austria-Hungary and Switzerland	11,000	14,000	25,000
France	18,000	2,000	20,000
England	7,500	4,500	12,000
Italy	1,000	6,000	7,000
Norway	1,500	14,000	16,000
United States	28,000	45,000	73,000

The total production thus increased by more than 100 per cent during the war, and includes countries where copper was readily procurable. It is maintained in Germany that aluminum in many respects is equal to copper and even superior as regards strength, continues the article. Aluminum wire is coated with copper or tin when soldered electrical joints are required. Welded joints have the same strength as the wire itself. Aluminum recently entirely superseded copper in a synchronizing transformer of 38,000-kw. capacity made in Europe.

PUTTING DOWN A [illegible] HOLE IN A WESTERN OPEN-PIT COPPER MINE

Churn Drilling of Disseminated Copper Deposits*—II

Casing Troubles and the Proper Procedure in the Handling of Casing—What To Do About Lost Tools—Records, Samples, Cross-Sections and Assaying of Samples—The Value of the Triangulation System in Drilling Work

By E. R. Rice

Written for Engineering and Mining Journal

IF THERE is one thing in drilling that gives more grief than any other cause it is the use of casing which is too light for service. The light, small-threaded casing is cheaper as to first cost, but the interest to be paid on the difference in original cost between light and heavy casing is astounding. The delays, accidents, loss of casing, fishing jobs, and other troubles directly and indirectly attributable to the use of too light casing will run into several times more money than the cost of good casing in the beginning.

A casing shoe should be used on each string unless it is positively known that the under-reaming will not have to be used. The shoe should be made up with the engine and then babbitted on.

In lowering casing into the hole the mast of the traction-type drill is usually too light to support the weight of the casing. There are two alternative supports that will usually answer, the choice depending on the weight of the string to be handled. Ordinarily it will suffice to stand the large string of drilling tools up in front of the mast and use them as a column to carry the major part of the weight. One of the casing blocks is attached to the rope socket of the drilling string, and by this arrangement all the weight supported by the mast is that imposed at the eye and of the casing line. The drilling string should be chained to the mast and the two securely blocked apart by means of blocks and wedges to make the whole more rigid. The other method of support is the erection of a bent of 12-in. x 12-in. timbers over the hole. In putting casing in, each joint should be measured and entered in a book kept at the rig for that purpose.

With the ordinary type of traction drill it is necessary to disconnect the drilling line from the rope socket and use the drilling line as a casing line or to spool the drilling line on one end of the drum and put the casing line on the other end. Where the ore lies deep, or the ground is bad and much casing has to be handled, it may be advisable to employ a portable drill having an auxiliary calf reel. This allows the casing to be handled independent of the drilling string.

No special directions are necessary concerning the putting in of casing, excepting to make the joints tight. After the casing reaches the bottom, it is usually turned loose and allowed to follow down the hole as far as it will, putting on new joints as the string lowers.

KEEP CASING FREE—A GOOD RULE TO FOLLOW

Sometimes casing may be driven a considerable distance, but this practice is not to be recommended by reason of [illegible] available for drilling of a cave or getting through a running formation. The secret of successful work is to keep the casing free and have the hole drilled or under-reamed large enough to permit the casing to be lowered freely. It often happens that after under-reaming the hole the casing refuses to go down, this being caused in most instances by the casing being frozen in the hole. Instead of driving the casing, the proper procedure is to raise it until the material behind it falls into the hole, thereby freeing the casing. Of course, if the ground above is bad and will not stand, the proper thing to do is to drive the casing. This is an instance where the heavy casing is especially desirable.

---

*Continued from the issue of June 25, 1921.

Most casing troubles start after the hole is finished and the pulling of casing has begun. In the formations encountered in prospecting for copper, casing is prone to freeze in, due to the character of the rock encountered. If the formation is wet, shattered rock will settle around the casing and hold it in an iron grip.

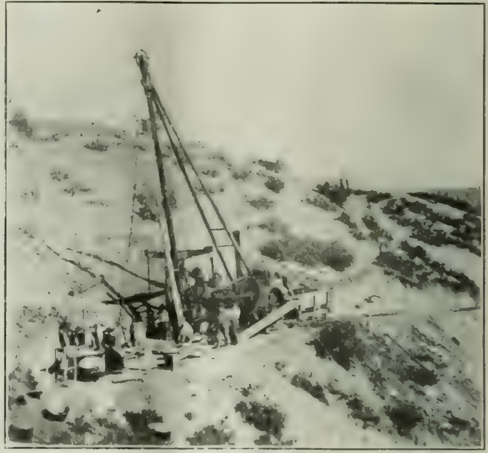
To give an illustration of the above, I will cite the following instance from my own experience: We were pulling 10-in. casing weighing 37 lb. per foot and were jacking the string with four 50-ton hydraulic jacks, taking all the strain possible with the jacks. Besides that we had a casing spear in the next to the last joint, jarring all a No. 24 Star rig would stand and using a 20-ft. 4½-in. stem and 24-in. stroke jar. Suddenly the strain eased up, and the casing could be easily jacked with one pair of jacks and without the aid of the spear. When we got the string out we found we had left the last joint in the hole, it having broken off under the coupling. The intense strain necessary to cause this was due to the freezing in of *one joint only*.

CASING SHOULD BE PULLED WITH CARE

In starting to pull casing it is always best to try first to move it with a block and tackle. If the casing will not come, then use hydraulic jacks, taking as much strain as the casing will bear. Care should be taken that the strain put on the casing is not so severe as to cause it to part. The amount of strain a string of casing will stand can be told only by experience in this sort of work. If jacking will not bring the casing it will then be necessary to go in with a casing spear or friction hold and try a combination of jacking and jarring. If no spear is available and a friction hold is taken it should be previously determined that there is plenty of room below the casing for the proper breaking of the friction hold.

FRONT END OF A TRACTION DRILL

If there are many strings of casing to be pulled, or much jarring of casing has to be done, a pit for the jacks should be dug below the level of the floor at the start. This allows the jacks to be set below the level of the floor and permits the casing to be jarred to greater advantage. Several nipples of different lengths should be on hand for each string of casing, so that, as the casing is jarred up enough to interfere with the working of the temper screw, the top nipple can be taken off and a shorter one inserted. In the event that the casing cannot be pulled by a combination of jacking and jarring, it will be necessary either to shoot off or cut the casing at some point below the bottom of the next larger string.



CHURN DRILL, WITHOUT HOUSING, IN OPERATION

The point at which the string is frozen can usually be determined by the use of the casing spear. If, when jarring with the spear, a definite impulse reaches the top of the casing at each stroke of the jars (told by holding the hand on the casing), the casing is frozen below the spear. If only a weak impulse reaches the top, the casing is frozen above the spear.

ONE METHOD OF CUTTING CASING

Casing is cut by running in a casing cutter on a string of 2½-in. or 3-in. pipe. In cutting casing the following points should be observed: Take a good heavy strain on the casing by means of the jacks, and after this is done do not raise or lower jacks until after the casing has been cut. Make up each joint of the cutting string very tight, so that there will be no screwing up of its joints after cutting has been started. If this does occur, the cutting string will be shortened, with probable breakage of the cutters and the starting of a cut in a new place. Raising or lowering the jacks after cutting has started will cause the same thing. If cutters are not available, the casing may be shot off, which is easily done in the following manner:

Make a wooden plug the diameter of the casing and drive it down the casing to near the bottom by means of the tools. Then throw sufficient stiff clay and rocks in the casing to fill it up several feet above the plug and insert another wooden plug in the casing, fitting fairly snug, but not tight enough to prevent the passage of water around it. Then push this plug down to the clay with the tools. After the plug has reached the clay, hook on the beam and drive the plug firmly down. This serves to compress the clay, drive it into all the crevices, and expands the second plug so that it completely fills the casing.

Preparing the Powder Charge

In the mean time the torpedo has been prepared. The torpedo is made according to the following instructions: A casing protector of the next smaller size casing is bored with four horizontal holes at ninety degrees to each other, and through these are placed ½-in. iron rods. The rods are bent upward and extend about 6-in. above the edge of the protector. They are bent outward at the top and the ends filed to a chisel edge, the sharp edge being outward. Weave a bottom on the protector with baling wire to carry the powder charge and fashion a bale out of wire for attaching the torpedo to the sand line. From the bottom suspend a piece of old iron weighing about twenty pounds to give sufficient weight to the torpedo to cause it to go freely down the hole. By a little cut and try, the torpedo can be made so that it will easily go down the casing, but cannot be pulled up, as the prongs of ½-in. iron will catch in the first coupling, which is what is desired, the scheme being to shoot the casing in a coupling. One to three sticks of ¾-in. 40 per cent dynamite is securely tied to the wire bottom of the torpedo, and it is then ready for use.

The baler is then strung in and a mark put on the sand line at the point where it is desired to shoot the casing off. All the water is rapidly bailed out of the casing, the bailer taken off, and the torpedo attached to the sand line. The torpedo is then lowered to the desired depth and slowly pulled back up the hole until it catches in the first coupling. Two detonating charges are then dropped in on top of the torpedo. These detonating charges are composed of one-half a stick of powder, blasting cap, and two or three feet of fuse. The fuse should be securely fastened to the powder to eliminate the chance of the fuse being detached while dropping down the hole. Before dropping in the detonators, a heavy strain should be taken on the casing with the jacks.

The reasons for plugging the casing and bailing out the water are twofold. If the casing is shot with water in it, it is likely to split for some distance above the point where the shooting takes place. By having the casing dry the danger of misfires, due to wet fuse and caps, is eliminated.

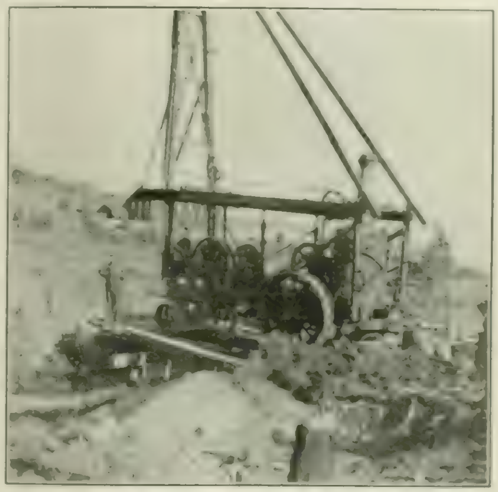
I have never failed to part the casing at the first shot by using light charges and shooting in the coupling as described, whereas in the old method of shooting any place with heavy charges I have seen many failures. The reason for this was that either the casing did not shoot entirely in two or the casing would bell out at the point where it was shot, making it impossible to pull.

Proper Strain on Casing a Matter of Experience

In pulling casing, especially when it is of light weight or old, too great a strain should not be taken on it with the jacks, for if too much is applied the casing is likely to part at some point down the hole, which creates more trouble. The gaging of the amount of strain a string of casing will stand is an art acquired only by long experience. In the event of the string parting, it will generally be necessary to reconnect with the lost string unless the amount left in the hole is too small to be of any moment. When the string parts there is a choice of several different lines of attack, the one to be chosen depending on conditions. If the casing has parted by the pulling out of a coupling, as is usual, it can be connected by using a steel male and female casing nipple on the end of the upper string, a conical wooden plug being inserted in the nipple to act as guide. If no nipple is at hand the casing can usually be connected by using a wooden guide plug in the end of the upper string.

If no connection can be made the proper thing to do is to shoot off or cut the casing at a point below the bottom of the next larger string and lift the casing out, either with a casing spear, or friction hold, or spear on another string of casing.

Fishing is one of the greatest sources of trouble encountered during drilling, and, although fishing jobs are bound to occur, a great many can be saved by proper attention to details. The drillers have a sarcastic saying, "Do your fishing on the derrick floor." If one takes the foregoing expression literally, and applies it, a great many fishing jobs can be saved by intelligent attention to all details entering into the work. A large number of fishing jobs are caused by carelessness, recklessness, and running in bad ground that is known to be dangerous. Fishing jobs are like accidents in mines, and "safety first" goes a long way toward their prevention.



DRILLING HOLE ON EDGE OF AREA BEING CAVED BY MINING OPERATIONS

After a string of tools has been lost it is important not to get excited and do something on the spur of the moment that will make matters worse. Unless there is an imperative need of haste it is wise to go into executive session and figure out all the angles of the situation before proceeding further.

The dimensions of the bailer and drilling string and any changes that may be made in them should be kept in the casing book so that the driller will be sure of the diameter and lengths of the component parts.

One of the first things to do is to find out how much line is left on the tools, and this can be told by "stringing out." If much line is left, the proper tool to use is the rope spear or rope grab, which will usually recover the lost string unless it is buried. If the tools are buried the problem resolves itself into getting the cable off of the tools, so that a fishing tool may go over them, and loosening the muck around the tools so they may be jarred out. The cable is removed either by clawing it off with a spear and grab, wadding it down, and cutting it up with a rope chopper, spudding it off with a side spud, or drilling it off, or a combination of these methods.

SURVEYING WITH AN IMPRESSION BLOCK

An impression block is run at intervals to show the condition of the top of the tools and their position in the hole. An impression block is a round, wooden block, one end of which is of the same diameter as the drill hole, the other being of the size necessary to fit into the horn or slip socket on which the block is run. The large end of the block is faced square, and tin is nailed around it, the tin projecting about an inch beyond the edge of the block. The end of the block is studded with 8d. nails, the nails projecting about one inch from the block. Into this nail-studded receptacle hard grease is tightly packed. The impression block is run on a horn socket or a slip socket and should be securely bolted in or securely fastened by some means other than friction.

If the tools are square in the hole, when the impression block is run, they will leave the impression of their top in the grease. If they lay over to one edge of the hole they will mark the impression block on its side. From the impression obtained it is possible to estimate the position of the lost tools and their condition, and accordingly decide upon the procedure. After clearing the drilling line from the top of the tools, the next thing is to loosen them so that they may be jarred out when hooked to the fishing string. This is accomplished by drilling beyond them with a regular bit or by spudding around them with a side spud or spear. After the tools are loosened, and the impression block shows that they stand straight in the hole, the fishing tool is placed in action.

If the tools lay against the wall, and the fishing tool will not go over them, they may be straightened up or caught with a wall hook, or straightened up by spudding around them. They may also be "drilled by," so that the lost tools will fall into the new hole in such a position that they may be caught, or they can sometimes be "drilled by" and cased off entirely. Sometimes, when the tools become buried, it is possible to loosen the muck around them with another string and pull them out on their own line.

If the tools get hung up while drilling, and cannot be jarred out in a short time with the drilling jars, it is important that the drilling line be cut at the top of the tools at once. Continued jarring does not help matters and only whips more material from the walls on top of the tools.

The following advice is the result of long experience in drilling bad ground:

Use good equipment and keep all parts of it in good repair.

Inspect the drilling line frequently.

Do not take chances by drilling far ahead of the casing when the ground is caving.

If ground is sticky or cavy, use a sinker bar above the jars.

Have good supply of fishing tools on hand.

If tools become buried while drilling, cut the line at once.

Do not take hold of a lost string with a fishing string until you are sure that the lost string will come. I have seen three strings of tools, one drilling and two fishing, tied to each other and left in the hole and the whole lost right on top of the orebody because some driller took hold with his fishing string before the lost tools had been properly loosened.

Figure out all possibilities to a situation before proceeding.

PRESERVATION OF SAMPLES IMPORTANT

It is of the utmost importance that adequate records, both physical and written, be kept. Churn drilling is one phase of mining operations where statistical records are of more importance than cost records. Physical records consist of sludge samples and of rocks brought up in the bailer from various formations penetrated. After the dried sludge sample has been sent to the assay office it should be crushed so that it will pass a 10-mesh screen, and riffled until enough is left to fill two 6-in. x 12-in. sample sacks. The sample is riffled again and one-half of it is placed in a sample sack, which is stenciled with the number of the hole, the depth at which the sample was taken, and the letter "D" to signify duplicate. The other half of the sample is further comminuted and reduced to a suitable assay size in the regular manner, the pulp being taken for assay. The rejected portion is placed in a sample sack, which is stenciled with the number of the hole, the depth at which the sample was taken, and the letter "O" to signify original. Both original and duplicate samples are then stored in a fireproof vault or building where no one may tamper with them.

The samples should be stored systematically. The best manner is to place them on shelves divided by partitions, each resulting compartment being of the proper size to hold ten samples. Originals are placed on one side of the building and the duplicates on the other. By this arrangement any particular sample may conveniently be picked out at any time. The duplicates should never be opened unless it be absolutely necessary, as they should be reserved for examining engineers in the event of examination for underwriting, sale, or consolidation. If any experimental work is to be done on samples, the originals should be employed. Rock samples are preserved in the same manner as sludge samples.

The records referred to in this paper are strictly of an engineering nature and do not deal with the receipt and disbursement of funds. The accompanying form, Fig. 1, shows the daily drill report. These reports measure 8½ x 11 in. and are the same size as ordinary business letter paper. They are printed in one, two, or three colors, depending on the number of shifts being employed, a different color being used for each shift. White, light yellow and light blue make three satisfactory colors.

I designed this form for either churn drill, rotary rig, or a combination rig where both rotary and churn drill are employed in conjunction with one another. For straight churn drilling, the form can be slightly modified by eliminating the headings peculiar to rotary drilling. It will be noted that much of the information desired is entered by simple check marks, the remainder consisting of the entry of a few figures. A driller and sampler soon learn to fill in these reports accurately, and as the sheets are turned over to the office every day the management can keep in close touch with the details of the work. The reports are filed in the office on a Y. & E. "Shannon Board File," one file being used for each hole. After a hole is finished, the reports are bound together with string and filed for reference. The daily drill reports, in conjunction with the assay sheet, storehouse requisitions, and topographic map, form the basis of all records. No form is given here for the assay sheet or the storehouse requisition as they are too simple to warrant reproduction.

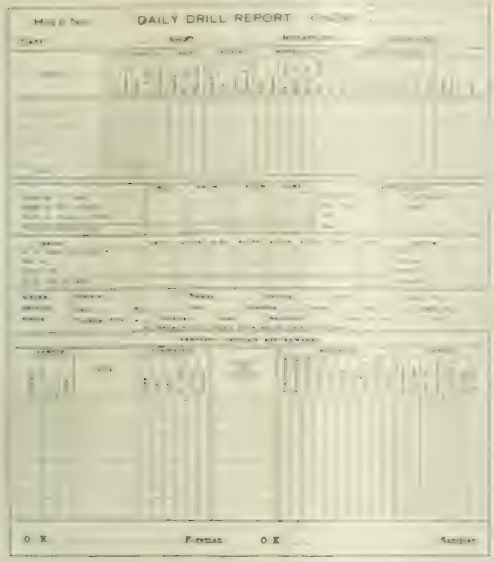

DAILY DRILL REPORT
O. K.
Foreman
O. K.
Sampler

FIG. 1. FORM OF DAILY DRILL REPORT

Of the final records, one of the most important is the hole record shown in Fig. 2. This is made up from data obtained from the daily drill report and the assay sheet. The hole record is made on standard cross-section cloth, divided into main squares measuring 1 in. on a side. These 1-in. squares are further divided into smaller squares measuring 0.1 in. on a side. The lines on the cloth are orange colored. The hole record sheets are cut 20 in. wide and 25 in. long. This allows all relevant data for 500 ft. of hole to be placed on one sheet. The first sheet would show data from surface to 500 ft., the second sheet would show data for the depth 500 ft. to 1,000 ft. and so on.

Fig. 2 shows the proper headings for this sheet and the method of entering data. The vertical 0.1-in. subdivisions correspond to 2½ ft. of hole, one inch vertical being equal to 25 ft. The hole record gives a condensed record of the hole from top to bottom and shows at a glance all of the important information. Blueprints are made from these hole records once a month, or bimonthly, and sent to the home office.

PREPARING CROSS-SECTIONS FROM DATA OBTAINED

Cross-sections are made up from the data obtained from the daily drill reports and from the topographic map. One set of sections should be made along the north-south co-ordinates and another set along the east-west co-ordinates. After a fair idea has been obtained of the trend of the orebody, a set of sections should be made parallel to the long axis of the orebody and another set at right angles to it. All relevant data should be plotted on these sections, the sections being drawn to a scale of 100 ft. to the inch. By connecting holes with colored lines representing different grades of ore, much information of value and interest can be obtained.

Another map that may prove of value is a contour map of the upper and lower surfaces of commercial ore, the contours on top of the orebody being full black lines, and those of the lower surface dotted red lines. The foot-per-cent-contour map will be of aid in the planning of underground operations. On this map the holes are shown in plan. The thickness of *commercial* ore in each hole is multiplied by its average grade, the product being the foot-per-cent for that hole, and this figure is written in at the location of the hole, i.e., at the coordinate intersections. Then equal foot-per-cent points are connected by contour lines, intermediate contours being interpolated as in the making of a topographic map. The ridges, as represented by the contours, will represent those portions of the orebody having the greater commercial value.

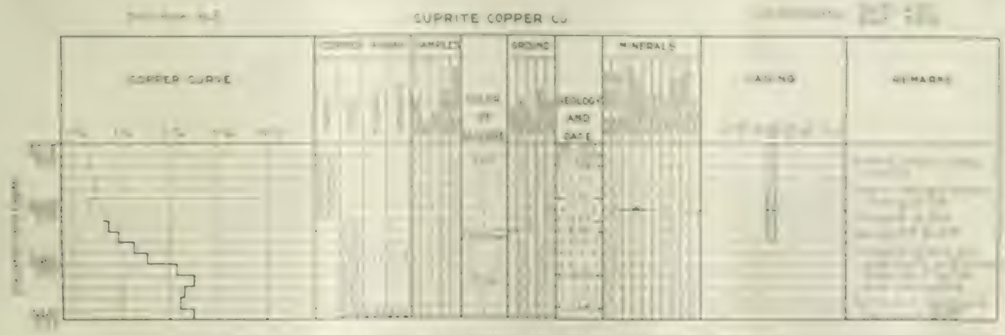


FIG. 2. HOLE RECORD AS SHOWN IN STANDARD FORM SHEET

While the drill is operating in nearly barren capping the slop-cyanide method is sufficiently accurate. When the slop-cyanide assays show that 0.75 per cent of copper is present, or when a hole enters the chalcocite zone, a more accurate method should be employed. In the earlier stages of development the laboratory will not be equipped for making determinations by the electrolytic method, so some other process must be employed. Some operators use the permanganate, though others use the iodide. I prefer the latter.

The following iodide method does not seem to be known as well as it should be, especially among the younger engineers, and I therefore give it in detail: The sample is ground, preferably by means of a disk grinder, so it will pass a 100-mesh screen. Assays are made in duplicate, and these should check to within 0.04 per cent on a 2 per cent ore, the average of the two assays being taken as the final result. If assays do not check to within the above limits, they should be re-run.

IODIDE METHOD OF COPPER ANALYSIS

Weigh out 3 g. for assay and put in a tall, 250-c.c. Pyrex beaker. Add 10 c.c. of nitric acid and 5 c.c. of hydrochloric acid and digest on a hot plate at a gentle heat until 4 or 5 c.c. of acid remains. Add 7 c.c. of concentrated sulphuric acid and take down to heavy white fumes. Cool, add about 150 c.c. of water and heat gently until all of the iron is in solution, this being told by the color of the solution and the appearance of the insoluble. Filter into a 500-c.c. beaker, washing well with hot water and make the filtrate up to about 350 c.c. Heat to boiling and from a 10-c.c. pipette slowly add a concentrated solution of sodium hyposulphite. At first a white precipitate begins to form and, on the further addition of hypo, turns brown and finally black. The black precipitate is copper sulphide.

After the black precipitate has begun to form, add 2 c.c. to 3 c.c. of hypo in excess. The reason for adding the hypo in the manner described is that if a large excess of hypo is added considerable sulphur will be precipitated. This sulphur makes a bulky precipitate, and will later have to be burned off. Boil until the solution is clear and filter through a 9-cm. filter paper. Wash with hot water. The beaker can easily be washed clean by means of a jet from the wash bottle. Put filter paper and precipitate in a clay annealing cup or porcelain crucible, dry, and ignite at a red heat—either in a muffle or over a Dangler lamp—until the filter paper is entirely consumed and the copper sulphide is practically converted into the oxide. Transfer the copper oxide into a 250-c.c. tall form beaker, or, better still, into a 6-oz. Lows copper flask. Add 3 c.c. of concentrated nitric acid and dissolve. Add 5 c.c. bromine water and boil until all bromine is expelled. Make up to 100 c.c. with water and add ammonia in slight excess. Boil until odor of ammonia becomes faint, then make acid with acetic acid and add 4 or 5 c.c. of acetic acid in excess. Boil for a few minutes, then cool and finish in usual way.

Hyposulphite solution for titration should be of such strength that 1 c.c. is equivalent to approximately 0.005 g. of copper. Assays are run on composite samples for every 25 ft. of hole, the composite sample being made from the pulp of five regular samples. This serves to further check the regular assays. The management should check the assayer at irregular intervals by sending random samples to some independent assayer.

The only engineering that is required during the course of drilling is ordinary surveying and the laying out of roads. Roads should be laid out with a maximum grade of 15 per cent, as this has been found to be about the maximum for the economic handling of supplies. A Brunton pocket transit is a most efficient instrument for road work, and one should be on the job at all times. If a topographic map has been made of the area to be drilled, the most suitable location for roads can be obtained from the map and then laid out in the field with the Brunton.

SIMPLIFIED ROAD SURVEYING

More often such a map is not available, and roads have to be laid out by cut and try. That is, a preliminary location is made, and if this is not satisfactory others should be tried until the proper location is secured. The best way to do this is as follows: Begin at the point from which it is desired to start the road and estimate the probable length and the difference in elevation between the starting and finishing points. Difference in elevation divided by length of the road is the tangent of the grade angle. If starting and finishing points are visible from each other, the grade angle may be obtained direct. Set the grade angle on the vertical arc of the Brunton. Find the point on the rodman's body, neck, face, or hat that corresponds to the height of the eyes of the instrument man. The rodman is then sent ahead as far as the instrument man can see him or to a point where a radical change in alignment takes place. He is motioned up or down the hill until the part of his body that is equal in height to the instrument man's eyes is on the line of sight of the Brunton, the Brunton being held so as to indicate the proposed grade. Then the point the rodman is standing on is on grade with respect to the point on which the instrument man is standing.

The instrument man then moves to the position occupied by the rodman, the rodman moves ahead, and the operation is repeated until the trial location has been run. If the first location is not correct, the grade angle is corrected by an estimated amount and the line re-run backward, by which operation the work will usually be found to be practically correct. With the corrected grade angle, final location is made. This is done by the rodman moving ahead about 20 ft. at a time and driving a stake on grade at each 20-ft. point. These stakes show the road crew the road location and grade points.

DIGGING THE ROAD TO GRADE

In construction, the road foreman has a man dig a trench measuring about 1 ft. wide and 18 in. long at each grade stake, the bottom of the trench being on grade. The bottoms of these trenches are connected with a trail about a foot wide, the trail being put to grade between trenches by the eye. This gives a trail corresponding to the location and grade of the proposed road. Most of the road work will be done by hand, though in some instances a plow and scraper can be used.

In hand work, the road should be divided into 25- or 30-ft. sections and one man put on each section. This allows the foreman to gage individual ability and also increases the efficiency, for a man will do more work when by himself than when in a gang. In hard ground expense can be lowered by putting in holes along the bank with a bull pick and blasting. The road crew should be supplied with plenty of sharp picks and good shovels. Roads should be 9 ft. wide in the solid on the straightaway and wider on the turns. They should also be higher on the outside, so that the drill, as it is moved along the road, will hug the bank. Drill locations should be made wide enough to allow a 14-ft. platform and long enough to accommodate the machine and platform. Machines should be backed into the location, so that tools and casing will come into the front end of the rig.

TRIANGULATION SYSTEM OF CONSIDERABLE BENEFIT

Of great aid in operations is a triangulation system and a topographic map. The installation and making of these should be started as soon as it is seen that the drilling is going to extend over any considerable period. This work can be done by the engineer as he can spare time from his other duties. The important thing is to start both in the proper way, so that this work will be of permanent value.

For a good type of triangulation station, see "Construction of Triangulation Stations," by E. R. Rice, *Mining and Scientific Press*, Nov. 23, 1912. A base line at least 1,000 ft. long should be laid out, correct to 1 in 25,000. The meridian should be determined correct to within 10 seconds of arc. A triangulation system should be laid out in quadrilaterals, which should be adjusted by the method given in Johnson's "Theory and Practice of Surveying," pp. 549-553, sixteenth edition. Angles may be determined to any degree of accuracy, although if they are correct to within 5 seconds of arc they will be sufficiently accurate for this purpose. In using the ordinary transit, angles are best determined by the repetition method, which consists of adding the angle on the plate from four to ten times, half of the readings being taken with the telescope erect and half with it inverted. In practice the interior angle is repeated a certain number of times, as described, reading in one direction. The exterior angle is then repeated the same number of times in the same direction. Then the sums of the interior and exterior angles should equal 360 deg. The difference between the sums of the angles and 360 deg. should be applied equally to each angle. Lines of levels should be run around each quadrilateral so as to form closed circuits and the errors balanced in proportion to the lengths of the lines. Elevations should be referred to mean sea level if it is possible to connect with a U. S. Geological Survey bench mark. If no bench mark is available, datum must be assumed.

STADIA USED IN OBTAINING TOPOGRAPHY

In the field work for the construction of the topographic map, topography should be done with transit and stadia, setting the transit over some known point and taking shots on controlling points such as ridges, gulches, and breaks of slope. As topography will generally be obtained when the engineer has no other duties to perform, it will be done piecemeal by the engineer and one assistant. Notes are reduced in the office by means of stadia slide rule and plotted.

The map should be of the best quality, heavy cloth-backed paper. Scale should be 1 in. equals 100 ft., and the contour interval should be 10 ft. Instead of ruling the map into 100-ft. squares with ink, it is ruled into 200-ft. squares with light pencil lines, these lines corresponding to the drill co-ordinates. At each co-ordinate intersection a small cross is made with yellow ink and then the pencil lines are erased.

Tonnages are of two kinds, total tonnage and minable tonnage. Of prime influence on tonnage is the lowest-grade ore that may be worked at a profit. This is in turn influenced by the size, shape, and mineralogical composition of the orebody.

Inasmuch as disseminated copper deposits gradually decrease in value with depth, and also horizontally away from the main ore occurrence, any change in the grade of ore that may be worked at a profit will affect the tonnage. There will be portions of the deposit, especially along the edges, that may be above commercial grade, but, owing to their irregularity of outline, or their thinness, it may not be commercially feasible to extract them. Conversely, there may be portions below commercial grade that it will pay to mine owing to a great deal of dead work having already been done near them for the purpose of mining higher-grade ore, which higher-grade ore has carried the expense of the deadwork.

CALCULATION OF TOTAL TONNAGE

Assuming that it has been decided, after a study of the subject, that 1.3 per cent is the lower limit of commercial ore, the orebody is divided into blocks, 200 ft. square, with drill holes at the corners of each block. Suppose the hole at one corner of a block has the following assay log through the horizon of commercial ore, zero depth being at the top of the orebody:

Depth, Ft.	Assay Per Cent Cu	Depth, Ft.	Assay Per Cent Cu
0-5	0.27	65-70	1.81
5-10	0.58	70-75	1.58
10-15	0.90	75-80	1.48
15-20	1.22	80-85	1.58
20-25	1.62	85-90	1.38
25-30	2.02	90-95	1.25
30-35	2.27	95-100	1.38
35-40	2.38	100-105	1.40
40-45	2.42	105-110	1.32
45-50	2.13	110-115	1.27
50-55	1.80	115-120	1.20
55-60	1.72	120-125	1.15
60-65	1.60		

From a depth of 20 ft. to a depth of 110 ft. there is 90 ft. of ore averaging 1.73 per cent. In the example given, ore above 1.3 per cent extends from the 20–25 sample, running 1.62 per cent, to the 105–110 sample, running 1.32 per cent, excepting the 90–95 sample, running 1.25 per cent. The 90–95 sample, though below the minimum grade, occurs 15 ft. above ore running sufficiently over minimum grade to make the entire 20 ft. above minimum grade.

The foot-per-cent of this hole would be 90 × 1.73, which equals 155.7. Suppose the other three holes at the remaining corners of the block show 80 ft. of 1.62 per cent ore, 110 ft. of 1.92 per cent and 85 ft. of 1.62 per cent copper. The foot percentages of these holes would be 129.6, 211.2, and 137.7 respectively. The sum of the four foot-percentages would be 634.2. The sum of the individual thicknesses of ore in each hole would be 365 ft. The average grade of the block would be 634.2 divided by 365, which is equal to 1.73 per cent. The average thickness of the ore in the block would be 365 divided by 4, which is equal to 91.2 ft. Therefore the block contains an orebody that averages 1.73 per cent copper, the dimensions of the orebody being 200 ft. square and 91.2 ft. thick. Ore of the size under discussion has been assumed in many instances to be of such specific gravity that 12½ cu.ft. weighs one ton. Using the factor of 12½ cu.ft. to the ton, the tonnage of the block would be 291,000 tons of 1.73 per cent ore.

Each individual block is treated in a like manner. Then the tonnage of each block is multiplied by the grade of ore of the block, giving the ton-per-cent for that block. Such factors calculated for all blocks are added together, giving total ton-per-cent for the entire deposit. Total ton-per-cent divided by total tonnage gives the average grade for the deposit.

No ore is regarded as fully developed unless blocked out by holes at all four corners of a square. With holes at three corners of a square, the ore in one-half the block is figured as probable. Possible ore is figured beyond existing holes from a study of the geology of the deposit, the cross-sections of the orebody, and the occurrence of the ore in the nearest holes.

AVAILABLE ORE DETERMINES MINING METHOD

Minable tonnage is of more importance than the total tonnage and is harder to compute. This is due to the fact that fluctuations in price of finished product, cost of mining, cost of concentration, concentration losses, and applicability of mining methods to the form of the deposit must be taken into consideration. The sections and foot-per-cent contour map mentioned under records will be of great aid in this connection. After studies have been made of the orebody and of mining methods employed by companies mining similar orebodies, a mining method may be tentatively decided upon. When this has been done, and costs of mining by this method have been estimated, one is in a position to estimate what portions of the orebody are minable at a profit. This having been determined, the calculation of minable tonnage becomes quite a simple matter.

Though the following remarks have nothing to do with actual exploration, they may be regarded as being of interest to the subject of mine development.

ADVISABLE TO SECURE SUFFICIENT GROUND AT BEGINNING

When it is seen that there is a probability of developing a commercial orebody, options should be taken on all the ground that is likely to be needed by the company, both mineral and non-mineral. A great deal of ground is needed in the exploitation of a disseminated copper deposit, and the best time to get the necessary territory is at the inception of operations when the pioneer operator is the only one who has reliable information as to ore occurrence and future possibilities. Nature does things on a grand scale, and when mineralization has been intense enough to form one large orebody it is safe to conclude that more than one orebody has been formed in the same zone of mineralization. Any of the important copper camps will confirm the accuracy of this statement.

Most of the important porphyry mines now own considerable territory, although many of these holdings have been acquired by a purchase of the holdings of other companies or by consolidation. Rarely does one find an instance where the pioneer company has had the foresight to buy up large acreages from the original claim owners.

All mining claims should be taken to patent as soon as possible, as such a step eliminates possibility of subsequent litigation.

Drilling should be done in supposedly barren formations to prove that these formations are non-mineral, and also for the purpose of being able to locate the main shaft and the concentrator at points where they will not be endangered by subsequent caving of ground due to mining operations.

Safety Cutout for Trolley Wires At Loading Chutes

BY E. D. GARDNER*

Trolley lines used in connection with electric haulage in mines are a source of danger, and many lives have been lost by men accidentally coming in contact with the wires. Usually the wires in metal mines are sufficiently guarded to prevent men from touching them with their person or by pieces of steel which they may be carrying on their shoulders while walking along the level. However, it is difficult to guard effectively the wires at loading chutes along the haulageways, and despite safeguards, chute trammers have been electrocuted through loading bars that accidentally touched the trolley line.

To overcome this danger the Calumet & Arizona Mining Co. formerly used a hinged V-shaped trough made of 1-in. x 6-in. lumber, that was dropped over the wire in front of the chute, when the cars were being loaded. This arrangement interfered with the easy operation of the chute, and a cutout device for the trolley line was devised. This cutout is efficient, easily constructed, and does not interfere with the operations at the chutes or with the motors operating on the same level.

When the cutout is open the electric current is carried past the gap by an insulated wire on the opposite side of the drift. A hinged board drops down over the ends of the trolley guard when the slide is open and prevents anything touching the live wires.

The cutout is simple in construction and consists essentially of a section of ¼-in. rod that slides back into a 6-ft. length of ½-in. pipe, both of which are a part of the trolley line. When closed, one end of the rod remains in the long pipe, at the set back of the chute, and the other end fits into a 6-in. length on the set ahead, and both ends have enough bearing to make proper electrical contact. Standard electric equipment is used in the mine, and as the trolley-wire hangers will not fit the ½-in. pipe, a ¼-in. rod is welded on top for clamping it in place. The motors run past the cutouts with no interference.

When the cutout is closed, it is guarded by two ½-in. x 6-in. boards, as elsewhere. The free end of the rod and guard boards are fastened together by an open rectangular piece of ½-in. x 3-in. iron. The trolley rod is hung from the top of the iron by insulated hangers, and the guard boards are bolted to the sides. The boards slide back in brackets outside of the regular guards. Occasionally, in wet places, enough current leaks through the insulators to the boards of the cutout to shock a man, and, to prevent this, insulated knobs are placed on both guard boards for handling.

Silver Deposits in the Philippine Islands

According to a statement in *Philippine Resources and Opportunities*, silver in the Philippine Islands, in most instances, is found in a ratio of 1 to 4 alloyed with gold. Silver deposits are found in Bulacan, Paracale, Cebu, Marinduque, and Mindanao. No extensive attempt has been made to develop the silver mines, which, according to authority, can be advantageously worked on a commerical basis. The establishment of a local mint would serve to stimulate the interest in the mining of this metal in the islands. Both China and India are on a silver-standard basis, thus assuring a near-by market for Philippine silver.

---

*In *Reports of Investigations*, U. S. Bureau of Mines

Mining Engineers of Note

L. D. Anderson

THE earliest recollection of the subject of this sketch is that of being pulled by the heels from beneath a switch engine under which he had crawled to find out how the Stephenson link motion made the engine run backward. Fortunately an indulgent parent did not allow his wrath to overcome his appreciation of the fact that an avidity for mechanical knowledge might be put to some good use. Born of Swedish parents in Ishpeming, Mich., Mr. Anderson's early education was of the normal American type gained in the public grade and high schools of that place, followed by four years of study in mechanical engineering in the University of Michigan, at Ann Arbor. His first professional engagement after graduation was as a helper in the shops of the Nordberg Manufacturing Co. at Milwaukee. Later came a promotion to the drafting room. After this Mr. Anderson spent a year in the engineering offices of the Bucyrus Co., of South Milwaukee, Wis., specializing in the design of steam shovels, pile drivers, and wrecking cranes. It is not generally realized that the rough-looking steam shovel is a triumph of engineering design. Deep interest was attached to making the drawings of the first fifty shovels for digging the Panama Canal.

L. D. ANDERSON

A year as mechanical engineer for the Champion Copper Co. at Painesdale, Mich., brought a more intimate contact with mining. Under the initiative of its chief engineer, F. W. O'Neil, many innovations were introduced to the Michigan copper country, such as the cross-compound steam stamp and the Nordberg quadruple expansion, two-stage air compressor, which broke all world's records for economy. Although the cross-compound stamp has been replaced by the simple compound, it was the pioneer in compounding. After completing the work at this place another year was spent in the engineering offices of the Bucyrus Co.

Through the recommendation of Mr. O'Neil, Mr. Anderson was sent out to Humboldt, Ariz., as construction engineer for the Arizona Smelting Co. With this engagement began a real and permanent connection with mining and smelting. The experiences at this plant were interesting in the extreme, involving the effort to make a success of many novelties, things which were in fact too novel. It was attempted, for example, to launder reverberatory slag five hundred feet to a river bank, keeping it hot and liquid en route with oil flames. Needless to say, the attempt was a failure. After the construction work on this plant had been completed, Mr. Anderson became assistant to C. F. Moore, chief engineer of the United States Smelting, Refining & Mining Co. About six years of extraordinarily varied engineering work in all lines of mining and smelting were followed by the superintendency of the Midvale smelter of that company. This work was taken up with some trepidation, representing apparently metallurgical rather than engineering practice. It was soon found, however, that neither field was independent of the other; that in fact good metallurgy meant the application of good engineering. During the incumbency of this position a number of effective improvements were worked out. Among these was the invention of a new method of charging lead blast furnaces. When this was put into operation about sixty charge wheelers were laid off. Mechanically accurate charging, in addition to cutting labor cost, improved the metallurgical recovery. The plant was fortunate in having able technical men on its staff during this time, and they did much meritorious work. Notable were R. H. Stevens, who invented a method for cadmium recovery from baghouse dust; J. F. Cullen, inventor of methods for making metallic arsenic, calcium arsenate, and weed killer, and assistant superintendents C. L. Colbert, Curtis Powell, and Robert Wallace.

After two years of business work as manager of the Midvale plant, Mr. Anderson is now chief engineer of all the company's properties, with headquarters at Salt Lake City. He is a member of the American Institute of Mining and Metallurgy, the American Society of Mechanical Engineers, and the Utah Society of Engineers. He was married to Miss Mabel [illegible], of Milwaukee, Wis., in [illegible]. They have one daughter and two sons.

HANDY KNOWLEDGE

The Alvarado-Type Ore Skip

Written for *Engineering and Mining Journal*

The Alvarado Mining & Milling Co., operating in the Parral district, Mexico, has long used an ore skip designed on the three-point suspension principle for service in inclined shafts. No trouble has been experienced from derailment during hoisting.

The front axle of the skip is bolted securely in place, as shown in Fig. 1. The back axle consists of a single steel casting, pivoted midway and held in place by angle-iron guides. When the skip is running on an uneven track, its weight is thus distributed equally over the four wheels, wherein lies the advantage of three-point suspension. Both axles are equipped with Hyatt roller bearings.

The rear axle with the pivoted casting may be removed as a unit, when repairs are necessary, by taking out the steel pin, *C*, Fig. 1. Similarly, the front axle may be removed by taking out the four bolts shown at *D*, Fig. 1. Spare axles are kept on hand.

The accompanying illustrations show such a skip of 80-cu.ft. capacity, which is also equipped with emergency valves in the lower end, so that it can be used for bailing water in a pinch. These valves are shown at *B* in Fig. 1. When ore is being hoisted, each valve is kept closed by a washer made of pipe and held in place by a nut. When bailing is necessary, this piece of pipe is removed and a light spring substituted for it.

At the lower end of the skip, on the upper side, are three 3 x 6-in. slots, as shown at *A* in Fig. 1. Through these a bar may be inserted to clean out the clay and other sticky material which accumulates in the bottom of the skip. There is considerable clay in some of the ore handled, and this tends to pack solidly. In case the skip is used for bailing water, soft wooden plugs are driven into these slots.

Ordinarily the skip is not used for bailing, but is equipped for the purpose, as described, as an added precaution against the drowning of the pumps in case the water flow should become too heavy for the latter to handle.

Protection of Mill Ore Chutes

Written for *Engineering and Mining Journal*

The protection of ore chutes from undue wear caused by a moving stream of ore is accomplished in a variety of ways. At the flotation mill of the Calaveras Copper Co., Copperopolis, Cal., worn-out ball-mill liners are cut to size by means of the acetylene torch and used to protect the bottom of the chute. The sides of the chute are protected by iron straps which are bolted to the side boards.

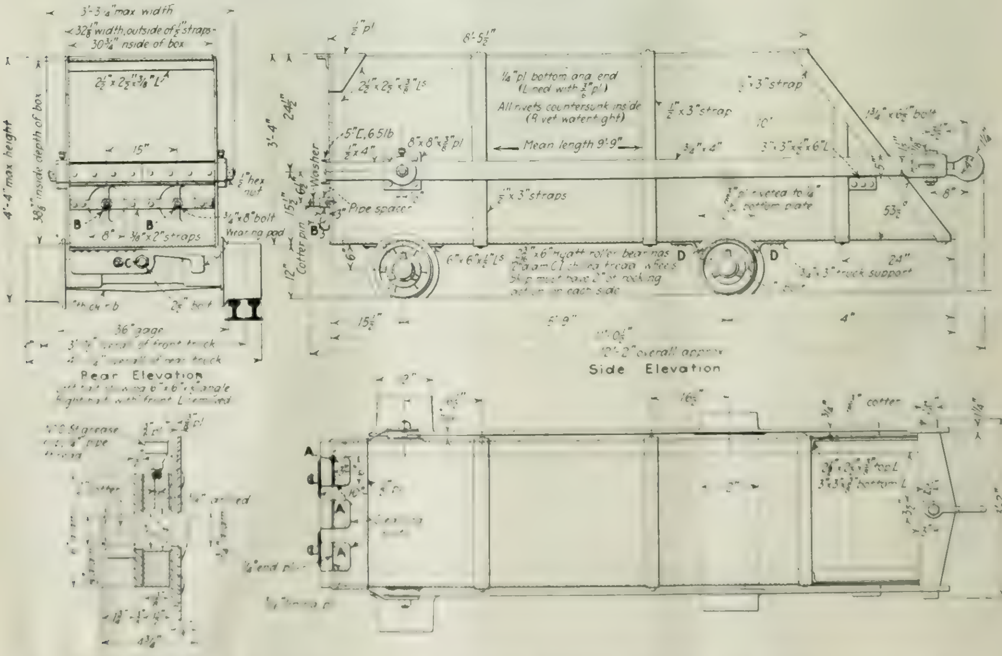


FIG. 1. DETAILS OF 80-CU.FT. ORE SKIP USED BY ALVARADO MINING & MILLING CO., PARRAL DISTRICT, MEXICO. THIS IS BUILT ON THREE-POINT SUSPENSION PRINCIPLE

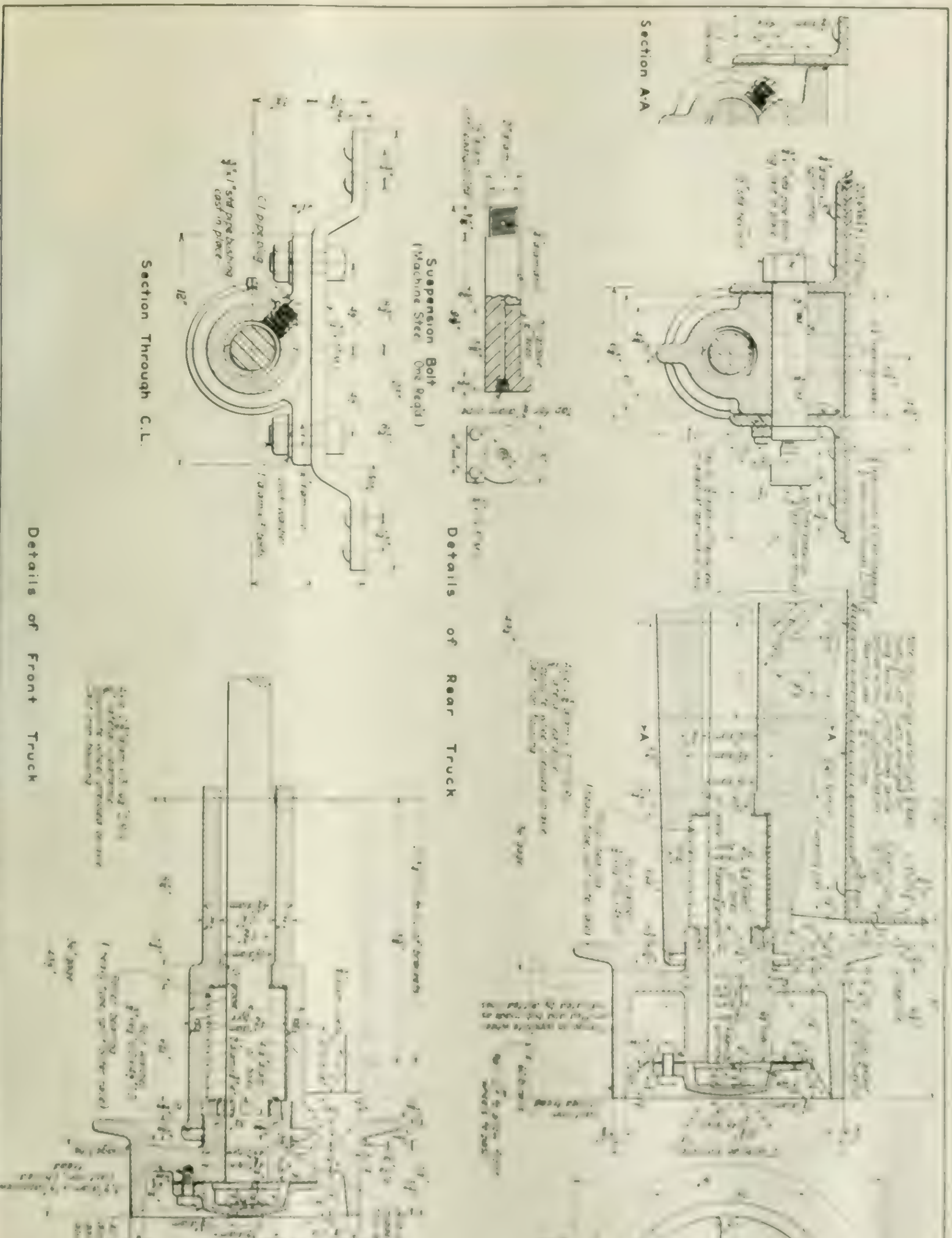


FIG. 8. DETAILS OF FRONT AND REAR TRUCKS OF ALABAMA-TYPE ORE SKIP

CONSULTATION

The South African Gold Premium

"I would like to know whether you have any data available regarding the exact significance of the so-called premium in the operations of the gold mines of the Transvaal, South Africa, and how much the cost of mining Transvaal gold has increased."

Although it is well known that the premium received by the South African gold miner is a measure of the depreciation of British paper money, and that the premium is of great help to British gold mining in South Africa, the average reader is possibly not so well informed about the exact relation between the gold premium and the profits of Transvaal mining companies, as expressed in pounds sterling.

The reports of individual South African gold-mining companies practically all bear tribute to the value of the gold premium to their operations and view the gradual improvement in sterling exchange, which amounts to a corresponding gradual extinction of the premium, with alarm.

In order to indicate the influence of additional gold revenue or premium in South African gold mining, the following table, showing comparative statements of revenue, working expenditure, and working profits of the gold mines of the Witwatersrand area, is given:

WITWATERSRAND GOLD MINES

	1919	Per Ton Milled	1920	Per Ton Milled
Tonnage milled	24,043,638	... ...	24,096,277	...
Revenue from gold won (at standard price)	£34,297,431	28 53 —	(a) £33,231,257	27 58 ·
Working expenditure	£27,518,253	22 89 —	£30,814,861	25 57 -
Working profit (exclusive of premium)	£6,779,178	5 64 -	£2,416,396	2 01 -
Additional revenue from sales of gold above standard price	£3,503,067	2 91 -	£8,885,380	7 37 ·
Total revenue	£37,800,498	31 44 —	£42,116,637	34 95 -
Working profit (inclusive of premium)	£10,282,245	8 55 —	£11,301,776	9 38 ·
Dividends declared.......	£5,845,607	4.87/—	£8,275,708	6.87/—

(a) Exclusive of revenue from accumulated sands and slimes estimated on the 1919 basis at £157,000.

The table clearly shows that gold production declined slightly during the year 1920, compared with 1919, that working profit, exclusive of premium, declined greatly (due to increased cost of mining), but that additional revenue from sales of gold above the standard price of 85s. more than made up the deficiency in working profit, and swelled the total revenue figures.

The large difference between the additional revenue from sales of gold above the standard price in 1919, £3,503,070, and the sales of 1920, £8,858,380, can be accounted for partly by the widely fluctuating value of the gold premium during those two years and the fact that the premium was not realized until July, 1919. The total dividends declared in 1920 almost equaled the additional gold revenue for that year. An inspection of the table will quickly disclose the importance of the gold premium. Without this additional income the South African gold-mining industry would be in the same position as it is in the United States.

The cost of producing South African gold has greatly increased during the last six years, so that for a particular group of South African gold mines in the year 1920 it was about 47 per cent greater than the average for 1915. The report of the directors of The Central Mining & Investment Corporation, Ltd. (British), a company operating many large gold properties, contains a table supplied by H. F. Marriott, consulting engineer of the corporation, which shows the increases in costs of mining during the last six years for gold-mining companies operated by the corporation or in which it is financially interested. The table follows:

DIRECT WORKING EXPENDITURE AT THE MINES

(Exclusive of Charges Not Under the Control of the Management)

	Wages					
Year	European	Native	Materials	Other Costs	Total	Tons Milled
1915 .	4 9 6	3 10 8	5 8 3	3 2 1	17 6 8	10,405,000
1916	4 11 7	4 1 6	6 0 9	3 3 4	18 5 6	10,156,000
1917 .	5 7 1	3 10 6	6 4 9	3 9 3	19 7 9	9,359,000
1918 . ..	6 8 2	4 2 8	7 6 6	3 7 1	22 0 7	12,005,000
1919 . .	7 4 6	4 2 3	7 10 3	3 11 1	23 4 3	11,267,000
1920	8 6 4	4 6 1	8 5 3	4 4 9	25 10 8	11,028,000
Month December, 1920.........	9/2.4	4/9.6	9/2.4	4/1.7	27/4.1	867,000

European wages have increased greatly (assuming the same ratio of wages to total costs throughout the period); native wages have increased moderately; materials show an increase of 61 per cent; other costs have advanced 39 per cent. All these costs are not, however, calculated on a metallic basis, particularly for the years 1919 and 1920, during which period the full extent of the depreciation of the pound sterling was felt and measured by the gold premium. The increase in mining costs is but a reflection of the world-wide increase in the cost of operating mines, and the table is significant in hinting what the state of affairs would be were no premium available to offset the increased charges. Incidentally, it is instructive to observe that the total cost of the European white employees, who largely act in a supervisory capacity and constitute one-eighth of the total labor force, is nearly double the whole expenditure on native laborers who carry on the work.

South African gold production has kept up remarkably well during the last five years, although it has declined. It may appear strange that an industry should capitalize on the depreciation of its government paper currency, but that is precisely the situation in South Africa. As sterling exchange improves, the profit of the gold miners decreases, and vice versa. It may well be, that before sterling exchange returns to its parity of $4.866, deflation of labor commodity prices will have progressed to such an extent that mining can be continued on a normal cost basis, in which event the gold premium will have proved a remarkable stabilizer.

"When gold falls to 100s., it will cause unemployment of 5,800 Europeans, with sixteen mines working at a loss; when gold falls to 90s., there will be 12,000 Europeans out of employment, and twenty-six mines working at a loss; when gold falls to normal, 85s., there will be 14,400 Europeans out of employment and thirty-one mines working at a loss." Although this estimate of Lord Buxton's is theoretical, it gives an indication of what the industry might expect upon a sudden return of sterling exchange to par.

THE PETROLEUM INDUSTRY

Petroleum in the Mendoza-Neuquén District, Argentina*

BY ARTHUR H. REDFIELD

Evidences of oil occur in the Province of Mendoza and the territory of Neuquén, in a belt along the eastern slope of the Andes, beginning forty miles north of Mendoza, and extending south to 42 deg. S. latitude. The area covers 6,000 square miles, of which 300 square miles show possibilities of oil; and less than one square mile has been proved.

The principal seepages in Mendoza occur at Cacheuta, in the Department of San Rafael, at the southern end of the Cordillera de Mendoza, and at Colonia Alvear, near the boundary of Neuquén, 120 miles from the terminus of the Western Argentine railway. In Neuquén, the principal deposits appear to lie in the vicinity of Plaza Huincul, between the stations Challaco and Ramon M. Castro on the Argentine Southern railroad; six miles from Zapala, the western terminus of the Southern railroad; at Cerro Lotena, in the southern part of the territory; and along the Rio Barrancas, sixteen miles from its confluence with the Rio Grande.

The primary oil horizon of the Mendoza district is found in the San Rafael shales and sandstones, Kimmeridge-Portlandian series (Upper Jurassic). Secondary enrichments occur in the variegated sandstones (areniscas abigarradas) of the Upper Cretaceous. The parent formation is in all probability the bituminous shales of the Rhaetic (Upper Triassic). The petroliferous formation of the Neuquén district is the marl complex of the Kimmeridge-Portlandian (Upper Jurassic) grading into the Upper Tithonian (Upper Jurassic) limestones. As in the Mendoza district, secondary deposits are found in the Upper Cretaceous sandstones.

The structure in the Mendoza district is that of an elongated flat anticline, whose axis runs generally northeast-southwest. This anticline is continued in the Neuquén district to the south. The petroliferous character of the Mendoza district is evidenced by numerous seeps of oil and exudations of semi-solid asphalt (rafaelite). Similar indications are found in the Neuquén district.

The Mendoza district was surveyed in 1886 by Dr. Zuber, and exploitation soon followed. The Compañía Mendocina de Petróleo drilled in this field from 1886 to 1897, without notable results. In 1910 the Argentine Western Syndicate drilled three wells, and the Cacheuta Oil Syndicate drilled two. Shows of oil were obtained. Active development ceased in 1916. The greatest output ever obtained did not exceed [illegible] bbl. a day. The petroleum encountered is a paraffin-base oil containing 4 per cent of light oils and 23 per cent of illuminants.

Efforts prior to 1915 by the [illegible] Syndicate and by local operators by means of shallow pits produced no results in the Neuquén district. Borings by the Argentine government begun in 1916 proved successful in 1918. A paraffin-base oil containing 25 per cent of naphtha and 35 per cent of kerosene was found in commercial quantities.

Pouce Coupé District Promises Activity

SPECIAL CORRESPONDENCE

Preparations for the exploratory work of the Imperial Oil Co. in the Pouce Coupé district of eastern British Columbia, practically on the border of this province and the province of Alberta, are well under way. Wet weather at the beginning of May interfered with the work of transporting plant and supplies, but since then conditions have improved. All the equipment and the casing necessary for the first well, however, is on the ground.

An unusually heavy outfit is being used for the first well. It drills a 21-in. hole, and is capable of going to a depth of 4,000 ft. The hole is being sunk near one of the seepages. The most promising of these is at the junction of Tepee Creek and the Pouce Coupé River. Oil, it is stated by geologists, is most likely to be found either at a depth of 700 ft. or of 3,300 ft.

Negotiations are said to be in progress for the purchase of 200 sections of land in the district by Eastern capitalists, and it is probable that between fifteen and twenty drills will be operating in the field within the next two or three months.

Oil and Gas Drilling in Arkansas

SPECIAL CORRESPONDENCE

The Walbert Oil Co., Batesville, Ark., has started the erection of a derrick for an oil and gas test on a block of 6,000 acres, recently leased in Township 12, five miles west of Batesville. A Keystone No. 32 rig has been shipped, and work will start on the test as soon as it arrives. The company is composed of local men, who will give their ground a thorough test. The well is being sunk near a water well drilled a number of years ago, which has produced a small flow of gas since that time. The ground has been favorably reported upon by two geologists, who say that it is possible that gas and oil will be encountered in three sands—one at 800 ft., another at 1,100, and a third at 1,700 ft.

A derrick has been completed for Cave City No. 1 well, at Cave City, fifteen miles east of Batesville, on the Independence-Sharp County line. Standard tools will be used in making this test. The drilling contract with the Big Six Drilling Co. calls for a hole 2,000 ft. deep, with an option of going deeper.

Oil-Well Machinery Exports in May

WASHINGTON CORRESPONDENCE

Exports of drilling machinery increased during May as compared with exports of May, 1920. In May of this year, exports of all well machinery were valued at $1,[illegible]. Exports of other types of drilling machinery were valued at $[illegible]. In May, 1920, exports of all well machinery were valued at $[illegible]. Other drilling machinery exports were valued at $[illegible].

There was a decrease in the value of exports of pumps and pumping machinery. In May of this year, the value of the exports of this type of machinery was $[illegible]. In May of 1920 exports were valued at $1,[illegible].

---

*[illegible]

Technical Papers

Pyrometry—All who use pyrometers or conduct high-temperature operations will be interested in the latest publication of the U. S. Bureau of Standards, Bulletin No. 170, entitled "Pyrometric Practice" (326 pages, obtainable on request to the Bureau at Washington, D.C., for a limited time, or for 60c. from the Superintendent of Documents, Washington, D. C.). The bulletin is a complete treatise embracing not only the theory of design of modern American instruments but discussing their practical application and standardization.

Nova Scotia Mines—The Annual Report on Mines, 1920, by the Nova Scotia Department of Public Works and Mines, Halifax, N. S., is at hand. (103 pages, obtainable on request). The chief products were coal, iron, limestone and dolomite, and gypsum.

Yukon—Memoir 123, sixty pages with maps, of the Canadian Geological Survey, Ottawa, Ont., describes the Sixty-mile and Ladue Rivers Area, in the Yukon. The geology of the region and the placer gold deposits are discussed. The bulletin may be obtained on request.

Salt in Nova Scotia—Memoir 121 of the Canadian Geological Survey, Ottawa, Ont., obtainable on request, describes the Malagash salt deposit in Cumberland County, N. S. The salt occurs as a stratified deposit interbedded with rocks of the Mississippian period.

British Columbia Minerals—Memoir 118 of the Canadian Geological Survey, Ottawa, Ont. (129 pages, obtainable on request to the Survey), describes the various mineral occurrences between Lillooet and Prince George, B. C. Besides giving the general geological features of the region, separate chapters are devoted to hydromagnesite and calcareous tufa; epsomite and sodium carbonate; clay; diatomaceous earth, lignite, peridot and mica; chromite, molybdenite, manganese and nickel; and gold, silver, copper, and lead.

Accidents—Technical Paper 286 of the U. S. Bureau of Mines, Washington, D. C., ninety-seven pages, is largely of a statistical nature and is devoted to metal-mine accidents in the United States during 1919, with supplemental labor and accident tables for 1911 to 1919 inclusive. Obtainable for a time free from the Bureau or from the Superintendent of Documents, Washington, D. C., for 10c.

Queensland Geology — The Queensland Geological Survey, Brisbane, has issued Publication No. 265, forty-eight pages, with numerous illustrations and maps, describing mining operations and geological conditions in the Cloncurry-Camooweal-Burketown-Boulia area of northwestern Queensland.

Petroleum—"Underground Conditions in Oil Fields," by A. W. Ambrose, has been issued as Bulletin 195, Petroleum Technology 62, by the U. S. Bureau of Mines. This bulletin points out general methods of procedure in studying the various factors met in oil exploitation, including the solution of water problems and the preparation of cross-sections. Obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 65c., or for a time free of charge from the U. S. Bureau of Mines.

Petroleum in Alaska—Bulletin 71 A, issued by the U. S. Geological Survey, "Preliminary Report on Petroleum in Alaska," has been prepared by George C. Martin. Petroleum indications are confined to five districts, only one of which, the Katalla field, is producing. The report covers location, development, geology, and occurrence and production of petroleum in each of the districts. Copies may be obtained from the Superintendent of Documents, Washington, D. C., at 50c. each, or, for a time, free from the U. S. Geological Survey.

Western Crude Oil—"Properties of Typical Crude Oils From the Producing Fields of the Rocky Mountain District" is the title of the U. S. Bureau of Mines *Reports of Investigations* No. 2,235. It is a mimeographed paper of fifty pages, and may be obtained on request to the Bureau at Washington, D. C. Analyses and tests are given of oils from Wyoming, Colorado, and Montana, with laboratory figures for typical samples from several other producing fields for purposes of comparison. This supplements Report No. 2,202, issued in January, 1921, which described oils from the Eastern producing fields.

Helium — "Helium-Bearing Natural Gas" is the title of U. S. Geological Survey Professional Paper 121, 113 pages, obtainable upon request to the Survey, Washington, D. C., free of charge for a limited time, or from the Superintendent of Documents, Washington, D. C., for 30c. Helium is extremely useful for inflating balloons and Zeppelins, for it has 93 per cent of the lifting power of hydrogen and is not combustible, as is hydrogen. This paper is an exhaustive treatise on the subject.

Diamond Drilling—In the April issue of *Mine and Quarry* (Sullivan Machinery Co., Chicago, Ill.) appears an article, "The Romance of the Diamond Drill," which is the second chapter of a series, "Fifty Years of Rock Cutting Tools." The article covers the history and use of diamond drills in prospecting, with particular emphasis on the work done in South Africa.

The Federal Reserve System—A seventy-page booklet descriptive of our national banking system, entitled "The 'Why' of the Federal Reserve," has been published by R. H. MacMasters & Co., 82 Broad St., New York City, and is presumably obtainable upon request.

Book Reviews

The Tin Resources of the British Empire. By N. M. Penzer. Cloth; 5½ x 9; pp. 358. William Rider & Son, Ltd., London; 1921. Price, 15 shillings, net.

This is a book in the "political and commercial geology" field. The war has stimulated interest in this new branch of economic science. Following the publication of "Political and Commercial Geology," edited by J. E. Spurr, and the atlas on "Commercial Geology," issued by the U. S. Geological Survey, there have appeared a number of brief memoirs of the Imperial Institute of Great Britain, each covering some economically important metal or mineral, and modeled on the same plan as the chapters of "Political and Commercial Geology." A similar series of world studies on the political and commercial aspect of the distribution of important mineral supplies, and again on the same plan, is also now appearing in France in the *Revue des Mines*. It is safe to say that the permanent foundation for a new branch of political science is being laid in the work covered in these publications.

This book on "The Tin Resources of the British Empire" is a more elaborate treatment of one of the key metals economically. The general introduction states the economic purpose plainly: "One of the great problems of the day is the development of the British Empire's industrial resources, *and unless full and detailed information is obtainable on such important raw materials as tin it is ludicrous for statesmen to attempt to formulate an economic policy*." The italicized statement is a true one for any country and for the world, and a realization of the principle set forth is of major importance at this time.

The restriction of the treatment of the subject of the commercial geology of tin to the British Empire is, of course, a frank viewing of this important economic field from the standpoint of British nationalism. Of this we cannot but approve; it is the simple one from either the British or the American standpoint. It is the necessary step toward greater intelligence, peace, and prosperity.

The execution of the book seems careful and reliable. It should be in the library of any student of political and commercial geology. The tin resources of the British possessions in the five great continental areas—Europe, Asia, Africa, America and Australasia—are treated by colonies, and this is followed by chapters on the uses of tin, prices and output, and a bibliography. Under each continent the subject is treated geographically, and in each district the geography, geology, winning, data of commercial control, economic factors, production, and other essential features are woven together in one narrative.

J. E. S.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Long-Flooded Timbered Metal Mines Form an Unusual Hazard*

Recent Reports Indicate Distinct Danger From Methane in Reopening Old Shafts

Though metal mining is at a low ebb, there is, especially in the West, a well defined movement toward reopening long-abandoned mines with intent to extract ores of a grade formerly rejected but probably amenable to present-day methods of treatment. Many of these properties have long been under water, and their recovery presents, according to D. Harrington, the danger of the possible occurrence of methane.

On April 21, 1921, an explosion of gas, severely burning the two workmen present, occurred in an adit near Black Hawk, Col., the morning after a hole had been opened into a timbered flooded shaft which had been under water for more than twenty-five years. The adit had been driven from the surface on the mountain side about 1,400 ft., partly in a quartz vein, partly through granite country rock, had intersected no strata containing gas or carbonaceous material, and had encountered no gas of any kind until within a short distance of the shaft. Then water started to come into the tunnel from back and floor, bringing with it a gas having a musty odor. The gas gave the men headache, but was not ignited by and did not extinguish the flame of a carbide lamp. The shaft was intersected at a point about 400 ft. below the shaft collar. Some account of the accident was given in *Engineering and Mining Journal* for May 7, 1921, p. 802.

Presumably the gas carried into the adit by the water escaping from the shaft had been pocketed in the region above the level of the hole into the shaft. When the place was inspected two days after the explosion, using safety lamps (the adit had not been entered since the explosion), it was found that air circulation had been established through the adit and up the shaft, and no afterdamp and no methane could be found in the adit, so that it was impossible to obtain samples, nor could any samples be taken in the shaft, as it was inaccessible.

The occurrence parallels one observed near Butte, Mont., in 1917. A timbered vertical shaft 1,000 ft. deep had been filled with water and silt for about [illegible] years, and when it was reopened gas which burned was met just above the 500-ft. shaft station. The gas would bubble out of the water and mud on the floor and in presence of an open flame would ignite along the sides of the timbers. Notwithstanding the installing of electric lights, one morning after several hours' cessation of work at the bottom of the shaft the men went down with open carbide lights, and a small explosion occurred at the bottom. The men were badly shaken up, but not injured. Later two samples of gas were obtained from a point close to the water on the floor of the shaft, while the watery mud was being loosened by a shovel. The analyses showed that both samples were relatively high in CO_2 and both contained methane, thus definitely establishing the identity of the gas causing the ignitions.

These gas samples were taken when the shaft had been recovered to a point about 580 ft. below the collar. As the work proceeded, care was taken against use of open lights; the men noticed much bubbling of gas when they approached the 800 shaft station and again when about 50 ft. above the 1,000 shaft station. Also, it was noticed that immediately after copious bubbling of gas through the water on the floor, the water would disappear, presumably taking the place vacated by the gas as the latter was released by lessened pressure above it, with progressive removal of silt and water.

When the working bottom was about 30 ft. above the 1,000 shaft station, three men were at work on the bottom using closed lights and wearing rubber garments, as there was a copious flow of water down the shaft and on the floor. The night foreman, with a naked flame, was being lowered on the cage, when his light ignited gas just below the 800 level. The foreman on the cage was burned severely, and notwithstanding the copious flow of water in the shaft, the flame extended down 170 ft. to the bottom where the three men were working. All three were severely burned about face and hands, and they, as well as the foreman, had to spend some weeks in the hospital. It is remarkable that the four men were not severely injured by flying objects, as the concussion tore out lagging, broke pipe, ventilation partitions, and other fittings.

In the above-related occurrence it was definitely established by analyses that methane was present. There is no reason to doubt that this methane was formed by the decomposition of timber under water, in a manner somewhat similar to the formation of methane in swamps and from which methane takes its name, marsh gas. The shaft was wholly in granitic material, as was the shaft at Black Hawk, Col. There was no record or knowledge of intersection with carbonaceous shale or other strata bearing explosive gas, and in both cases there were no limestone or coal-bearing strata within miles. Both shafts were timbered and both had been under water for many years. Though no definite samples of methane were obtained from the recent Black Hawk explosion, there is ample reason to warrant the conclusion that the gas which ignited was methane. It is stated by miners in Black Hawk that a few years ago in another Black Hawk mine, a raise was being driven to connect with a timbered winze which had been flooded for several years. The winze was drained by a drill hole, and on the first trip into the raise after the flow of water was controlled, the miners were severely burned by the ignition of a gas of mysterious origin.

Though there is no assurance that methane will always be encountered in dewatering or recovering long-flooded caved shafts and mines, in such work it is certainly advisable to take reasonable precautions at all times. Ample air circulation should be assured and, in general, this can be obtained only by use of mechanical ventilation equipment such as fans, tubing, and complementary apparatus. When necessary to explore recovered timbered territory which has been under water a number of years, it is advisable to use an approved type of coal miners' safety lamp to test for explosive gas, and if it is found to be present, not only should ventilation be supplied but the workers should use only the best types of electric safety lamps until it is certain that all explosive gas has been adequately controlled or wholly removed.

---

[*] Bureau of Mines Investigation.

Advisory Committee Appointed for British Metal Mining Industry

The Secretary of Mines for Great Britain and Ireland, acting under the provisions of the Mining Industry Act of 1920, has appointed an "Advisory Committee for the Metalliferous Mining Industry" of the empire, under the chairmanship of Sir Cecil Budd, according to *The Iron Monger*. On this committee mining industries are represented as follows: Iron ore mines and quarries, by Myles Kennedy, S. J. Lloyd, and C. E. Pease; iron ore workers, by Harry Dack, T. Gavan Duffy, William Lewney, and Will Sherwood; tin mine owners, by R. Arthur Thomas, and tin mine workers by Joseph Harris; lead and zinc mine owners, by Anthony Wilson, and workers by James Wignall. Mining engineers are represented on this committee by Thomas Eaton, F. H. Hatch, and Frank Merricks; metallurgists, by M. W. Harbord; economic geologists, by [illegible] Hall, Henry Louis, and J. Malcolm Maclaren; iron and steel interests, by J. Burton; and medical science by Dr. K. W. Goadby. F. C. Starling of the Mines Department is the secretary of the committee.

Men You Should Know About

Dr. E. A. Holbrook has been reappointed assistant director of the U. S. Bureau of Mines.

Mark L. Requa, mining engineer, underwent a serious operation recently in San Francisco, Cal.

Wilbur H. Grant, mining engineer, of San Francisco, Cal., is in Mexico on professional business.

P. A. McKenzie, mining engineer of Oakland, Cal., is making inspections in the Kingman district, in Arizona.

Madame M. S. Curie, of Paris, sailed from New York on June 25, having completed her tour of the United States.

Walter L. Reid, of the United Metals Exploration Co., is designing the mill for the United Comstock Mines Co., of Gold Hill, Nev.

E. S. Larsen is making an examination for the U. S. Geological Survey, of the corundum-bearing rocks in the Gretna, Va., area.

Cyril W. Knight, assistant provincial geologist, is at Cobalt, Ont., and will spend the summer there making an underground study of the silver mines.

E. H. Walters, president, and **Charles O. Ball**, secretary, of the Co-operative Mining Co., Lordsburg, N. M., have been in New York on business for their company.

A. G. McGregor passed through New York City last week on his way to Warren, Ariz., returning there from a trip to inspect the new Cerro de Pasco smelter in Peru.

Thomas H. Allan, mining engineer with the Forty-Mile Power & Dredging Co., operating in the Yukon Territory and in Alaska during the last year, has returned to New York City.

Prof. H. O. Hofman, who occupies the chair in metallurgy at the Massachusetts Institute of Technology, Cambridge, Mass., has been elected an honorary member of the A. I. M. E.

Eugene Dawson, mining engineer, of New York City, recently completed examinations of mining properties in New Mexico, Arizona, and Chihuahua and has returned to New York.

Charles A. Mitke, of Bisbee, Ariz., who recently completed a series of lectures at the Massachusetts Institute of Technology, is looking over mines in the Michigan iron and copper districts.

Percy E. Barbour, assistant secretary of the A. I. M. E. who has been indisposed for some time, is reported to be improving. He expects to be able to resume his duties at the Institute before the close of July.

Charles F. Rand, a director and a past president of the A. I. M. E., mining engineer and mine owner, of New York City, has been elected an honorary member of the Iron & Steel Institute of England. There are but four other honorary members, including the King of England and the King of the Belgians.

Dr. George Otis Smith, Director of the U. S. Geological Survey, will sail on July 9 for London to attend a special meeting on July 20 of the organization committee of the International Geological Congress. **Prof. R. W. Brock**, of the University of British Columbia, who is the other delegate from this hemisphere, is the chairman of the organization committee.

Frederick F. Sharpless, secretary of the Mining and Metallurgical Society of America, has just been elected to succeed Bradley Stoughton as secretary of the American Institute of Mining and Metallurgical Engineers.

Mr. Sharpless has been a member of the Institute since 1889, the year after he received the degree of B.S. in chemistry from the University of Michigan, but his prompt entry upon an active professional carreer that carried him to all parts of the world, between 1893 and 1912, prevented his accepting confining society duties earlier. On graduation in 1888 Mr. Sharpless was appointed to the chair of metallurgy at the School of Mines in Houghton, Mich., and served in this capacity until 1893, when he resigned to take on private consulting practice. While teaching his work won hearty praise from his associates and contemporaries. While in private practice he was for a time in partnership with H. V. Winchell, of Minneapolis, and during that association gained a wide experience in consulting practice. For many years he was the American representative of The Consolidated Mines Selection Co., Ltd., of London. While still in this position he joined in becoming a charter member of the Mining and Metallurgical Society of America. This society he has served as secretary for two separate terms, and for one term as vice-president.

FREDERICK F. SHARPLESS

Mr. Sharpless was born in West Chester, Pa., in 1866, of parents who raised him in the Quaker faith. His judicial and discriminating mental habits, combined with a pleasing gentleness of manner, eminently qualify him to be Mr. Stoughton's successor in the secretaryship of the A. I. M. E.

Society Meetings Announced

The Mining Institute of Scotland will hold its next general meeting on Aug. 13 at Glasgow. The meeting planned for June 11, at Edinburgh, was cancelled because of the coal miners' strike and difficulties with the railway services. G. L. Kerr, Royal Technical College, Glasgow, is the secretary.

American Institute of Mining and Metallurgical Engineers holds a fall meeting at Wilkes-Barre, Pa., Sept. 12 to 17, inclusive. The program suggested by the committee in charge starts with a technical session on the afternoon of Sept. 12, followed on the 13th by an all-day excursion through the anthracite region, ending at Scranton, where, on the 18th, another technical session will be held. The same afternoon an excursion through the Wyoming valley brings the party to Wilkes-Barre for the dinner. Technical sessions on the morning of the 19th are followed by visits to special points and the meeting adjourns in the evening.

Obituary

Quartus Almon Gillmore, of Lakewood, Cleveland, Ohio, superintendent of the Cleveland ore docks of the American Steel & Wire Co., died at his home on June 9. Mr. Gillmore was sixty years old.

Earl R. Leib, geologist, of San Jose, Cal., with the Southern Pacific Company, died on June 16 from the effects of carbon monoxide which overcame him while he was examining an abandoned mine near Ione, Cal. Mr. Leib fell to the bottom of a 100-ft. shaft. He had been geologist for the Union Oil Co., Los Angeles, Cal., and was a technical graduate of Leland Stanford, Jr., University. His father, Judge S. F. Leib, is also a resident of San Jose.

Captain William J. Richards lost his life in a shaft accident in the Monongahela mine, Crystal Falls, Mich., recently. He and three others were being hoisted from one level to another by a small engine when the cable overwound and then became released, causing the bucket to drop. Captain Richards and one of the others fell to the bottom of the shaft and were killed. He was a son of the late W. J. Richards, who was formerly in general charge of the mines of the McKinney Steel Co., in the Michigan field, and a graduate of the Michigan College of Mines.

THE MINING NEWS

LEADING EVENTS

Little Iron Ore To Be Shipped This Season

Oliver Company's Decision To Curtail Further Dispels Hopes of Optimists —Ore Prices Fixed

From present indications only a light tonnage of iron ore will be moved down the lakes from the Lake Superior iron ranges this summer. Few mines are making regular shipments, and only a small number of lake carriers are leaving Lake Superior ports with cargoes. Until the last week it was thought that the Oliver Iron Mining Co., the largest of the operators, would ship considerable ore, but this company has ordered many of its mines closed, and numerous properties have been placed on a part-time basis. The Oliver laid off 2,000 men in the Virginia district, on the Mesabi Range, and suspended all operations at Iron Mountain and Norway, on the Menominee Range. The mines on the Marquette and Gogebic ranges are working half-time with two crews, the men being at the mines one week and at home the next.

The orders to curtail were issued following a visit to all of the ranges by D. J. Kerr, vice-president of the U. S. Steel Corporation; McGilvary Shiras, ore agent for the corporation, and officials of the Oliver company. Mr. Kerr stated that there are large stocks of ore on hand at the furnaces and at Lake Erie docks, and most of the underground mines are carrying large stockpiles. Some of this large surplus will have to be consumed before the mines can operate on a full-time basis, and the opinion prevails that it will be next spring before conditions on the iron ranges will be back to normal.

Many of the independents are now working a single property, and some are endeavoring to maintain their organizations by operating on a small scale. The depression is greater than any since 1894.

Iron-ore prices have been fixed at $1 less per ton than in 1920, making them the same as in 1919. The base prices are as follows: Old range bessemer, base 55 per cent natural iron and .045 phosphorus dried, $6.45, ranging down to $5.55 for Mesabi non-bessemer, base 51½ per cent natural iron. The price was fixed June 16. It was established by a sale of 100,000 to 150,000 tons of iron ore by Pickands, Mather & Co. to the Steel Company of Canada, Hamilton, Ont.

Part of Oatman Burned

Fire originating in the St. Francis Hotel destroyed over half of the residential and business districts of Oatman, Ariz., on June 27. No mining property was burned.

WEEKLY RÉSUMÉ

[illegible] extending the time for doing assessment work on mining claims. The new tariff bill was unexpectedly reported to the House on June 30.

In Illinois a new mines inspection act, conforming to the so-called "model law," has been passed. On the iron ranges curtailment is marked, and little ore is expected to be shipped this season. In Texas, a hurricane damaged the plants of the Texas Gulf Sulphur Co. and the Freeport Sulphur Co. on June 22, also considerable property in the Goose Creek oil field. The Freeport company has started to operate its new asphalt plant. In Ontario, arrangements to refinance the British America Nickel Corporation are reported to have been completed. Organization of three new sections of the A. I. M. E. has been authorized. In Utah the Bingham-Galena Mining Co., with which George Graham Rice's name is connected, has secured a stock-selling permit despite numerous protests.

Three New Sections of A. I. M. E. Authorized

At a meeting of the directors of the American Institute of Mining Engineers held in New York on June 14, three new sections were authorized. These are to be known as the [illegible] section, the Tampico (Mexico) section, and the Charleston (West Virginia) section. The Lehigh Valley section is not yet sufficiently organized for authorization.

The affiliated students' society of the Rensselaer Polytechnic Institute has been recognized.

Freeport Sulphur Now Operating New Asphalt Plant

The asphalt plant of the Freeport Sulphur Co. at Freeport, Texas, has begun operations and the first shipment, consisting of eleven cars, has been made. The plant is not yet entirely completed. When finished it will have four stills. E. W. Stone, of Houston, is sales agent.

Illinois' New Mines Inspection Act Conforms to "Model Law"

Same as That Drafted by Committee of Leading American Engineers and Published in 1915 by Bureau of Mines

A law known as the Mines Inspection Act, which provides for the health and safety of persons employed in metal mines, has just passed both houses of the Illinois Legislature. It is practically the same as the "Model Law" drafted by a committee appointed by the American Mining Congress in 1906 and consisting of W. R. Ingalls, James Douglas, J. R. Finlay, J. Parke Channing, and John Hays Hammond. In 1909 these engineers were invited to act for the same purpose as a committee of the A. I. M. E. and the Mining and Metallurgical Society of America, and in 1911 as a committee of the U. S. Bureau of Mines. In 1915 the bureau published the final draft of the model law as Bulletin 75. The bill just passed in Illinois was introduced at the suggestion of the fluorspar operators in the southern part of the state.

George Graham Rice Bobs Up Again

Expected To Connect With Bingham-Galena Mining Co.—Latter Gets Utah Stock-selling Permit Over Numerous Protests

A stock-selling permit has been granted the Bingham-Galena Mining Co., of Bingham Canyon, Utah, over the protests of the Utah Chapter of the American Mining Congress, a Salt Lake City brokerage firm and others. On the other hand, a majority of the members of the Salt Lake Stock Exchange urged that the permit be granted. In granting it the commission [illegible] if improper methods should be used and that this is understood by the mining company.

The Bingham-Galena is a reorganization of the Silver Shield Mining & Milling Co. with certain properties of the New York Bingham and United Bingham groups added, and the new company is stated to wish to sell to an underwriter, F. R. Dodge, of Reno, Nev., [illegible] shares of stock. The whole question centers on the fact that although the name does not appear, George Graham Rice is admitted by the officials of the company to be behind the proposed transaction, Judge Dodge being his attorney and financial agent. It is felt by those in opposition to the granting of the permit that the entrance of Rice again into the Utah field can hardly be beneficial in view of the aim of both the mining industry and of the potential oil industry of the state to maintain a high level. The brokers in favor of the new enterprise hold that the floating of the new company and the possible work in connection with it would bring greater activity and increased employment to Bingham as well as the chance of developing a property of value.

Utah has many properties of potential value, which may be developed into paying mines, and the opinion is expressed that it would be a pity, in view of the many successful mines of the state and the many opportunities available, that a name so widely and not always favorably known as that of Rice should be mentioned, though not directly, in connection with a Utah enterprise. Utah's mineral wealth, both developed and still to be developed, is so great, it is said, that her opportunities do not need to go begging, and this is true despite the present status of mining, with its difficulties and hardships, which will be met, and are being met.

Ontario Mining Association Holds Annual Meeting

The annual meeting of the Ontario Mining Association was held at Cobalt, Ont., June 16-18, with a representative attendance. Among other resolutions adopted was one strongly urging the immediate construction of a railway to open up the mining districts east and west of Swastika. R. B. Watson was elected president.

Washington Magnesite Companies To Furnish Small Tonnage

The outlook for early resumption of some magnesite mining and calcining operations in the Valley district in Washington is somewhat improved, owing to the announcement by the American Mineral Production Co. to the effect that a group of Western steel refiners have reached an understanding to pool their requirements and use from 50 to 100 tons per day of the Washington output. The plan of operation provides for production from the Allan quarry and for burning at the plant of Northwest Magnesite Co., Chewelah, thus giving both that company and the American Mineral Production Co. a share in the business.

G. L. Allen Built Shattuck Mill

In an article describing the present activity at Tombstone, Ariz., that appeared on p. 960 of *Engineering and Mining Journal* June 4, it was stated that "the National Metals Recovery Co. plant is in charge of J. W. Stockham, who erected the Shattuck mill in Bisbee." Mr. Stockham has written saying that this statement is only partly true. He says:

"That I am in charge of the National Metals Recovery plant is a substantial fact, but the credit for the erection of the Shattuck mill belongs entirely to Glenn L. Allen, residing at the present time in Warren, Ariz. I acted in capacity of assistant superintendent at the Shattuck mill for about two and one-half years, but had nothing to do whatever with the erection of same, the mill being completed and in operation when I became associated with this company."

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

House Gets New Tariff Act

Producers of Metals and Ores Receive Various Degrees of Protection—Petroleum on Free List

The new tariff measure was rather unexpectedly released by the Committee on Ways and Means and presented to the House on June 30. Petroleum is on the free list.

Among the duties that are of especial interest to the mining industry are the following imposts: Manganese ore, 1c. per lb.; molybdenum ore or concentrates, 75c. per lb.; tungsten ore or concentrates, 45c. per lb. of tungsten content; ferromanganese containing an excess of 1 per cent of carbon, 2⅛c. per lb.; ferromanganese metal, 2⅛c. per lb. and 28 per cent ad valorem; ferromolybdenum, metallic molybdenum, and all other alloys and compounds of molybdenum, $1.25c. per lb. and 17 per cent ad valorem; all other alloys used in the manufacture of steel, 30 per cent ad valorem; aluminum in crude form, 5c. per lb.; plates, sheets and all other forms, 9c. per lb.; antimony 1½c. per lb.; quicksilver, 7c. per lb.; nickel, 5c. per lb.; tin in bars, 2c. per lb.; lead-bearing ores and mattes of all kinds, 1½c. per lb. on lead content; lead bullion, 2⅛c. per lb.; zinc-bearing ores, containing less than 10 per cent, free; 10 per cent and less than 20 per cent, one-quarter of 1c. per lb.; 20 per cent or more and less than 25 per cent, one-half of 1c. per lb.; 25 per cent or more, 1c. per lb.; zinc in sheets, 1⅝c. per lb.; in blocks or pigs, 1⅝c. per lb.

Little Hope for Frelinghuysen Coal Bill

The Frelinghuysen coal stabilization bill has little chance to pass the Senate. Its companion measure, the seasonal rate bill, has only slightly better prospects. These opinions are generally held, as this is written, although Senator Frelinghuysen himself is sure that he can secure a vote on each measure.

Seek To Sway Committee as to Assessment Work

Strong Last-Minute Efforts Made To Secure Continued Suspension of Annual Requirements

Strenuous efforts were made last week to get the House Committee on Mines and Mining to reconsider its action in declining to report out the bill suspending the 1920 assessment work. There is no evidence, as this is written, that the committee will change its position, but it can be said that great pressure is behind the movement to secure concurrence in the bill which passed the Senate. On the other hand, there is strong sentiment in evidence against any further exemptions from performance of the assessment work.

Government's Silver Purchases Over 60,000,000 Oz.

Purchases of silver under the Pittman Act during the week ended June 25 totaled 1,154,000 fine ounces. This brings the total purchases under the act to 60,485,697 fine ounces.

Delay Likely on New Relief Bill

House May Await Opinion From Comptroller of Treasury—Further Study Desired

Action by the House of Representatives on the bill intended to liberalize the War Minerals Relief Act may be held up awaiting an opinion from the Comptroller of the Treasury as to the action which may be taken on claims which have been the subject of a final ruling. Under the existing rulings of the Comptroller, the liberalization bill, as it passed the Senate, probably could be applied only to about thirty claims on which no action has been taken by the Secretary of the Interior. It is probable that no action will be taken by the House Committee on Mines and Mining until an opportunity has been given by the Secretary of the Interior and by the new War Minerals Relief Commissioner to make a further study of the situation.

Shortridge Holds Back Bill for Mines Department

Senator Shortridge has been delayed in introducing his bill which provides for the creation of a Department of Mines, on account of his desire to study certain changes which, it has been suggested, he ought to make in the draft of the bill that he now has before him. Pressure of other duties has made it impossible for him to study into the effects of these proposals. He expected on June 25, however, to be in a position to introduce the bill within a few days.

NEWS BY MINING DISTRICTS

London Letter

Buena Tierra Reports for Past Year—Deal Off Between Burma Corporation and Associated Lead Manufacturers—West Springs Stops Shaft Sinking To Drift

London, June 14—The report of the Buena Tierra Mining Co. for the last calendar year is a rather depressing document. Funds were provided by an issue of £66,000 in five-year 10 per cent notes (repayable at 125 per cent), and an extended program of development was arranged. On this program about £30,000 was expended, and including it there is a debit balance on the year's working of £34,619.

Here and there indications were given of orebodies carrying hopeful prospects; but all costs had risen to such an extent, and prices of silver and lead had fallen to such unremunerative levels, that operations are to be suspended temporarily as from June 30.

The quantity of ore mined was 7,246 metric tons, of which 461 tons was rejected as waste, leaving 6,795 tons for shipment. The smelter received 6,927 tons, from which the net return was $63,048, or an average of $9.10 per ton Total costs per ton were $26.55, of which $4.68 represented mining, $5.69 development, $10.09 exploration, and $4.13 general expense.

The course of metal prices, accompanied by variations in the grade of ore shipped, is discernible in the smelter returns, but deductions did not alter in the same proportions.

It is understood that the deal between the Burma Corporation and the Associated Lead Manufacturers has been abandoned. The scheme was for the Burma Corporation to acquire a controlling interest in the Associated Lead Manufacturers by an exchange of securities and the payment of about £100,000 in cash, one of the objects being the purchase by the Associated Lead Manufacturers of the output of the Burma Corporation.

From the statement it is inferred that the result of the meeting of stock brokers and others recently held at the offices of the New Consolidated Gold Fields was adverse to carrying out the scheme. No official announcement has yet been made, nor has the rumor of abandonment met any denial. The questions now are: Will the A. L. M. buy the production of the Burma Corporation, and will it still be necessary for the corporation to issue new capital to complete the zinc works and the Namtu branch railway line?

The Main Reef series in the Far Eastern Rand is by no means flat, but is of a very undulating character. In the West Springs area this characteristic would seem to be pronounced, for the sinking of No. 2 shaft is to be suspended temporarily, in order to put down a borehole from the bottom of the shaft to locate the reef series. Work is to be concentrated in the No. 1 shaft district, with the object of creating an ore reserve at the earliest possible date. The No. 2 shaft was started nearly two years ago, and has reached a depth of about 2,600 ft. No actual figure was mentioned in the cablegram.

The cessation of shaft sinking and the putting down of a bore do not necessarily mean that the reef series is lost. It may mean either that the contour is not as expected, or that finance is a factor in mining policy at the moment. At the same time, following upon other occurrences, it is a bit depressing for the East Rand.

The phenomenal assays taken in the Akoko Main Reef mine, in West Africa, to which I made reference recently, were 598 dwt., 88 dwt., 38 dwt., and 75 dwt. Only four assays apparently were taken, and these, though interesting, are not of course convincing. Other factors are necessary before any opinion can be formed of the value of the find. Attempts are being made to infuse life into West African gold shares by the publication of such assays.

AUSTRALIA

Queensland

Decided To Start Chillagoe State Smelters Again—Coal and Sapphire Mining Alone Active

Brisbane, May 28—Following the report of the two accountants who investigated the affairs of the Mount Morgan company, and the advice of the industrial judge for the men to accept the 20 per cent reduction of wages which the company had offered, a ballot of the employees on that offer was taken. By a vote of 726 to 547 the men turned it down. Next the state government decided to allow the company a rebate in railroad freights amounting to £1,000 per week if operations were resumed. As the company would, on the showing of the accountants' report, be losing £2,500 per week and making no profit, the offer naturally was not considered good enough, and the mine and works, which had closed down on March 24, still remain idle. No move is now being made on either side, and the only glimmer of hope for a return to work is the slightly rising market for copper, which has gone up from £66 per ton when the mine closed to £77 at present.

Mount Morgan has been producing over [illegible] per cent of the gold and about 40 per cent of the copper yield of Queensland, so that the closing down of this big concern will mean a heavy reduction in the output of the state.

It has been definitely decided to re-start the Chillagoe State Smelters, which had shut down on March 5, at the beginning of June. When the smelters ceased operations, a number of men were kept on developing the silver-lead mines at Mungana and the copper mine at Einasleigh, in the Etheridge district, all of which mines are now under the control of the government, and it is owing to the discovery of good new orebodies in these mines that smelting can be resumed, the manager hoping that he will be able to at least pay running expenses. In the Mungana mine it is estimated that there is in sight [illegible] tons of the newly developed ore, and that this will run 10½ per cent lead, 10 oz. silver, and 5 per cent copper. At the Einasleigh mine, which has hitherto been a low-grade property, the new orebody, which is 15 ft. wide, assays 10 per cent copper.

From the cobalt mine, in the Cloncurry center, another shipment, consisting of twenty-two tons of 20 per cent ore, has been sent to England. The first shipment, fifty tons, was sent away four or five months ago.

The general manager of the Mount Morgan company, W. H. Corbould, is leaving Queensland for London to consult with the directors regarding the raising of the money which is needed, but which could not be got in America, to carry out the big scheme outlined by himself—namely, the erection of a central treatment plant at Cloncurry, the extension of the Mount Cuthbert railroad from Dobbin, the present terminus, to the company's Mount Oxide mine, eighty miles northeast, and the opening up of the company's various mines—a project that has an important bearing on the future of the great Cloncurry copper belt.

The most promising, and really the only active, branches of mining in Queensland at present, apart from the search for silver-lead ores in the suburbs of Brisbane, are those connected with sapphires and coal. On the gem fields of Anakie, in the central district, there has been a large increase in production during the last two or three years, and energetic operations are continuing, with every appearance of prosperity, consequent on the large buying that has lately taken place under the arrangement made through the government for the marketing of the gems.

One of the companies operating at Indooroopilly has been working under the guidance of an electrical "diviner." This diviner predicted an orebody first at [illegible] ft. and then at 65 ft. The shaft is now down [illegible] ft. without striking the ore and the diviner's last prediction is [illegible] ft.

CANADA

British Columbia

Gold Output Expected To Show Increase Over 1920—Northport-Rossland Branch of Great Northern May Be Abandoned

Three Forks—Resumption of operations on the property of the MacAllister Mining Co., on the north fork of Carpenter Creek, was to take place about July 1, with a crew of fifteen to twenty men. The plan is to develop and increase ore reserves to justify mill construction next year.

In the same district the Rambler-Cariboo is continuing development with a small crew. The snowslide season is safely past. The annual meeting of shareholders was held at Three Forks on June 14, resulting in the re-election of the former directorate and officers. The matter of resumption of milling operations is being given consideration.

Rossland — An estimate of British Columbia's gold production for 1921 shows a likelihood of an increase of $1,000,000 in output over the preceding year, with an increase from Rossland camp of about $900,000, or $1,500.000 for 1921, as against $600,000 in 1920.

The announcement has just been made by the Great Northern Railway that application will be made to the board of railway commissioners for permission to abandon operation of the Northport-Rossland branch, between the international boundary and Rossland. Vigorous opposition is manifested locally to the move, but the railway officials claim that the Northport-Rossland section of the line has been a source of loss for a long time, a deficit of $48,000 appearing against it for 1920.

Vernon—Owners of mining property through Fire Valley, lying between the Okanogan and Arrow lakes, are encouraged because construction of a government wagon road through the valley is now under way, with promise of completion by next year. The project is of considerable importance to the Lightning Peak section, with a number of promising properties, development of which has been long retarded by lack of transportation.

Trail—Ore received at the Consolidated smelter the week ended June 21 was as follows:

Mine	Location	Tons
Florence,	Princess Creek	102
Knob Hill,	Republic	50
Company Mines		6,237
Surprise,	Republic	87

Ontario

British America Nickel Arranges Re-financing

Sudbury — The British America Nickel Corporation has carried out its scheme for financial reorganization and arranged for capital as follows: $6,000,000 first income bonds; $18,500,000 second bonds; and $20,000,000 common stock. Capt. D. Vogt, president of the Norwegian nickel works, who has been in charge of affairs during the reorganization period, has resigned as president of the corporation and takes the position of vice-president and managing director of the European office. Hon. Edgar N. Rhodes, of Amherst, N. S., speaker of the Canadian House of Commons, becomes president and managing director. A. Gronningsater, who was chief consulting engineer, has been appointed technical director. The corporation is ready to resume operations as soon as the market improves.

Kirkland Lake—The Lake Shore during May produced gold to the value of $29,637, from the treatment of 1,865 tons of ore, this being a recovery of nearly $16 per ton. The mill ran 93.55 per cent of possible running time.

Cobalt — Government assistance in the construction of the projected railway across the mining belt of northern Ontario is regarded as practically assured, judging from the expressions of Harry Mills, Minister of Mines, during his recent visit to the mining districts. The only question appears to be what form government aid will take, which may be either a subscription to bonds or a direct cash bonus. The matter is under consideration by the cabinet, and a speedy decision is anticipated. In the meantime, thirteen miles of the route through Teck, Lebel, and Gauthier townships of the Kirkland Lake district has been surveyed. Many prospectors are staking claims along the route, which would be regarded as valueless without the prospect of transportation.

Holmes Township—A staking rush has set in to Holmes Township, twenty miles west of Kirkland Lake, where a discovery of gold was made last fall. It is on the line of the projected Northern Light Railway.

ALASKA

Falcon Mining Co. Operating on Chichagof Island

The property of the Falcon Mining Co. is at the head of Falcon Arm, Chichagof Island, Alaska, and consists of nine claims and four mill sites. The property at the highest point is 2,310 ft., and a 7 x 7-ft., 1,200 tunnel is being driven into the mountain 600 ft. back from the water and at 160 ft. elevation, which will crosscut the mineralized formation. This tunnel, according to the management, is now in 850 ft. and within another 100 ft. the first ledge which outcrops on the surface (5 ft. in width) will be reached, after which seven more ledges ranging in width of from 2 to 15 ft. will be reached in quick succession. The ore carries gold and silver.

Mine buildings, such as are necessary until the construction of a mill and power plant is begun, are completed, together with a 600-ft. rail tramway connecting the portal of the main tunnel with the 510-ft. wharf. Modern mining machinery and supplies are on the ground, and the development work is being rushed. Sixteen men are employed, working three shifts in the tunnel.

MEXICO

Guanajuato

Committees To Arbitrate Between Capital and Labor To Be Organized in All Centers—Guanajuato Reduction & Mines Co.'s Mill Running Smoothly

Guanajuato—The drop in the price of silver has been a most severe blow to operations in the State of Guanajuato, and much work has been curtailed or stopped entirely. It has also been difficult to bring in the necessary supplies, owing to the congestion in railroad traffic caused by strikes and shortage of locomotives and rolling stock. The mines of Guanajuato are nearly all of low grade, and in most cases operations are being continued only because shutting down would be more expensive than operating at a loss, provided the loss be not too heavy. Those that can afford it are doing development work, as there is confidence that either silver will improve or the cost of supplies will decline to such an extent that it will make possible operations even at the present price of silver.

The State Congress has recently enacted a law, based on certain of the provisions of Article 123 of the National Constitution of 1917, ordering the immediate formation, in all industrial centers, of committees of arbitrage and conciliation to deal with and resolve all questions between capital and labor. These committees are to have an equal number of representatives from capital and from labor and one representative of the State Government, who will have the deciding vote. Much anxiety was at first manifested by all employers, as under the terms of the law capital seems to have everything and labor nothing to lose. Relying upon the good will and sense of the Governor, it is now felt, however, that no serious difficulties will be experienced.

The Guanajuato Reduction & Mines Co. is treating monthly from 18,000 to 20,000 metric tons of ore from its mines and dumps on the Mother vein near the city of Guanajuato. The same company has completed the construction of a mill and cyanide plant on its properties in the La Luz district, about eight miles from Guanajuato. This mill and plant were put in operation Jan. 1 and have been running smoothly for some time.

The primary crushing is done in a 20 x 15-ft. Blake-type crusher, the fines from which, after passing a ⅜-in. Symons (?) vibrating screen, go directly to a 6 x 6-ft. Allis-Chalmers ball mill. The oversize of the vibrating screen is crushed in twenty stamps, the discharge of which passes to a classifier, the oversize going to the ball mill. The fine grinding is done in three 5 x 16-ft. tube mills in closed circuit with Dorr duplex classifiers.

The plant uses the all-sliming counter-current system. The cyanide plant consists of five 36 x 10-ft. Dorr thickeners and four 36 x 12-ft. Dorr agitators. The pulp from each of the thickeners is handled by a No. 4 Dorrco diaphragm pump. After passing the No. 1 thickener the pulp flows through three agitators in series, after which the solution is changed by passing through a thickener followed by second agitation in one agitator, the washing being done in three thickeners. The discharge from the last thickener goes to a tailings pond, from which the solution is decanted and returned to the mill circuit. The overflow solution from No. 1 thickener, after being passed through the clarifying filter, is pumped through two Merrill precipitation presses located in the precipitation room at the top of the mill. The Crowe vacuum process is used in connection with the Merrill zinc-dust process of precipitation. The mill is giving satisfactory results.

The company is opening up three levels from the new three-compartment shaft at the Rosario mine. The shaft is being sunk to the 150-meter level, which will be reached this month. A surface tram road has been installed, connecting the Pilí mine with the new mill, and a compressor has just arrived for the purpose of sinking an incline shaft and carrying on other development at this mine.

The Guanajuato Consolidated Mining & Milling Co. has shut down its mill and cyanide plant, to which extensive repairs and alterations are being made with a view to increased capacity in the future, when general conditions are more normal. A new compressor plant is being installed at the Sirena mine of the company, in which considerable development work is being done.

The plant of the United Mines Co. at Melladito, La Luz district, has been shut down for some time, but active development work is under way at the Puertecito properties of the company, also in the La Luz district. A new three-compartment shaft is being sunk.

The Pinguico Mines Co. suspended work, with the exception of a little development, on the Esperanza group of mines at Santa Ana, upon which it has a lease and bond. The San Prospero mill and cyanide plant, where the Esperanza ores were treated, had in consequence also to be shut down. The Esperanza ores are of too low a grade to permit of profitable exploitation with silver at its present level.

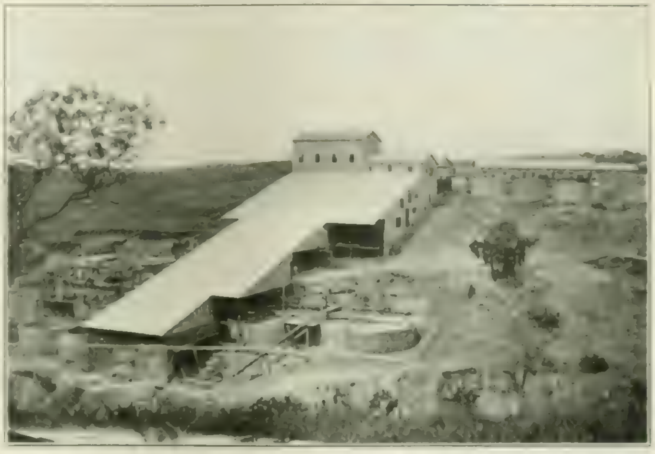
The Peregrina Mining & Milling Co. is treating monthly about 3,500 metric tons of ore, mainly old fills from the Peregrina mine, with some custom ore.

The Cubo Mining & Milling Co. is treating monthly about [illegible] tons of ore, mostly from the Villapando [illegible]. Considerable development work is being done, including a new interior shaft, and a connection is projected between the Villapando mine and the main shaft of the Tajo de Dolores mine, close to the mill. This connection, which is a long one, probably requiring a year or more to complete, will greatly [illegible] and facilitate the handling of the ore between mine and mill. At present the ore is transported over a long surface tramline which is both expensive and unsatisfactory.

The owners of the Asuncion mine, at the village of San Nicolas del Monte, famous as a bonanza mine, are shipping two or three tons of high-grade ore weekly to the smelter, and from 500 to 600 tons of medium-grade ore monthly to the mill of the Peregrina Mining & Milling Co. A little development work is being done, and the installation of a compressor plant and air drills is [illegible].

The San Cayetano group of mines in the district was leased by a Mexican company which a few months ago completed the erection of a small mill and cyanide plant in which about forty tons of ore is treated daily, a tonnage which will be increased later as more of the old workings are opened up. These mines were great producers in the old days of the Guanajuato camp, and it is hoped that a large tonnage of ore will be found that may be successfully treated by modern methods, the more so as a high percentage of the values is in gold.

The mill and cyanide plant of the Minera de Augustias, in the Pozos camp, is shut down but development work is going on in the mine. The same statement is true of the Cia. Minera [illegible], operating near the town of San Felipe.



THE MILL AND CYANIDE PLANT OF GUANAJUATO REDUCTION & MINES CO.
LA LUZ, GUANAJUATO, MEXICO

Sonora

Calumet & Sonora Property Closed Down

Cananea—The Calumet & Sonora property, belonging to the Cananea Lead & Zinc Co., has been closed down. [illegible] H. S. McKay, manager, [illegible]

The Cananea Consolidated Copper Co. has started development work in some of its mines.

[illegible]

CALIFORNIA

Grass Valley Miners Refuse Wage Scale—El Oro Gold Dredging Co. Testing New Ground

Grass Valley—Miners at Grass Valley are reported to have refused to accept the proposed new wage scale reducing wages 75c. to $1 per day, effective from July 1. They have offered to accept one-half of the proposed cut.

Labor conditions in the Mother Lode mines are still unsatisfactory at the smaller properties, as the producing properties have in most instances introduced contract work, and although a reduced wage scale is in operation miners are making as much or more than before the wage scale reduction. The small mine operating under the wage scale cannot get good men. Efficiency has fallen off. One operator states that "it seems that everybody had decided not to work too hard any more. There used to be a lot of skilled miners who would do a real day's work, but no one seems to know where they have all gone." The mine under development is forced to meet high costs, low efficiency, and poor labor.

Tuolumne—The Confidence and Black Oak mines are holding their water down, but are doing no work. The [illegible]

The Old Rawhide mine, [illegible] and sampled by the Pittsburgh Silver Peak Mining Co. [illegible]

[illegible]

Sonora—A new mill, hoist, and compressor have been installed at the National mine.

Chico—In the vicinity of Chico the El Oro Gold Dredging Co. is trying out a block of land which has been in its control for some time. An old dredge formerly owned by the Pacific Gold Dredging Co. is being used to test out the ground. The company's Siskiyou dredge will be placed on this ground if the results are satisfactory.

Jackson—The Kennedy has been unwatered to point 58 ft. below the 3,900 level, leaving 92 ft. to unwater to reach the 4,050 level.

Sacramento—E. C. Bellows, Commissioner of Corporations, has given permission to the Randsburg Silver Mining Co. to sell and issue certain of its securities. This company has an unpatented lode mining claim in what is known as the Coyote Lode Mining Claim situated in San Bernardino County close to the California Rand Silver Inc.'s mine, which is known as the Kelly mine.

Under the permit the company is authorized to issue 255,000 shares to J. W. Kelly, John C. Wray, Harry Alderson, and E. L. Blanck, as consideration for the transfer to the company of the unpatented mining claim. The company also is given permission to issue 245,000 shares at 20c. per share, cash.

There is a provision in the permit requiring that the shares which are issued to the persons named shall be deposited as in escrow. There also is a provision requiring that not more than 20 per cent commission shall be paid on the sale of the shares. The permit contains a paragraph to the effect that purchasers of the shares are advised that the California Rand Silver, Inc., commonly known as the Kelly Silver Mining Co., has filed a protest claiming ownership to any ore that may be discovered beneath the Coyote claim, by virtue of apex rights.

NEVADA

Leadville Mines Resumes — Tonopah Strike Situation Little Changed

Gerlach—The Leadville Mines Co., with property about forty miles north of Gerlach, the nearest railroad station and on the Western Pacific, has resumed production. A. A. Codd, of Reno, secured control of the property in 1919 and built a mill after spending some time in developing the mines. Gasoline power is used. The ore, after coarse crushing, goes to a Marcy mill, then to a Dorr classifier and through two K & K flotation machines; the concentrates pass to a Dorr thickener and Oliver filters. The concentration ratio is six to one, and extraction is said to be about 90 per cent. Production at present is at the rate of twenty-five tons per day, and a carload of concentrates is being shipped every ten days.

Rochester — The Rochester Silver Mines Corporation is operating normally with about 100 men on the payroll. The Nevada Packard Mines Co., which employs sixty men, reports regular normal production.

Spanish Belt—Work on the mill of the Consolidated Spanish Belt Silver Mining Co., with property situated about midway between the old camp of Belmont and Manhattan, is being rushed as fast as possible. The mill is practically completed with the exception of the flotation machines, which should have been on the property by July 1. Capacity will be 50 tons per day, with few additional changes necessary to increase it another 50 tons. Electric power will be used. Mine development continues satisfactory. Crosscutting is being done, and a drift on a new ore showing on the 145 level of the San Pedro shaft is following 8 to 12 in. of ore of good grade.

The Big Four Mining Co., which controls the old Hancock property adjoining the Consolidated Spanish Belt ground, has installed a new compressor and is cleaning out and retimbering the old Hancock tunnel preparatory to doing exploration work. This mine was a producer of high-grade ore many years ago, and the recent excellent results from development in the Spanish Belt mine have induced the present owners to start work.

Tonopah—There are no apparent indications of an early settlement of the strike which has hindered operations in the Tonopah and Divide districts since April 16. The Tonopah Extension started milling operations on a ten-stamp basis on June 15, and reports development footage for the week ending June 18 as 83 ft. The Tonopah Belmont has about a third of a normal crew and is breaking ore and doing development work preparatory to resuming milling operations soon. The Tonopah Mining Co. is making no apparent effort to resume operations. The West End shipped $51,000 worth of bullion on June 18, which represented the cleanup for the first half of June. In the Tonopah "76" ground 78 ft. of crosscutting in favorable formation was accomplished in May by the West End Co., working from its 800 level.

Johnnie—Several "dry washers" have been built and put to work in the placers of the Johnnie district. The dry washers are simple and inexpensive to build, working on the principle of an air jig. The recovery is unusually good and permits prospectors to develop the claims and pay expenses until the main channel is found.

Coarse gold was found two miles south of the Congress mine, and a small rush has taken place. A large number of claims have been staked out.

Coarse gold and nuggets have been found in the Mill Canyon on the Eureka Johnnie ground, and the extent of the pay ground is being ascertained by active prospecting with a view to putting a dry washer in that canyon. In the main Johnnie gulch F. M. Otto is taking good pay dirt from a shallow shaft, and work on a large scale is planned.

Ely—More interest is being shown in outside districts tributary to Ely, and recent development work at Hamilton and Freiburg is giving interesting results. Old properties such as the Mammoth and the Arguile are being prospected. Interest is waning somewhat in the oil possibilities of the Illipah Basin, but little has really been proven to date.

Pioche — Ore shipments from the Pioche district for the two weeks preceding June 23 showed a decided increase, totaling 838 tons. Bristol shipped 395 tons; Black Metals, 376; Consolidated Nevada Utah, 42, and Gypsy Lease, Smith & Smith, 25.

The Nevada Des Moines property recently figured in rather complicated litigation at Des Moines, Iowa. The case will again be heard before the State Supreme Court. The property has no ore developed or extracted.

Silverhorn—Properties are in demand in the new Silverhorn district, and a number of sales have recently been made. On account of the lack of developed ore on the outside properties little cash is paid down, the properties being incorporated and underwritten by Eastern capital. In most instances two-thirds of the amount of the underwriting price is being applied on the expense of development, while the other third goes to the owners of the property, who share with the promoters who have advanced the preliminary money for incorporation and other expenses prior to the actual receipt of moneys under the underwriting agreements. Of course, some properties have been sold outright for cash, but these for the most part have either a valuable location or else have had a good surface showing.

The Nevada Silver Horn Mining Co. has about forty men on its payroll, the Silver Dale fifteen, and the Silver Peer eight. The other incorporated companies have a few men employed. High-grade silver ore still continues to be found over a wide area, and Silverhorn appears to have an assured future, as the presence of high-grade indicates a tonnage of milling ore and warrants the erection of treatment plants.

Fairview—The Columbia Mines Corporation has been formed to take over and develop the Nevada-Fairview group of claims about five miles from Fairview, Nev.

Reno—The Nevada Supreme Court has reversed the decision of the Nye County District Court in the case of Donohue et al. vs. Tonopah Oriental Mining Co. The suit involves validity of the title of the Oriental to the New York claim, on which its gallows frame and hoisting plant are situated over a 900 ft. vertical shaft. The Oriental bought the ground and the sale was contested by Donohue, who alleges that the claim had been forfeited for failure to do the annual assessment work and error in filing declaration of intention to hold the claims. The declaration of intention to hold was filed in Esmeralda County, while the New York claim is located just over the county line and in Nye County.

UTAH

Park City Shipments Drop—Shipments From Eureka—Lead Furnaces in Blast

Park City—Shipments of ore and concentrates for the week ended June 17 amounted to 887 tons, as compared with 1,109 tons the week preceding. Shippers were: Judge allied companies, 382 tons; Ontario, 286; and Silver King Coalition, 269 tons.

Eureka—Shipments from the Tintic district for the week ended June 17 amounted to 137 cars. Shippers were: Tintic Standard, 49 cars; Chief Consolidated, 39; Dragon, 14; Eagle & Blue Bell, 7; Iron Blossom, 6; Iron King, 6; Colorado, 5; Mammoth, 4; Victoria, 4; Swansea, 4; Eureka Mines, 1; and Martha Washington, 2.

Salt Lake City—On June 20, there were three lead furnaces and one matte furnace in blast at the United States Smelting Co.'s Midvale smelter. On the same date, the America Smelting & Refining Co. had four lead furnaces in blast at its Murray smelter, having added two recently.

The International smelter at Tooele had two lead furnaces in blast on June 20.

The United States Smelting Company at Midvale has started work on its new stack and has built the base, which is practically completed. This is 87 ft. in diameter and 10 ft. deep. Between 1,700 and 1,800 cu.yd. of concrete is in the base alone. The stack will be 50 ft. higher than the A. S. & R. stack at Murray (455 ft.), or approximately 505 ft. high. It will cost with flue connections about $300,000. This stack will probably be completed the latter part of the year.

Eureka—The Tintic Standard mill is treating 140 to 150 tons of ore daily, and making a good recovery of the silver in the ore. Experiments are being made with a view to rocovering the lead also, and a small electrolytic plant is being installed, without, however, interfering with the regular work of the mill. The physical condition of the mine is excellent; new ore finds are continually being made. Following the presentation of figures gathered by the company, Federal officials have increased the net valuation of the discovery orebody from their former estimate of $1,800,000 to $4,150,000 which of course gives a much larger depletion reserve. Income tax due the Federal Government for the period of 1916, when the discovery was first made, to 1919 inclusive, is reduced from $360,000 to $84,031.

Colorado

Gateway—The Radium Co. of Colorado is operating its properties with about 200 men. Ore shipments are made from Whitewater station, on the Denver & Rio Grande Ry., and from Placerville station, on the Rio Grande Southern Ry. James S. [illegible] is manager. The main office of the company has been moved from Naturita to Grand Junction.

IDAHO

Increased Activity Reported in Hailey Section

Hailey—With the Independence and North Star mines (Federal Mining & Smelting Co.) in a position to maintain production, and the Bunker Hill & Sullivan company's development of the Bullion and Mayflower groups well under way, the prospect of large-scale mining operations in the Wood River district are considered satisfactory. In the Muldoon section of the Wood River country, the Federal, Golden Glow, Minnie Moore and the Queen of the Hills properties are active, with a renewal of development and prospecting in evidence. More men are now employed at mining in the district than for a number of years.

Sandpoint—A winze started on a small seam of ore showing in the main tunnel of Falls Creek mine early in May, after being put down several feet, disclosed an 8-in. lens of ore, assaying $105.63 in zinc, copper, lead, silver, and gold. At last reports the high grade showed a 5-in. streak of lesser value along each side.

A deed has been filed with the recorder of Bonner County for the transfer of the Spider and Conjecture properties, six miles south of Lakeview, to the Lakeview Silver Mines Co. The consideration involved is $68,000.

After they had driven 32 ft. in faulted ground on the Blue Bird property on Blacktail Mountain lessees picked up the vein with an 8-in. streak of high-grade silver. A shipment of eight tons of similar ore, made before encountering the fault, netted $4,000. The lessees plan to install a small concentrator.

Mackay—A number of prospecting parties will likely be outfitted here this summer to search for placer and lode minerals in central Idaho. One outfit has already left for the Middle Fork country. Additional activity in this section is indicated by the Mt. Sullivan Mining Co. renewing the lease and bond held on the George W. Stewart group on Alder Creek, a cash payment being made. Driving of the main tunnel, which is now 640 ft., is to be continued this summer.

Coeur d'Alene City—Caribou Mining Company has acquired two additional claims which may be of value to the company for mill site purposes.

Wallace—A. P. [illegible] has secured an option on the control of the Sonora Mining & Milling Co. The terms of the agreement have not been made public, except that it runs for eighteen months and requires the continuous employment of at least four men. The deal also includes a lease under which the company will receive a royalty of [illegible] per cent on all ore shipped. The property is situated near Burke and has been developed to the extent of approximately 4,000 ft. of underground workings. Considerable lead-silver ore has been found but not of commercial quantity.

MONTANA

Hearing on Butte & Superior's Accounting With Minerals Separation Under Way

Butte—Drifting for the copper vein disclosed some time ago on the 2,050 level of the Black Rock mine of the Butte & Superior is under way on the 2,200 level, and it is expected to reach the fissure within two or three months. The hearing on the accounting in the case of the Minerals Separation company against the Butte & Superior is being held before Federal Judge G. M. Bourquin at Helena.

About two and one-half feet of good silver ore has been uncovered by the Butte & Plutus in the Norwich vein on the 400 level.

Some drifting is being done by North Butte on levels below the 2,000 level. A raise is under way and possibly two will be driven. Operations in the main, however, are more on the order of marking time, meanwhile keeping the property in repair. Seventy men are employed.

Driving of raises for more ore chutes is the chief feature of the work at Davis-Daly's Colorado mine at the present. At the Hibernia shaft a sinking from the 600 to the 800 level has begun.

Corbin—Official announcement has been made of plans for extensive development of the Alta-Montana property, formerly one of the large producers of Montana. A mill, to be built at Corbin, is also a possibility of the near future. New York capital is chiefly interested.

WASHINGTON

Sylvanite Concentrator To Be Started Soon

Swauk District—The small concentrator constructed for the Sylvanite Mining Co., in the Swauk mining district in Kittitas County is expected to be in operation about the end of July. The ore is said to run about $20 per ton in gold and silver. Arrangements have been completed for shipping concentrates to the Bunker Hill smelter.

Republic—The Knob Hill mine is maintaining steady shipments to the Trail smelter.

NEW MEXICO

Development Work in Progress at 85 Mine—Rosedale Property Sold

Lordsburg—At the Eighty-five Mine property of the Calumet & Arizona Mining Co. development work continues on the [illegible] levels. Ore from this work is shipped to the Douglas smelter. The work of sinking the main shaft 300 ft. farther, making a total depth to the lowest workings of 1,350 ft., was started July 1. Karl I. [illegible] is manager.

The Co-operative mine has shipped another car of silver and concentrates to the El Paso smelter.

William Ragsdale's lease on the Rosedale property has expired. One car of ore running 11 per cent lead with good silver values was shipped. The property has been taken under lease by

William Karwer and associates, of El Paso. A camp has been built and work started.

Socorro — The Rosedale gold mine, thirty miles southwest, has been sold for a consideration reported to be $250,000 and will be incorporated for $600,000. The sale was negotiated by Colonel M. R. Crawford. The property has been idle for about ten years. New equipment of mining machinery and a new stamp mill will be installed.

Hachita—The old Gillespie mine has been opened and a 50-ft. crosscut run intersecting several small streaks of high-grade silver ore. On the Thanksgiving claim adjoining, a 30-ft. shaft has been sunk opening a vein of 50-oz. silver ore. A gas hoist has been installed. M. D. Lincoln is in charge.

ARIZONA

Don Luis Section of Warren District Active

Bisbee—The Calumet & Arizona continues the work of concreting the Campbell shaft. Sinking was discontinued some time ago due to the fact that considerable water was encountered. Connection is made with the 1,400 level of the Junction. A drift is now being driven on the 1,800 level of the Junction to connect with the Campbell. Recently this drift struck a large flow of water, and 1,500 gal. per min. has been added to the amount handled at the Junction, which brings the total above 4,000 gal. per minute.

There is considerable development activity in the Don Luis district. The Boras Leasing Co. is enlarging the Boras shaft from one and a half compartments to two and one-half compartments. About 80 ft. has been completed. Work of enlarging has been started from the 400 level and is proceeding toward the collar. The White Tail Deer shaft is being sunk. Work is being done on three shifts.

The Night Hawk Leasing Co., after sinking its winze on the 650 level on the Lone Star fraction to a depth of 35 ft., has discontinued work and is now running the 750 level to explore beneath this territory. The winze bottomed in ore and altogether sufficient ore was opened up to warrant the extension of the 750 level.

The Wolverine & Arizona is doing considerable development work.

MICHIGAN

Gogebic Range

M. A. Hanna and Pickands-Mather Stop Injunction Proceedings Against Wakefield

Ironwood—The Geneva mine, near Ironwood, is being shut down completely. All tools and underground equipment are being removed, but the mine will not flood, as the water drains over to the Davis mine. At the latter property the work of repairing the 26th-level pump station, where several thousand tons of rock crushed in the roof, is nearing completion. The rock has been cleared away and a 4-ft. reinforced concrete wall is being built across the middle of the pump house to support the roof, and the entire roof system is being strengthened with heavy steel.

"H" shaft of the Pabst mine made its first shipment of ore on June 17, just as orders were received to cut production in half. However, regular shipments will be made on the reduced scale.

The big 30 x 72-in. duplex steam hoist which the Ashland mine bought from the Norrie when the latter changed over to electric hoisting has been erected at No. 9 shaft and is now ready for operation.

Wakefield — The M. A. Hanna and Pickands-Mather subsidiaries operating the open pit mines at Wakefield have discontinued their injunction proceedings against the city of Wakefield on condition that only part of the bonds recently authorized by the city shall be used for erecting a community building. The sum of $145,000 had already been raised for that purpose, and $100,000 additional was held to be unnecessary.

The L. E. Meyers Co., which through several subsidiaries furnishes electric light and power to the mines and cities on the range, had a bad break-down at its steam generating station in Ashland. The main generator, rated at 5,000 kw., was almost completely burned out. The company is having difficulty in taking care of its load, especially as one of the dams is in a weakened condition and the pond had to be lowered. There is also less water in the streams than a few weeks ago. The pumping plant of the city of Ironwood is using its auxiliary gasolene-driven pumps. Fortunately, the demand from the mines for power is far below normal. Pumping continues, but compressors and hoists are not working more than half time if at all.

Hamilton, Wis.—The Montreal mine, at Hamilton, Wis., where the forces had been cut to 250 men, has again reduced operations and laid off half the men and stopped all development work.

MINNESOTA

Plans of Palatine Mining & Development Co. Outlined

Duluth—Officers of the Palatine Mining & Development Co., which has recently taken over the old Paulson mine in northern Minnesota, are as follows: Joseph Mierzynski, president, Chicago; Frank Wydra, secretary, Chicago; Stanley Grzybowski, treasurer, Chicago; Arthur Mitchell, consulting engineer, Duluth; Thomas Krakowiak, chemical engineer, Palatine City, Minn.; Roman Turczynowicz, construction engineer, Chicago; Maximillian J. St. George, general counsel, Chicago; James Ostrowski, director, Chicago, and Edward A. Zolkowski, director, Chicago.

The Paulson property comprises about 1,000 acres. In addition about 1,500 acres adjoining the Paulson have been taken over. The Canadian National Railways is being extended, or rather, rehabilitated, from its present end of track at North Lake, Ont., to the holdings of the Palatine company, in Cook County, Minn. The company has also purchased the blast furnace located at Port Arthur, Ont., which will be enlarged and put in operation.

Mesabi Range

Pilot Mine Resumes Work—Many Oliver Properties Close or Curtail

Mountain Iron—The Pilot mine, operated by the M. A. Hanna Ore Co. as an open pit, has resumed operations, with a steady shipment of ore to the docks.

Buhl—The pit limits of Butler Bros., Margaret mine are being extended to the east.

Plans for deepening the shaft at the Oliver's Wanless mine have been completed, and the work will start soon. The shaft is 180 ft. below the collar and is to be sunk an additional distance of 70 ft.

Coleraine—The Arcturus mine of the Oliver company has suspended operations. About 140 men were thrown out of employment.

Chisholm—The Oliver company has closed its Chester mine; also its Glen pit, and at its underground workings and at the Fraser open pit are being worked only one shift. Approximately 275 men are effected.

Virginia—The Missabe Mountain open pit, operated by the Oliver company, has reduced its shipments for the season. About 200 men have been laid off.

Eveleth—The Oliver company has either closed or curtailed at the Genoa, Fayal, Spruce, Adams, and Leonidas mines. About 900 men were thrown out of employment.

Hibbing — The Oliver company has closed the Morris open pit, the Sweeney open pit, the Pool underground workings and the Philbin underground workings. Five hundred men were thrown out of employment.

It has just been announced from the office of the state mineral land examiner that the state-owned mines were shipping approximately 40 per cent of the amount of ore that was shipped at this time last year.

The Mahoning mine, operated by the Mahoning Ore & Steel Co., has closed for four or five weeks. Two steam shovels will continue the operation of stripping.

Keewatin—The general orders for the closing of the properties of the Pickands-Mather Co. have been changed as preparations are being made to ship approximately 500,000 tons of ore from the Bennett mine. Two steam shovels will be used grading the ore and handling the tonnage.

Grand Rapids—The Tod-Stambaugh company has acquired additional acreage west of Grand Rapids. The tract of eighty acres lies in Sec. 13, Tp. 55, R. 26, which is in Itasca County nearly adjacent to the first tract acquired several months ago. It is planned to build a mill to treat the ore on this property.

THE MARKET REPORT

Daily Prices of Metals

June	Copper, N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
23	12.50	[illegible]	[illegible]	4.25@4.40	4.10	4.35@4.40
24	12.50	27.875	[illegible]	4.25@4.40	4.10	4.30
25	12.50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	12.50	28.00	[illegible]	[illegible]	[illegible]	4.25
28	12.50	[illegible]	[illegible]	4.35@4.40	4.125@4.25	4.25
29	12.50	28.00	29.00	4.40	4.125@4.25	4.20@4.25

*These prices correspond to the following quotations for copper "delivered": [illegible] for the week.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

June	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
23	[illegible]	70	74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25									
27	[illegible]	[illegible]	74	[illegible]	[illegible]	[illegible]	23	[illegible]	[illegible]
28	[illegible]	[illegible]	74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	74	166	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

June	Sterling Exchange	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	June	Sterling Exchange	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
23	[illegible]	[illegible]	[illegible]	[illegible]	27	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	28	[illegible]	[illegible]	59	[illegible]
25	373	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, June 29, 1921

Business has been somewhat more encouraging in copper, lead and zinc during the last week, although lead is the only metal the price of which has shown firmer tendencies. No large sales have been reported, however, and as domestic business conditions show no improvement, it is unlikely that the metal market has taken any distinct permanent turn for the better. The stock market seems to have reacted upward, and the settlement of the British coal strike is reported, and both of these facts tend toward a better feeling in markets generally. Not much business activity can be expected in July and August, however.

Copper

Demand has been a little more satisfactory than it was last week, but no large orders are reported. The price level is virtually unchanged, but there are now many more producers willing to consider bids of 12.75c., delivered, than there were formerly. Some of the largest producers are now quoting this price confidentially to preferred customers, but are trying to hide the fact from the general public. A little copper for August delivery has been sold at a premium of [illegible]. One of the smaller Arizona producers who has always sold all his current production is understood to be marketing some metal at [illegible], delivered, and this price is also being quoted by some traders, but the larger volume of copper sold is at the price which we quote.

Export demand continues weak. Germany continues as almost the sole buyer through the Copper Export Association, with a very small tonnage to France. The price has been unsatisfactory, netting producers not more than 12.50c. f.a.s. New York.

Lead

The A. S. & R. price of 4.40c., which was established a week ago today, remains unchanged.

A buying movement, not of large proportions to be sure, but still very discernible after the dullness of the last few weeks, appeared about Friday. White-lead and paint interests have been the chief factors, but cable and cartridge manufacturers have also been in the market, and supply houses have taken a few small tonnages. Most of this business has been done on the St. Louis basis, and except for chemical lead held by one producer at close to 4.125c. supplies at current prices are scarce. This has resulted in the St. Louis price advancing more than the New York figure has. Lead is probably in the strongest position of all of the metals, a fact which is evidenced by the immediate increase in prices which takes place every time buying of consequence sets in. A 10-point premium is quoted for August business over June-July figures.

Zinc

The market has declined daily, and although sales cannot be said to be satisfactory, comparatively large amounts were sold to galvanizers throughout the week. Whether the cut in iron and steel prices induced buying, or the unusually attractive low level of the market was responsible, is not known. Several of the larger producers are almost entirely out of the market, and are only filling the requirements of favored customers. Some zinc was sold as low as 4.20c., East St. Louis. Futures are neglected.

Stocks of zinc, as a consequence of the enforced dullness in the trade, have increased, which is a disquieting element in the situation. Considering that production has been cut to the bone, the increase in stocks [illegible] during May, indicates how stagnant the zinc market has been.

Tin

The British coal strike seems to have had little effect on the price of tin. [illegible] at the height of the strike and now that it is to be settled, no advance is [illegible]. Demand in this country is almost entirely confined to small tonnages bought and sold by traders and [illegible]

The tin-plate business seems to be in a bad way. Tin for forward delivery is quoted nominally at the same prices as those indicated for spot.

Arrivals of tin, in long tons: June 21, Australia, 20; 22d, Straits, 500; 24th, Rotterdam, 25; Straits, 50; 25th, China, 10.

Gold

Gold in London: June 23d, 109s. 9d.; 24th, 110s. 5d.; 27th, 109s. 6d.; 28th, 109s. 5d.; 29th, 109s. 3d.

Foreign Exchange

The exchange market is exhibiting a seasonal dullness, and in the last week price changes have been within a narrow range. On Tuesday, June 28th, francs were 8.055c.; lire, 4.95c.; and marks, 1.3775c. New York funds in Montreal, 13½ per cent premium.

Silver

The silver market has been fairly steady in London the last week, ruling between 35d. and 35⅝d., closing at the latter price on China buying. The New York market has been higher than the London equivalent on buying by China banks for San Francisco shipment. Supplies of silver have been moderate, which has helped to steady prices. There has been some decrease of silver stocks held in Shanghai, and reports from India indicate favorable progress of the monsoon, and with somewhat brighter economic conditions in China the trend of the silver market seems steady or possibly higher, unless some governmental action by Germany or England in the sale of silver should depress the market. The purchases of domestic silver under the Pittman Act amounted to 59,635,697 oz. up to June 24.

Mexican Dollars—June 23d, 45; 24th, 45; 25th, 45; 27th, 45; 28th, 45¼; 29th, 45½.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 4⅞c.; market dull. W.C.C. brand, 5¾@5⅞c. per lb. Cookson's "C" grade, spot, 9@9½c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500-lb. lots.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb.; black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $165@$185 per oz.

[1]**Molybdenum Metal in rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage**

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$65@$70 per oz.

Platinum—$75 per oz.

Quicksilver—Nominally, $46@$47 per 75-lb. flask. San Francisco wires $46.50.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.**

[1]**Thallium Metal—Ingot, 99 per cent pure, $20 per lb.**

[1]**Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.**

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal. Market very dull.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55. Prices have been reduced $1 per ton for the 1921 season.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $5.80; old bed concentrates, 63 per cent, $6.70; Harmony, cobbed, 63 per cent, $6.70; new bed low phosphorus, 65 per cent, $9.50.

Manganese Ore — 25c. per unit, seaport; chemical ore (MnO_2) $55@$60 per gross ton, lump; $70@$75 per net ton, powdered.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., June 25—Zinc blende, per ton, high, $26.45; basis 60 per cent zinc, premium, $21; Prime Western, $20; fines and slimes, $19@$16. Average settling price, all grades of zinc, $23.31.

Lead, high, $56.25; average settling price, all grades of ore, $43.92 per ton.

Shipments for the week: Blende, 4,823; lead, 2,036 tons. Value, all ores the week, $201,830. Shipments for six months: Blende, 134,180; calamine, 80; lead, 29,583 tons. Value, all ores six months, $4,805,950.

The bulk of the Oklahoma zinc ore sold on $21 basis, and the Waco ore, with an 80c. favorable freight differential, has that additional factor in settlements.

Lead ore halted in the downward course that has marked the last five weeks, dropping from $60 to $40 per ton in that time.

One smelting company is purchasing zinc ore, building bins and storing it in the Oklahoma mining area.

Platteville, Wis., June 25—No sales of zinc or lead ores. Shipments for the week: Lead ore, 30 tons. Shipments for the year: Blende, 11,461; lead ore, 940 tons. Shipped during week to separating plants, 368 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,700@$2,000; No. 2, $1,200@$1,500; spinning fibers, $400@$800; magnesia and compressed sheet fibres, $275@$400; shingle stock, $95@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga. Prices largely nominal.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $7@$9; washed, $9@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $20@$25, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

---

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Feldspar—Crude, $7@$9 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$8.50, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine. No. 1 Canadian, $26@$28, f.o.b. cars. Market quiet; prices largely nominal.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $18 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $13.50, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $30, New Mexico. Good demand for ground grades in West.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7@8c. per lb.; chip, 5½@6c.; dust, 3@4½c. No. 1 flake, 6½@7c.; amorphous crude, 2@2½c. Market quiet.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9: f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.; No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5 $1.75; No. 4, $3.25; No. 3, $5; No. 2 $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity), ground roofing mica, $2[illegible] $70, all f.o.b. New York.

[*]Monazite — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 72@74 per cent, $11; 70 per cent, $6.75; 6[illegible] per cent, $6.25; 68@66 per cent, $6.

---

[*] Foote Mineral Co., Philadelphia, Pa.

Pumice Stone—Imported, lump, 3@10c. per lb.; domestic lump, 5c.; ground, 3@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $8@$12 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton

Mineral Products

Arsenic — White arsenic, 6½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $18@$20 per ton, f.o.b. Western mines, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.50@$1.75 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 14c. per lb. of chromium contained; 4 to 6 per cent carbon, 15c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $75@$80, f.o.b. furnace; re-[illegible], English, $75@$80, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $28@$32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works. Imported material, [illegible].

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $40@$4[illegible]; 50 per cent, $[illegible]; 75 per cent, $140@$145.

Ferrotungsten—Domestic, 70 to 80 per cent W, [illegible] per lb. of contained tungsten, f.o.b. works. Foreign, [illegible] f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$5@$6 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 21¼@21½c. per lb.; wire, 14¼@14½c.

Lead Sheets—Full lead sheets, 8.25c.; cut lead sheets, 8¾c. in quantity, mill lots.

Nickel Silver — 31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets 17¾c.; sheathing, 16¾c.; rods, ⅜ to 3 in., 14¾c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $60@$65 per net ton, shipping point; arches, keys, wedges, $66; splits, soaps, $84.

Fire Brick—First quality, 9-in. shapes $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $70@$75 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, June 28, 1921

The stoppage of orders for steel products passes all previous conception. Experience before the war was that the minimum requirements in the worst times would be about 50 per cent of mill capacity, but for several weeks the mills have operated at not over 25 per cent, and a rate below 20 per cent is to be expected for July. One point of difference is that buyers, including jobbers and manufacturing consumers, are making the strongest effort in the history of the trade to dispose entirely of their stocks, and thus there is reselling that keeps some orders away from the mills. Some buyers evidently expect still further reductions in steel prices.

The only general reductions from the so-called "April prices" have been $5 a ton in wire products, about a month ago, and $5 a ton in sheets, about a week ago.

With such light operations production costs are extremely high, and additional mills are deciding that it does not pay to try to operate.

Pig Iron—There is practically no business to test the market, prices being largely nominal, [illegible] furnaces, freight to Pittsburgh being $1.96.

Coke

Connellsville — Furnace, $3@$3.25; foundry, $4@$4.50.

Cadmium Above Pre-War Level

1920 Production Was Continued on War Scale—German Output Now Declining

CADMIUM is a byproduct metal, and its production is dependent upon the output of the major metal, zinc, or some chemical process from which it is also recovered as a byproduct, such as lithopone manufacture, which uses a zinc chemical. The principal producers in the United States are the American Smelting & Refining Co., the U. S. Smelting, Refining & Mining Co., Grasselli Chemical Co., Krebs Pigment & Chemical Co., and the Midland Chemical Co. The first two companies derive cadmium from lead smelters, treating zinkiferous lead ores, and an electrolytic zinc plant; the remainder obtain the metal from chemical works.

Cadmium production in the United States fluctuates greatly, as the following table, prepared by the U. S. Geological Survey, indicates:

	Metallic Cadmium		Cadmium Sulphide	
	Quantity, Lb.	Average Price per Lb.	Quantity, Lb.	Average Price per Lb.
1910	4.700	$0 55	..	
1911	26,152	.67	2,392	$0 70
1912	52,508	.76	8,998	.71
1913	54,198	.77	17,302	.70
1914	91,409	89	22,723	89
1915	91,415	1 19	10,624	1 13
1916	135,212	1 56	22,176	1 26
1917	207,408	1.47	50,169	1.41
1918	127,164	1.48	51,702	1.36
1919	99,939	1.22	31,197	1.20
1920	129,283	1 17	32,133	1 16

It is noticeable that the average price of cadmium during the war jumped greatly over the pre-war average, due partly to the cessation of imports from Germany. The price of cadmium at present is $1@$1.10 per lb., which is below the 1920 average, but greater than the pre-war scale of prices. As production in the United States is only about sixty-five tons annually, the price received for the metal is not of much consequence to the corporations producing it, except that there are incidental costs of recovering the metal which influence prices.

The cadmium resources of the United States have never been strained, as the demand for the metal is confined to comparatively few industries, such as the manufacture of fusible alloys and paint pigments. It is estimated by the U. S. Geological Survey that at the end of 1918 about 750 tons of recoverable cadmium in zinc residues was available, or many times more than the annual consumption in the United States. The heavy sales in 1920 resulted in reducing stocks.

If the demand and price of cadmium should increase, production could readily respond, but as the uses of cadmium have not expanded greatly there is no warrant for looking for any improvement in the near future. Experimental work in the endeavor to increase cadmium uses is necessary.

Before the war Germany produced relatively larger amounts of cadmium than the United States. Thus in 1910, 90,516 lb. of metallic cadmium was produced; in 1911, 93,961 lb.; in 1912, 94,262, and in 1913, 81,993 lb. In 1918, production reached a peak of 236,000 lb. German and American production together constitute practically the world's total production.

Transvaal Gold Production

The following table summarizes Transvaal gold production since 1917:

RAND GOLD OUTPUT 1917-1921, IN FINE OUNCES

	1921	1920	1919	1918	1917
January	681,382	670,503	676,059	714,183	782,634
February	671,123	625,330	636,728	659,759	721,321
March	688,137	707,036	712,379	696,281	787,094
April	661,593	686,979	694,944	717,099	742,778
May	687.776	699.041	724.995	741,217	729.385
June		715,957	702,379	727,696	737,724
July		736,099	723,497	736,199	757,890
August		702,083	706,669	740,210	756,658
September		682,173	698,558	708,206	738,231
October	......	662.472	723.722	679.764	751.290
November	......	633.737	677.970	658.701	722.839
December	......	632.215	650.191	641.245	722 419

Movements of Ores and Metals

Imports and exports of the more important metals and ores, as reported by the Department of Commerce, for May, 1921, and the figures for May, 1920, as finally revised, are as follows:

IMPORTS, MAY, 1920 AND 1921

(In Pounds, Unless Otherwise Stated)

	May, 1920	May, 1921
Antimony ore, contents	26,625	....
Antimony matte, regulus or metal	2,296,000	891,180
Brass, fit only for remanufacture	4,216,563	984,628
Copper:		
Ore, contents	5,449,040	1,153,410
Concentrates, contents	4,720,868	1,102,147
Matte, regulus, etc., contents	437,463	817,150
Imported from:		
Spain	427,111	164,880
Canada	2,277,313	991,900
Mexico	2,778,787	511,633
Cuba	1,453,742	902,397
Peru	539,129	501,897
Unrefined, black, blister, etc	23,920,357	5,171,667
Imported from (in part):		
Canada	2,450,910	160,142
Mexico	8,913,745	930,790
Chile	2,424,174	88,117
Peru	8,367,902	3,370,764
Refined, in bars, plates, etc	18,580,986	7,400,392
Old, etc., for remanufacture	665,121	58,321
Composition metal, copper chief value	87,076	58,421
Lead:		
Ore, contents	5,623,742	1,209,508
Bullion, contents	3,258,425	8,466,192
Imported from (in part):		
Canada	208,880	208,170
Mexico	8,413,133	8,713,712
Pigs, bars and old	3,170,707	23,482,927
Imported from:		
England	224,000	.
Canada	8,627	
Mexico	560,032	4,443,233
Peru	9,275	. .
Australia	2,368,773	
France	.	11,200,000
Spain		7,839,694
Manganese ore, long tons	56,586	54,663
Imported from (in part):		
Cuba, long tons	118	
Brazil, long tons	30,100	26,849
British India, long tons	14,300	21,300
Tungsten ore, long tons	96	370
Pyrites, long tons	25,329	19,143
Imported from:		
Spain, long tons	17,629	19,139
Canada, long tons	7,700	
Tin ore, long tons	3,120	425
Tin bars, blocks and pigs, etc.	9,102,341	2,021,762
Imported from (in part):		
United Kingdom	3,065,287	828,941
Straits Settlements	4,286,663	1,078,409
Hongkong	973,011	43,842
Zinc		
Ore, contents	4,042,627	5,820
Imported from (in part):		
Mexico	2,653,621	5,820

EXPORTS OF COPPER, LEAD, AND ZINC

(In Pounds)

	May, 1920	May, 1921
Copper:		
Unrefined, black, blister, etc	111,880	11,138
Refined, in ingots, bars, etc	72,107,577	32,259,011
Exported to (in part):		
Belgium	3,450,000	1,183,531
France	17,803,625	4,454,538
Germany	7,055,336	7,073,597
Italy	81,364	2,345,608
Netherlands	3,895,917	2,623,529
United Kingdom	14,810,044	6,765,201
Composition metal, copper chief value	61,524	2,100
Old and scrap	13,698	2,960
Pipes and tubes	296,622	120,834
Plates and sheets	4,883,671	275,695
Wire, except insulated	5,248,746	2,706,213
Lead:		
Produced from domestic ore	363,986	119,700
Produced from foreign ore	4,785,752	505,375
Exported to (in part)		
Netherlands	291,200	
United Kingdom	1,021,144	
Canada	62,674	50,626
Japan	2,464,000	448,000
Zinc		
Dross	675,593	
Spelter		
Produced from domestic ore	14,868,768	135,365
Produced from foreign ore	2,134,383	
Exported to (in part)		
Japan	82,462	112,013
France	2,483,939	
United Kingdom	13,460,960	
Sheets, strips, etc	2,607,059	214,74

COMPANY REPORTS

Tennessee Copper & Chemical Corporation

A report of operations of the Tennessee Copper & Chemical Corporation for 1920 states that 10,[illegible] lb. of copper, 333,629 tons of sulphuric acid, 55,586 oz. of silver, and 237 oz. of gold were produced, and that a deficit of $285,889 was incurred, compared with a deficit of $[illegible] in 1919. Consolidated income account follows:

	1920	1919	Changes	
Sales	$[illegible]	$[illegible]	[illegible]	$[illegible]
Miscellaneous income	[illegible]	[illegible]	[illegible]	[illegible]
Total income	$[illegible]	$[illegible]	[illegible]	$1 843 419
Operating and miscellaneous expenses	[illegible]	4 307 047	[illegible]	[illegible]
Interest on loans, etc.	[illegible]	254 612	[illegible]	[illegible]
Reserve for depreciation	[illegible]	[illegible]	[illegible]	[illegible]
Deficit	285 889	675 379	[illegible]	389 490

Consolidated balance sheet follows:

ASSETS

	1920	1919
Mining property, plant and equipment	$11 084 862	$7 380,945
Cash	461 970	275 494
Investments	3 257 535	[illegible]
Call loans and accrued interest	[illegible]	
Liberty bonds, etc.	[illegible]	[illegible]
Tennessee Copper bonds	175 000	
War Finance Corporation 5 per cent gold bonds		[illegible]
Copper inventories	872 432	[illegible]
Other inventories	[illegible]	694 052
Accounts receivable	398 273	[illegible]
Railroad freight claims	50 899	[illegible]
Deferred charges	1 070 752	[illegible]
Total	$[illegible]	$[illegible]

LIABILITIES

	1920	1919
Tennessee Copper & Chemical Corporation stock (774,0[illegible] shares)	$4 000 000	$4 000 000
Tennessee Copper Co. stock	5 000 000	5 000 000
Tennessee Copper Co. first mortgage bonds	2 326 000	2 487 500
[illegible]	1 000 000	150 000
First mortgage notes	449 000	
Accounts and notes payable	[illegible]	[illegible]
[illegible]	[illegible]	
[illegible]	[illegible]	156 874
Accrued expenses [illegible]	[illegible]	135 105
Deferred credit	[illegible]	47 368
Surplus	[illegible]	5 549.728
Totals	$19 849 730	$18 256 995

Howe Sound Dividends $396,830

A report of operations of Howe Sound Co. for 1920 states that 18,161,854 lb. of copper, 101,505 oz. of silver and 6,496 oz. of gold were produced by Brittania operations. Combined profit and loss account (including Potosi Mining Co. and subsidiary operations) follows:

Debit		Credit	
Mining	$1,746,254 93	Smelter returns: copper [illegible]	
Transportation from mine to shipping terminals	260 601 44	18 161 854 [illegible] 16 041 [illegible] 2 862 [illegible] 6 496 [illegible]	$[illegible]
Milling	485 265 16	Miscellaneous [illegible]	[illegible]
Smelting and marketing (including freight to smelter and Mexican export duty)	2 224 041 86		
Extraordinary, due to Mexican revolution, etc.	38 411 78		
Administration, including general and legal expenses, etc.	92 716 86		
Taxes	127 774 [illegible]		
Balance	1 847 163 14		
	$7 024 330 14		
Depreciation and depletion	$1,532,292 04		$7 024 330 14
Interest	205 117 47		
Balance	109 753 63	Balance from above	$[illegible] 14
	$1 847,163 14		$[illegible] 14

Balance Dec. 31, 1919, was $3,220,[illegible]. Adding profit of $109,753.63 and deducting dividends totaling $396,830, left $2,933,305.02 on Dec. 31, 1920. Capitalization, 1,984,150 issued shares of $1 par each.

Cia. Minera "Las Dos Estrellas"

A report of operations of the Cia. Minera "Las Dos Estrellas" states that the mines and mill are near Tlalpujahua, State of Michoacán, Mexico. Financial statement follows:

		Mexican Currency—Pesos
Realized by sales of bullion		6,163,296 06
Interest		[illegible]
Income from other sources		35,282 89
		6,[illegible]
	Pesos	
Total import of operating expenses	4,952,152 19	
[illegible]	[illegible]	[illegible]
Net profit during 1920		[illegible]
Profit and loss balance brought forward from 1919		44[illegible]
Total profit balance at Dec. 31, 1920		1,813,300 61

Dividends during 1920 were 1,161,712.63 pesos, and the total to Dec. 31, 1920, 35,844,124.52 pesos. The import of the original capitalization, or 300,000 pesos, was returned to the shareholders during 1909, but this sum is not included in the aforementioned dividend total.

Total assets on Dec. 31, 1920, were 9,042,219.02 pesos; total liabilities, 2,026,603.38 pesos.

Development for the year amounted to 3,795 m., consisting of 1,869 m. drifting; 1,079 m. crosscutting; 727 m. raising, and 120 m. of winzes. The estimated ore reserves at the end of 1920 were 429,664 tons of proved ore and 399,535 tons of probable ore.

The total ore milled during 1920 was 361,878 dry metric tons, of an average grade of 8.9 gm. gold and 157 gm. silver per ton. The average price received for silver was $1.0064, U. S. currency, per oz. Value of metals recovered per ton of ore was 17.73 pesos. The total production of the mine from its inception (1900) down to Dec. 31, 1920, was 4,867,152 dry metric tons. The calculated net value of output to Dec. 31, 1920, is 114,426,261 pesos.

Total operating costs, including development and Mexico City office expenses, were $6.08, U. S. currency, per dry metric ton (2,204.6 lb.), compared with $5.77, U. S. currency, for the year 1919.

Mining Dividends for June, 1921

The following dividends were paid by American mining and metallurgical companies during June, 1921:

Companies in the United States	Situation	Per Share	Total
Amer. Smelt. & Refining, pfd	U.S.	[illegible]	$[illegible]
Calumet & Arizona Mining, c	Ariz.	[illegible]	[illegible]
Federal Mining & Smelting, pfd. [illegible]	Idaho	1 00 Q	120 000 00
Golden Cycle M. & R., g	Colo.	0 02 Q	30 000 00
Hecla Mining, s.l.	Idaho	[illegible]	80 000 00
Homestake Mining, g	S. D.	[illegible] M	62 790 00
Marsh Mines Consol., s.l.	Idaho	[illegible]	39 500 00
National Lead	U. S.	[illegible]	[illegible]
National Lead, pfd	U. S.	1 75 Q	426.433 00
Rochester Silver Corporation, s.s.	Nev.	[illegible]	[illegible]
Utah Copper Co.	Utah	0 50 Q	812.245 00
Companies in Mexico			
Lucky Tiger Combination, g	Mex.	[illegible]	[illegible]

Q, Quarterly; I, Irregular; M, Monthly; SA, Semiannually; X, Includes extra.

American Smelting & Refining Co. passed its dividend on common stock for the first time since 1904, and Cerro de Pasco Copper, which paid $[illegible] last March, has passed its dividend not missed since 1916. Hecla Mining Co. announced a reduction from the [illegible] paid last March, as did Utah Copper from the $1 paid at that time. The latter pays the present dividend out of the surplus earnings since 19[illegible]. Tonopah Belmont Development joins the ranks of delinquents. Marsh Mines Consolidated pays its usual dividend from the sum it received from Hecla Mining and Federated M. & S., and Rochester Silver Corporation has just effected certain settlements. Seneca Copper Corporation stockholders have authorized an additional [illegible] shares of common stock.

MINING STOCKS

Week Ended June 25, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Adventure	Boston	. .		½		
Ahmeek	Boston	48	47	47	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	½	⅜	½		
Allouez	Boston			20	Mar. '19	1.00
Anaconda	New York	37½	34¾	37⅜	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2	2	2		
Ariz. Com'l	Boston	8	7½	7½	Oct. '18,	50
Big Ledge	N. Y. Curb	¼	3/16	¼		
Bingham Mines	Boston	[illegible]	9	9	Sept. '19, Q	25
Calumet & Arizona	Boston	47	45½	46	June '21, Q	50
Calumet & Hecla	Boston	235	226	229½	June '20, Q	5.00
Canada Copper	N. Y. Curb			*13		
Centennial	Boston	7½	7	7	Dec. '18, SA	1.00
Cerro de Pasco	New York	26	24⅛	25	Mar. '21, Q	50
Chile Copper	New York	10¾	10	10⅝		
Chino	New York	23½	20⅛	22	Sept. '20, Q	37½
Columbus Rexall	Salt Lake	‡....	....	*26½		
Con. Arizona	N. Y. Curb	....	....	1/16	Dec. '18, Q	05
Con. Copper M.	N. Y. Curb	....	....	1⅛		
Copper Range	Boston	33	32	33	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*36	*32	*35		
Davis-Daly	Boston	6¾	5½	5⅝	Mar. '20, Q	25
East Butte	Boston	8¼	7⅞	8	Dec. '19, A	.50
First National	Boston Curb	*57	*50	*52	Feb. '19, SA	.15
Franklin	Boston	2	2	2		
Gadsden Copper	N. Y. Curb			*25		
Granby Consol.	New York	18½	17½	17⅛	May '19, Q	1.25
Greene-Cananea	New York	21½	21	21	Nov. '20, Q	50
Hancock	Boston	3¼	3¼	3¼		
Howe Sound	N. Y. Curb			2¼	Jan. '21, Q	05
Inspiration Consol.	New York	32¾	31	32½	Oct. '20, Q	1.00
Iron Cap	Boston Curb	5½	4½	4¾	Sept. '20, K	25
Isle Royale	Boston	19½	19½	19½	Sept. '19, SA	50
Kennecott	New York	18¼	17	18¼	Dec. '20, Q	.50
Keweenaw	Boston	1¼	1¼	1¼		
Lake Copper	Boston	2¼	2¼	2⅜		
La Salle	Boston	..		2		
Magma Chief	N. Y. Curb			*21		
Magma Copper	N. Y. Curb	18	17	17	Jan. '19, Q	.50
Majestic	Boston Curb	*12	*12	12		
Mason Valley	Boston			1		
Mass Consolidated	Boston	2	2	2	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	3¼	3	3½		
Miami Copper	New York	20½	19	20½	May '21, Q	.50
Michigan	Boston			2		
Mohawk	Boston	48½	47	47½	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5	4¾	5		
Nevada Consol.	New York	11¼	9¾	11¼	Sept. '20, Q	.25
New Baltic	Boston Curb			3		
New Cornelia	Boston	14½	14	14½	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb			5		
North Butte	Boston	9¼	8¼	8¾	Oct. '18, Q	.25
North Lake	Boston			½		
Ohio Copper	N. Y. Curb			½		
Old Dominion	Boston	19½	19	19	Dec. '18, Q	1.00
Osceola	Boston	26	25	26	June '20, Q	.50
Phelps Dodge	Open Mar.	†160	†150	....	Apr. '21, Q	1.00
Quincy	Boston	37	36¾	36¾	Mar. '20, Q	1.00
Ray Consolidated	New York	12⅜	12	12½	Dec. '20, Q	.25
Ray Hercules	Boston Curb	*30	*24	*24		
St. Mary's Min. Ld.	Boston	33	31	33	June '20, K	2.00
Seneca Copper	Boston	14¼	14	14		
Shannon	Boston	*90	*80	*90	Nov. '17, Q	25
Shattuck Arizona	New York	6½	6⅛	6½	Jan. '20, Q	25
South Lake	Boston	...	....	1		
Superior Copper	Boston	.	....	3½	Apr. '17,	1.00
Superior & Boston	Boston	1¼	1	1 1/16		
Tenn. C. & C. cfs.	New York	7½	7	7¼	May '18, I	1.00
Toulumne	Boston	*60	*50	*60	May '13,	10
United Verde Ex.	Boston Curb	23	21	22	May '21, Q	25
Utah Consol.	Boston	4	3½	3¾	Sept. '18,	25
Utah Copper	New York	50	45¾	48¾	June '21, Q	50
Utah Metal & T.	Boston	1 3/16	1⅛	1⅛	Dec. '17,	30
Victoria	Boston	1½	1¾	1¾	....	
Winona	Boston	*40	*40	*40	....	
Wolverine	Boston	10½	9	9	....	
		NICKEL-COPPER				
Internat. Nickel	New York	14¼	13	13¼	Mar. '19	50
Internat. Nickel, pf.	New York			82½	May '21, Q	1.50
		LEAD				
National Lead	New York	72	69	71½	Mar. '21, Q	1.50
National Lead, pfd.	New York	100½	100	100½	June '21, Q	1.75
St. Joseph Lead	New York	11	10⅞	11	June '21, Q	25
Stewart Mining	Boston Curb	....	....	*6	Dec. '15,	05
		ZINC				
Am. Z. L. & S.	New York	8½	7¾	8½	May '20,	1.00
Am. Z. L. & S. pfd	New York	25¼	23½	24	Nov. '20, Q	1.50
Butte C. & Z.	New York	4¼	4	4	June '18,	50
Butte & Superior	New York	11¼	10½	10¾	Sept. '20,	1.25
Callahan Zn-Ld.	New York	4¼	4½	4¾	Dec. '20, Q	50
New Jersey Zn.	N. Y. Curb	120	117	120	May '21, Q	2.00
Success	N. Y. Curb	*3	*1½	*2½	July '16,	03
Yellow Pine	Los Angeles			*55	Sept. '20, Q	03

Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	⅝	½	½		
Alaska Juneau	New York	1¾	1½	1¾		
Carson Hill	N. Y. Curb	....	....	13½		
Cresson Consol. G.	N. Y. Curb	1⅞	1¾	1 13/16	June '20, Q	$0.10
Dome Extension	Toronto	....	....	*75		
Dome Mines	New York	17½	14¾	16⅞	Apr. '21, Q	.25
Golden Cycle	Colo. Springs	*70	*70	*70	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*7	*6½	*7	Dec. '19,	.05
Hollinger Consol.	Toronto	7.20	7.08	7.19	Feb. '21, M	.05
Homestake Mining	New York	55	54¾	55	June '21, M	.25
Kirkland Lake	Toronto	*43	*40	*40		
Lake Shore	Toronto	1.30	1.13	1.13	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.90	1.85	1.85	Jan. '21, K	.05
Porcupine Crown	Toronto	*16½	*13	*13	July '17,	.03
Portland	Colo. Springs	....	....	*59½	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	*4½	*3	*4	May '19,	.05
Silver Pick	N. Y. Curb	*10	*6	*8		
Teck Hughes	Toronto	*12	*11¼	12		
Tom Reed	Los Angeles	*76½	*68	*69½	Dec. '19,	.02
United Eastern	N. Y. Curb	2 9/16	2 7/16	2½	Apr. '21, Q	.15
Vindicator Consol.	Colo. Springs	....	....	*37½	Jan. '20, Q	.01
West Dome Consol.	Toronto	*6½	*6	*6½		
White Caps Mining	N. Y. Curb	*7	*5	*6		
Yukon Gold	N. Y. Curb	1⅛	1	1⅛	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*20	*16	*20	Apr. '20, M	.03
Batopilas Mining	New York	¾	⅝	⅝	Dec. '07, I	.12½
Beaver Consol.	Toronto	....	.	*30	May '20, K	.03
Coniagas	Toronto	....		1.70	May '21, Q	.12½
Crown Reserve	Toronto	*9½	*9½	*9½	Jan. '17,	.05
Kerr Lake	Boston	2⅞	2⅞	2⅞	Apr. '21, Q	.12½
La Rose	Toronto	....	..	*20	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	....	....	*20	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.15	1.11	1.11	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4½	4¼	4½	Apr. '21, Q	.15
Ontario Silver	New York	4	4	4	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	....	....	2	Jan. '12,	.10
Peterson Lake	Toronto			*5	Jan. '17,	.01½
Temiskaming	Toronto	*21	*21	*21	Jan. '20, K	.04
Trethewey	Toronto	*16½	*15	*15½	Jan. '19,	.05
		GOLD AND SILVER				
Atlanta	N. Y. Curb	*1	*1	*1		
Barnes-King	Butte	‡....	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*55	*44	*52		
Cashboy	N. Y. Curb	*5	*4	*5		
El Salvador	N. Y. Curb	....	....	½		
Jim Butler	N. Y. Curb	*9	*7½	*8½	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*6	*4	*5	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	¼		
MacNamara M. & M.	N. Y. Curb	*15	*15	*15	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	30
Tonopah-Belmont	N. Y. Curb	1⅛	1	1⅛	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1¼	1	1 1/16		
Tonopah-Extension	N. Y. Curb	1 5/16	1 3/16	1 3/16	Apr. '21, Q	.05
Tonopah Mining	N. Y. Curb	1⅛	1⅛	1 1/16	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	¾	¾	¾	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N. Y. Curb	*10	*9	*9½	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	‡		1.10	Dec. '21,	15
Chief Consol.	Boston Curb	2½	2¼	2¼	May '21, Q	05
Consol. M. & S.	Montreal	15	12½	12⅝	Oct. '20, Q	.62½
Daly Mining	Salt Lake	‡		1.50	July '20, Q	10
Daly-West	Boston			2¼	Dec. '20, Q	25
Eagle & Blue Bell	Boston Curb	....	....	2	Apr. '21, K	.05
Electric Point	Spokane			*7	May '20, SA	03
Federal M. & S.	New York	5½	5½	5½	Jan. '09,	1.50
Federal M. & S., pfd	New York	22½	21½	21½	June '21, Q	1.00
Florence Silver	Spokane			*12½	Apr. '19,	01½
Grand Central	Salt Lake	‡		*07½	June '20, K	03
Hecla Mining	N. Y. Curb	4	3½	3½	June '21, Q	08
Iron Blossom	N. Y. Curb	1/16	1/16	1/16	Apr. '20, Q	02½
Judge M. & S.	Salt Lake	‡		3.00	Sept. '20, Q	12½
Marsh Mines	N. Y. Curb	*5	*4	*5	June '21, I	02
Prince Consol.	N. Y. Curb	⅛	1/16	1/16	Nov. '17,	02½
Rambler-Cariboo	Spokane	*4	4	4	Feb. '19,	01
Rex Consol.	N. Y. Curb	*7½	7	7½		
South Hecla	Salt Lake	‡		*3	Sept. '19, K	15
Standard Silver-Ld.	N. Y. Curb	⅛	⅛	⅛	Oct. '17,	05
Tamarack-Custer	Spokane	1.85	1.80	1.80	Jan. '21, K	04
Tintic Standard	Salt Lake	‡		2.40	June '20, Q	10
Utah Apex	Boston	2½	2	2	Nov. '20, K	25
Wilbert Mining	N. Y. Curb	3	2	3	Nov. '17,	01
		QUICKSILVER				
New Idria	Boston	†*50	†....	*50	Jan. '19,	.25
		VANADIUM				
Vanadium Corp.	New York	28½	25½	28	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	55	39½	46	Apr. '21, Q	1.50
Asbestos Corp., pfd.	Montreal			78	Apr. '21, Q	1.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	36¼	32¾	35¼	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf.	New York	70	67	68½	June '21, Q	1.75
Am. Sm. pf. A	New York	70	69	69	Apr. '21, Q	1.50
U. S. Sm. R. & M.	New York	29½	29	29	Jan. '21, Q	50
U. S. Sm. R. & M. pf.	Boston	40½	39½	39½	Apr. '21, Q	87½

---

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annualy. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
CLEVELAND ABBE, Jr.
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, July 9, 1921 *Number* 2

Fake Assays and Assayers

RECENTLY an assayer told us the following story: "A fine old gentleman was in our establishment not long ago to receive the returns upon a sample which he had left with us several days before. As he looked at the certificate he asked me: 'Are you sure you are right?' On my reply he said: 'I believe that you are,' and drew a number of assay certificates from his pocket and handed them to me. They all indicated returns of approximately $8 per ton. My assay return was 10c. per ton on the sample submitted. It appears that the old gentleman in question had drifted several hundred feet on the strength of the false returns, and on attempting to interest others in his prospect had been told to submit a sample to me, and, if it gave similar results, that the parties would take over the prospect and continue the work."

This is a single instance of a kind of fakery that is more or less common. Another instance brought to our attention is the case of a local "assayer" in a Western state who claimed to have found tin in certain rocks. He pretended that by means of a special method unknown to other assayers he could find tin where other assayers could not. It is stated that the money for tin assays in this locality amounted to a large sum per month and was the source of considerable profit to the assayer in question. Investigation exploded the business temporarily, but the "assayer" began to give returns upon platinum, and spread the contention that no ordinary assayer or chemist could determine platinum in rock—only a chemist from the Ural Mountains conversant with platinum ores could do the trick.

Along with these false contentions we list the "colloidal gold" fake. This is in effect that the gold occurs in such a condition that the ordinary fire assay will not indicate it and only by some preliminary "secret treatment" is it possible to get the "gold." The "secret treatment" is of course known only to the faker.

Analytical and assaying methods have been developed to a high state of efficiency. There are many competent and conscientious chemists and assayers who can give accurate returns. The statement that only by special methods unknown to others can certain metals be determined is in itself questionable and should be further investigated before mining work be undertaken on the basis of "assay reports" issued under such a premise.

For the accurate determination of the presence of platinum the U. S. Bureau of Mines has published a satisfactory method in *Technical Paper* [illegible]. A competent assayer or chemist can readily apply this method. There is no necessity for a "chemist from the Ural Mountains." "Gold ores" which do not yield gold by the fire assay in the hands of a competent assayer can be viewed with a high degree of suspicion.

It is unfortunate that the law generally overlooks these petty knaves and that worthy persons are frequently misled by them. If such prospective victims would make inquiry as to who does the chemical and assaying work for established mining companies, they could get in touch with reliable chemists and assayers and thus protect themselves from fakery. Another effective way is to crush a sample to fineness, carefully mix it and divide into two portions, each of which should be sent to different assayers. A marked discrepancy between the two returns should result in further sampling and inquiry as to the reliability of the assayers in question.

The Tax Situation

THE FOLLOWING NOTES on taxation are not our own; they are the impressions of an expert, who, however, is not anxious to put out under his name any statement:

"The matter of primary importance to every tax payer is economy in government expenditures. This is the factor that is going to determine how much revenue must be raised by taxation, and the form which taxation shall take.

"As to the excess-profits tax, it is wrong in theory and practice, and should be abolished. This also seems to be the general sentiment. The mining industry is in the same boat as to the inequities of this tax as other industries are.

"As a substitute for the excess-profits tax, there has been an extensive propaganda for some form of a general sales tax, on the supposition that in this manner something over two billion dollars can be raised without any one feeling it. Of course, the very arguments which are used to gain support for this plan from business men furnish the ample reasons for the opposition to it on behalf of the farmers and laborers. As for the mining industry, a tax would, of course, mean that the companies would have to pay more for equipment and supplies. On account of the opposition of farmers and organized labor, this law has not much chance of enactment; and one danger is that the movement for it may result in the retention of the excess-profits law, because the sales-tax advocates are continually presenting the matter as being a choice between the two forms of taxation.

"As to the income tax, the outlook is that we must accept it as a permanent feature of our Federal tax system. Individual incomes will probably continue to be taxed for many years on substantially the basis of the present law, with the possible reduction of the higher surtax rates in order not to drive the larger incomes into tax-free bonds. If the excess-profits tax is abolished, it seems fairly evident that some form of straight income tax will be imposed on corporations, which will be much higher than the present 10 per cent rate. It also seems possible that some form of undistributed profits tax may be imposed upon corporations, as a curb upon the practice of leaving profits undistributed to avoid bearing individual surtaxes or dividends.

"There seems no reason to anticipate any change in the capital-stock tax law: but the question is now definitely up for consideration by the Treasury Department as to whether there is any reason why the valuations used to establish depletion allowances should not form the basis for the capital-stock assessment.

"Some changes will probably be made in special excise taxes on business, repealing some, and perhaps adding some others. The tax of greatest interest to the mining industry is probably that on freight. There is a distinct movement for its repeal, which the mining industry would do well to join.

"The question of 'depletion' and that of 'discovery' are of great importance to mining companies. The principle of depletion seems firmly fixed, with no probability of essential change. But the principle of 'discovery' is not so well established, and there is not even any clear recognition of what the 'discovery' clause in the existing law really means, either in theory or in practice. The principle is, of course, a justifiable one, for a mining company is compelled to dispose of its capital in the ordinary course of its operations, and, therefore, is entitled to a special consideration over what is extended to ordinary business, which may retain its capital intact. It is, therefore, gratifying to note that there is, at the present time, no particular move for a repeal of this special provision."

The Institute's Committee Plan

IT IS A QUESTION whether the Institute's plan for organizing committees is the best one. We refer to the practice of naming large committees, which, on account of their numbers, often become sleeping committees, indefinitely asphyxiated, awaiting the touch of the Prince Charming who never arrives.

The committee on mining methods has fifty-one names on it; and if it is like some other committees we are more familiar with, it is an almost safe bet that there are a lot of these men who have forgotten that they are on the committee. We know of cases where men have "served" on Institute committees for years, and the only activity in which they participated or had the opportunity to participate in was reading their names in the long list of committee members. Such a condition must be discouraging to those chairmen who tire of trying to be ornamental, and feel their conscience or natural pep urging them to the game as well as the name.

What operative effect do these ponderous lists have in general? Should not these committees be overhauled once in a while, say once in five years, and those members who have not been heard from during that period fired? Possibly we get it wrong, however; maybe we have the wrong idea: very likely the idea is simply to have a roll of honor. If, and when, activity is desired, smaller committees would have the effect of throwing responsibility on the members and getting action; or in being exposed, in the fierce light which beats upon a small group, as sleeping at their posts.

We do not wish to be understood as preaching a pernicious gospel of work, as compared with the greater glories of sunshine and peace; we know it is easy to work oneself into trouble. That is the great secret of success in Government employment—be dignified, not busy. The less you do, the more you have on hand and never finish; the less trouble you make, the more you portend. The Institute knows what it is about—whether it wants to encourage hard, disagreeable work by its committees, or the calm blaze of glory and the sweet twilight of self-satisfaction. If the former, then the system should be changed.

Science, Journalism, and Hypocrisy

"I HAVE THE HONOR of informing you that you have been nominated for membership in the National Geographic Society by a member of the society."

Doubtless you have received one of these flattering announcements. It gave you a thrill of pleasure to realize that your prominence in various matters had brought such recognition to you that a member of a national scientific society had nominated you for membership in it.

Of course, nomination in a national scientific society is one thing, and election is another. But there seems to be considerable confidence on the part of the secretary of the society, who has written you this personal letter, and who adds, "Please give your name exactly as you wish it to appear upon the membership certificate which will be sent you when your nomination is confirmed."

What does this really mean? It really means that you are being asked to subscribe to the *National Geographic Magazine*, at $3.50 a year. But this is the way it is put: "The annual membership fee is $3.50. There is no initiation charge and no appeal for contributions nor any other financial outlay. Membership gives you the right to nominate your friends for membership in the society."

What are the qualifications for membership in the National Geographic Society? Three dollars and a half. What else? Three dollars and a half. Is it an honor, a distinction, as the invitation implies? "Your membership makes you one of a group of persons of distinguished educational, engineering, industrial, and scientific service." Is that true? It is absolutely false. Your membership makes you one of a group, each of whom has three dollars and a half. Nothing more? Nothing more. But membership will give you "the right to nominate your friends for membership in the society." What does that mean? That means that you have the privilege of getting new subscribers for the Geographic Magazine at three dollars and a half per. Have you that privilege without becoming a member? Why, certainly. The three dollars and a half is the point.

Is the magazine worth three dollars and a half? It is: it is an admirable, interesting, instructive, and artistic highly popular magazine; it is worth the money. It has, we understand, over seven hundred thousand subscribers, each of whom is also, by value of his three dollars and a half, a member of the National Geographic Society; and if he is a fool, as many of us are, flatters himself that he is "one of a group of persons of distinguished educational, engineering, industrial and scientific service." "Who's Who in America," which is not exclusive, having included us and all our friends, can find only 23,443 persons of this class.

In the prospectus of the society it is stated that, "The society requires that those whose names are placed in nomination by one already a member—thereby vouching for their eligibility—shall be persons of good standing in their respective communities, and possessed of a sincere interest in matters geographic." To the best of our knowledge and belief this is absolutely untrue. The society only requires that you have three and a half—and give it up.

The whole thing is a smug hypocrisy to get your subscription. True, this is no commercial venture. Anything left over from the 700,000-odd subscriptions, after the costs of the magazine are paid, goes to worthy objects—expeditions and the like. But the false pretenses under which you are solicited prostitute the dignity of Science on the one hand and of Journalism on the other. It is a good business trick. We can see how it would work. Instead of sending out appeals for subscriptions to the *Engineering and Mining Journal* "Every man interested in the mining industry should read the *Journal;* subscription $5," how much more enticing a bait it would be if we should write under the letterhead of "The National Geognostical Society": "I have the honor of informing you that you have been nominated for membership in the National Geognostical Society by a member of the society. The annual membership fee is $5. Membership gives you the right to nominate ycur friends for membership in the society. Your membership will make you one of a group of distinguished geognosticians—carefully selected metallurgists, geologists, and famous mining engineers of not only national but international reputation. You will also receive fifty-two times a year, the publication of the society, the *Geognostical Journal*, formerly known as the *Engineering and Mining Journal*." Surely, simplicity and candor do not pay; our methods have brought us 10,000 subscribers, the humbuggery of the *National Geographic Magazine* has rounded up 700,000.

If you "have a sincere interest in matters geographic," as the prospectus states, you will be interested in the beautiful specimen photographs from the magazine, shown in the prospectus. They include the Giant Apeape Plants, a Czechoslovakian Beauty, Flags Famous in Early American History, the male and female of the Mallard Duck, Barnyard Grass (magnified thirty diameters), Cæsar's Mushroom (edible), the Common Skunk, the Night Blooming Cereus, the Portuguese Man-of War, and the Smooth St. Bernard. The ramifications of National Geography are indeed various. In our proposed *National Geognostical Journal* we would be accordingly warranted in publishing color pictures of Georges Carpentier, Sunset in the Bronx, the Common Mining Shark, and the Curb Market.

The Republic of Canada

THE RECENT STATEMENT of Lloyd George that the dominions of the empire were henceforth to be regarded as separate nations is a highly significant one, which must be interpreted as marking a historical event. It signalizes the climax of a natural growth which has taken place durirg the last decade and become especially noteworthy during and after the Great War. And Canada's decision to send a minister to Washington, which move will, of course, be reciprocated by the United States, marks the change as something more than one of sentiment and point of view.

The emerging of the Republic of Canada from the incompetent chrysalis is a pleasurable event for Canada, for the United States, and for the welfare of the world. It does not mean that the union between Canada and the mother country will be any weaker than before: on the contrary, the firm holding together between the the dominions and England, so necessary for the world's peace and progress, will be firmer under that strong bond which unites mutually respecting and self-competent equals than it ever is with the relations between superior and inferior.

The government of Canada is a republic, like our own: both less democratic, we are frequently told, than that of England—though we believe this largely a figure of speech. The Governor-General is a figurehead, like the King in England—a symbol of the past, a flag, a link that binds the English-speaking peoples outside of the United States, in wholesome sentiment, together.

Canadians and Americans are so difficultly distinguishable that neither thinks of the other as being of a foreign nation, for the trend of sentiment and evolution is similar on both sides of the longest international frontier in the world, and a frontier in which neither nation has taken any precaution against possible unfriendliness on the part of the other. The interests and inherited sentiment are similar, and business interests are interlocking. The nation on the North has a far closer appreciation of the problems of the Western hemisphere than have the inhabitants of the British Isles, engrossed in Continental affairs; and Canada, Australia, and New Zealand realize that they are, first of all, Pacific-fronting nations, like the United States, while the folks back home have much the same attitude as to Pacific problems that the inhabitants of our own Central States did toward the menace to our Atlantic Coast.

It is only a question of time before the minister for Canada will become an ambassador. During the war, Canada had her own mission in Washington, distinct from the British mission; and matters relating to mining and mineral supply were thus directly handled between the two countries.

The Activity of Mr. Rice

IT NEVER PAYS to be hasty. Back in January, 1920, many were congratulating each other that the indefatigable George Graham Rice had at last got in Dutch up to his neck, so to speak, over a paltry seven or eight hundred dollars belonging to a lawyer in the Middle West—this after doing a rousing business of $35,000,000 in 1917 and 1918. George was convicted of grand larceny on Jan. 29 last year and sentenced to three years in Sing Sing, but—so far, that's all. George is very much at liberty, pending his appeal.

Tender shrinking natures wither under the fierce heat of public wrath. Rice is hardier, and merely faded away to germinate later in Reno and San Francisco. Incidentally, punning is impossible with Rice's real name, which is Jacob Simon Herzig. The affairs of Rice and of the Fidelity Finance & Funding Co., which is linked with the Broken Hills Silver Corporation, we have discussed befo:e, and time has not sanctified them.

The curtain rises again, now in Salt Lake City. The Bingham-Galena Mining Co., incorporated to work the old Silver Shield holdings, together with certain other properties, has managed to secure a stock-selling permit from the State Securities Commission, despite numerous protests, including one by the Utah chapter of the American Mining Congress. The company plans to contract with George Graham Rice or his company at Reno, which is the same thing, to market [illegible] shares. Hence the protest. But apparently Rice has scored again. It is said that a majority of the Salt Lake Stock Exchange favor the proposition. Apparently they should worry! Let George do that—or better, leave it to the public.

WHAT OTHERS THINK

Not Even a Correspondence School Engineer

While reading the communication of E. M. Gleim in the issue of May 28, on "Self-Education," I am constrained, though with hesitancy, to make a few comments. I have the highest possible regard for a graduate mining engineer of any of the good mining schools, who is really an engineer and a *man.* I am not a graduate of any school, though I tried hard to get through Harvard and the Boston—now Cambridge—Technology. I also started studying with the I. C. S. to become at least "Only a Correspondence School Engineer." I did not even complete that. But I have read much and always hoped to have the cash to return to Harvard or M. I. T.

For a number of years I tried to sell mines, scattered all over the West, to large interests. I sold none, but I learned much, very much, of mining, promoting, and the duplicity of men when much money is involved. I also received the stereotyped "We are not now interested but thank you for bringing it to our attention." My only returns to date. To my present knowledge a number of the mines I tried hard to interest various large interests in, but which turned them down for me, have since been taken hold of by others and made into paying mines.

Several years ago, while returning with the resident and chief mining engineer of a certain very large mining company, from looking over certain mining ground near Butte, Mont., said chief engineer remarked, upon beholding the bold outline of the School of Mines on the hill, that soon those men would receive their degrees as E. M.'s. A certain per cent would be "shofurs," a certain per cent grocery and certain other clerks, etc., with a "residue" of about 10 per cent who would really become mining engineers. But I hope this statement will not discourage any young engineer. Some years ago I met a mining engineer who spent several years "scouting" in South America for a large mining company, presumably to locate a mine his people might purchase. He never found one, poor boob. Since then many large and rich mines have been opened up. This *educated engineer* quit mining and opened a hardware store! I know others who should "go and do likewise."

As to the "Relativity" of remuneration for an engineer and a promoter, I might cite one instance: I had a good engineer and a fine fellow make a report for me on a certain mine for a contingent fee of 10 per cent of my commission in the event of a sale. This would have given him, a graduate engineer, $10,000, and $90,000 to myself, not a graduate engineer. This difference is not accounted for because of my excessive greed, but because I had the "gumption" to undertake big things. The great trouble with graduate young engineers is that they have so much "book" knowledge that it is so easy to drop into some salary job from school, and so many of them resign themselves to mediocrity for life. If only such chaps had "guts" and ambition enough to get out and prospect for even a year or two! Even if they had to do as old-time prospectors: work a while for a grubstake. Even now I must work for a time for a grubstake to go out after some very promising things. I will yet make millions while many finely educated fellows will work for a salary simply through lack of ambition and love of a "sure thing *job.*" All possible credit to a "School Education," but one can accomplish wonders at self-education when circumstances are such that one can do no better.

If I have large mines, etc., to operate I can hire plenty of technical men. My mining experiences are not of a namby-pamby sort. I have had lots of hard knocks and injuries. I trust that these rather rambling observations—if printed—will put some ambition into some really educated engineers to do more than seek and hold down a mediocre salary "job." Get out and prospect.

Billings, Mont. M. F. GRAUPNER.

How Much of Ball-Mill Liners Are Scrap?

Now that practically all of the mining companies have a chance to take their breath, how many of them using ball mills are taking the trouble to investigate their scrap heaps for the purpose of learning how much of their linings was actually consumed in the grinding of the ore?

It was always my intention to investigate linings to learn how much was worn in grinding and how much went on the scrap heap. For instance, a lining plate for any ball mill may weigh from 50 to 250 lb. when put in the mill. If the 50-lb. plate were discarded because of its having a hole in it, and the scrap weight was 25 lb., the loss would be 50 per cent. If the 250-lb. plate, when discarded, weighed 125 lb., the loss would still be 50 per cent. In both instances, entirely too much metal is thrown on the scrap heap. In either case, the thickness of the plate might be changed to advantage.

Assume the heavier plate is 2 in. thick on both ends. One end wears down to approximately ½ in. before a hole develops. The other end still remains at 2 in., but the life of the plate is determined by the end that wears out first. Now, if some of the metal were removed from one end and placed at the end where the greatest wear occurs, the life of the plate would be lengthened and the size of the scrap heap diminished, with the resulting decrease in the lining cost per ton of ore ground. Some lining plates do not wear on the ends but in other places, but in any event the result is the same. Too much metal goes on the scrap heap.

Simply to add a lump of metal to the place where the most wear occurs will not solve the problem, for the reason that if the lump is considered as a little hill at the point of greatest wear, the balls would then strike the hill and divert the wear to other parts of the plate. It is probable that the plate well balanced for wear would not be lumpy, but the face would probably have the same contour as originally designed, with the exception that the part receiving the least amount of wear would be made thinner and the part receiving the most wear would be thicker.

At any rate, it might be interesting for a good many mine managers to weigh up some of the lining plates now on their scrap heap and check against the original weight, which might easily be obtained from the manufacturer. While they had their hand in, they might just as well ascertain how much carbon, chrome, nickel, or other alloys are in the plate, then look up their records and see what it was supposed to be when bought.

New York. EDW. W. LAWLER.

ENTRANCE TO HARBOR OF RIO DE JANEIRO, BRAZIL, SHOWING PART OF CITY

Brazil as a Mining Country

Region Poorly Mapped and Partly Unexplored—Railroad Facilities Inadequate, Waterways Being Largely Used—Morro Velho and Passagem Gold Mines Described—Manganese and Iron Resources Great—Potash, Oil Shales, Diamonds and Other Precious Stones Occur

BY GEORGE A. PACKARD
Written for Engineering and Mining Journal

BRAZIL, the largest country to the south of the United States, is not as well known as it deserves to be. Just prior to the war it had been visited by a number of engineers from other countries, and several properties had been taken under option, but, with the war to be financed, no money was available for exploration and development, and most of the options were dropped. The notes and maps here presented are offered in the hope of aiding those who desire to learn something of the country, and especially for the information of those planning to visit Brazil. Dr. John C. Branner, E. C. Harder, and doubtless many others, are better fitted to supply information concerning Brazil, for they have spent years in that country to my months. Dr. Branner is certainly *persona grata* there. His work has covered not only the geology of Brazil, but a study of other natural sciences. His map of Brazil and accompanying outline of the geology[1] is the last word, and represents a large part of the work of a lifetime. Brazil and every visitor interested in geology and mining will always be his debtor. To him also may the expectant visitor turn for a knowledge of the Portuguese language. His grammar[2] and thirty lessons enabled me to sojourn for days without an interpreter, and to comprehend the description of ore deposits given me. The language modifications of the interior will be found more difficult than the correct and carefully spoken words of thoughtful officials.

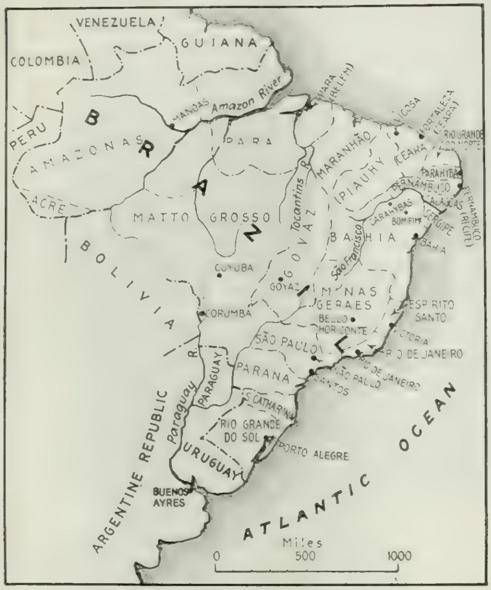
For geological information the Serviço Geologico of the Ministerio da Agricultura at Rio Janeiro fills the place of the U. S. Geological Survey. Here Dr. Gonzaga de Campos and his assistants are willing to give any information that they may have. One of Dr. de Campos' assistants, Dr. Horace E. Williams, was formerly with the Arkansas Geological Survey. He is a mine of information, not only concerning the geology and minerals but also as to the customs and food of the interior and the best methods of combating the mosquitos and other annoyances. He has recently contributed to our literature on Brazil, and it is to be hoped he may favor us further.

---

[1] "Outlines of the Geology of Brazil to Accompany the Geological Map of Brazil," Bulletin of the Geological Society of America, Vol. 30, pp. 189-338. A review of this with data, "The Economic Geology of Brazil," by Dr. B. L. Miller, appears in *Engineering and Mining Journal*, Vol. 109, p. [illegible]

[2] "A Brief Grammar of the Portuguese Language," published by Holt & Co.

The officials of the federal and state departments of agriculture, by whom mining matters are administered, will be found most willing to give information and aid. General information concerning the country and its geology is somewhat limited. Dr. Branner in his latest work has a brief bibliograhphy covering each state. This supplements a more complete bibliography published in 1909[3]. Miller and Singewald[4] have a brief outline of the geology, with references to the different mineral occurrences and mines.



MAP OF BRAZIL

Financial matters are advantageously handled through the branch of the National City Bank, the local officials of which were found helpful in many ways.

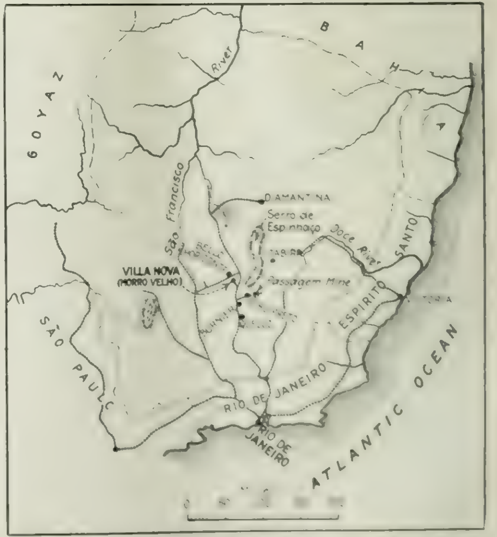
Maps Scarce—Some Parts Still Unexplored

Good maps are rare. Of one or two of the states only mere outline maps are to be had. Some of the country is unexplored. The government maps are prepared by the Ministerio da Viação e Obras Publicas (Ministry of Public Roads and Works), and may be had from various government bureaus if one is properly introduced. Maps of the northern states have been made by the Inspectoria de Obras Contra as Seccas. Topographic maps of portions of Minas Geraes and São Paulo have been prepared by state surveyors. Fairly good maps of some of the states may be purchased from F. Brikuet & Cia., in Rio Janeiro. They are on a scale of 1 to 5,000,000. The government maps are on scales varying from 1 to 1,000,000 up to 1 to 3,000,000. There is a good map on the larger scale of the State of Minas Geraes, in which most of the mining activity has occurred in the past.

Public assay offices, as we know them in the West, do not exist. If one wishes much information of that type it is better to take in a portable outfit. The assay offices at the operating mines may help out, but one does not like to impose on them, and they are not easily reached. The School of Mines at Ouro Preto will do this work, but has not time or facilities for handling large numbers of determinations. Dr. T. H. Lee, chief chemist of the Mines Section of the Department of Commerce and Industry, is a true research scientist. He has done a great deal of work in the analysis and investigation of the rarer metals and unusual minerals so largely found in Brazil.

Mining Law of 1910 Fails To Function—Title Transfers Difficult

Titles to mining property, or to any other, should be carefully investigated by a competent attorney familiar with the subject and the country. It is no job for a United States lawyer. The new law, passed in 1915, and found in various United States publications, unfortunately fails to function. There may be portions of the country where it is applied, but up to six months ago no one knew of them. It is remarkable that so large a part of this big country is owned by somebody, and has been for generations. It probably results from the gift of large areas as "Captaincies" to those to whom the old Portuguese monarchs found themselves under obligations. Anyway, as the result of a heavy tax on transfers of title, it becomes necessary to hunt all the heirs of an owner who may have died fifty or a hundred years ago. At the Morro Velho I was told that two heirs had recently turned up for a portion of the mine operated by the St. John del Rey company for nearly a hundred years. It took four years to get title to additional property recently acquired.



MAP OF MINAS GERAES, BRAZIL, SHOWING LOCATION OF MORRO VELHO AND PASSAGEM MINES

The system of taxation must be considered in estimating costs. The federal government derives its income from import taxes, but each state has the privilege of taxing exports; and this includes not only those exports originating within its borders or those passing across the state by water or railroad. Thus, rubber from the head of the Amazon is taxed by both Amazonas and Para. For large operations a concession can sometimes be obtained covering a period of years.

---

[3] Bibliography of the Geology, Mineralogy and Paleontology of Brazil. Bulletin of the Geological Society of America, 1909.

[4] The Mineral Deposits of South America, published by the McGraw-Hill Co.

Taxes went up in Brazil, as elsewhere, during the war. For example, the tax on manganese ore, which had been 4 per cent of the value, was raised to 8 per cent, and later to 12 per cent. This was based on the gross weight and the "official value." The gross weight includes about 6 per cent moisture, and also 2 per cent which is lost in transportation and reloading. The "official value" also does not always take into account the difference between the metric and the long ton, or fluctuations in prices.

Fairly satisfactory supplies are obtainable at the larger coast cities. If one prefers a good light folding cot to a hammock, it is better to take it from New York. Canned vegetables and fruits may be bought if desired, but the country furnishes a large variety of excellent vegetables and fruits. The native fare of rice, mandioca, and beans is not bad. Several white suits are desirable. The usual precautions for tropical countries are in order, but much of the country is healthful, free from malaria, and has an agreeable climate.

Waterways Much Used in Absence of Rail Facilities

The railroad rarely penetrates more than three hundred or four hundred miles from the coast, and much traveling is by water or on muleback. The only exception is in the approximate latitude of Rio Janeiro, where there is a railroad nearly to the Bolivian line, about a thousand miles. Water transportation is of such importance that the curriculum at the Ouro Preto School of Mines includes a course in river navigation. Traveling is much influenced by the rainy season, which comes with the warmer weather, from November to March. Clay soil and few roads mean slow progress overland at this time; but some streams are navigable only in wet weather.

The two northern states, Amazonas and Para, are little known in connection with mining. They lie largely in the valley of the Amazon and close to the equator. Some gold has been found in the highlands near the Guianas.

Coastal Oil Shales From Amazon to Rio

Concerning the states to the south of these, Dr. Williams[1] has recently written as follows:

> In the vast pasture region of the interior south of the twentieth parallel of latitude, granites, gneisses, mica schists, and very old metamorphosed sedimentaries predominate. Later sedimentaries occupy a minor position and, where found in the interior, represent a flat remnantal capping on the older rocks. At several places near the coast they have a greater development and contain considerable beds of oil shale. Such deposits are found in the Permian rocks of central and southern Maranhão, in the Tertiary and Cretaceous rocks along the coast of Alagoas, Sergipe, Bahia, and perhaps farther south in Espirito Santo.
>
> This fringe of sedimentaries, with its conspicuous white or varicolored bluffs, and resulting sand dunes, quickly catches the eye as one approaches the coast south of the mouth of the Amazon, and continues nearly to Rio Janeiro.

From the states of Maranhão, Piauhy, Ceara, and Parahyba come reports of copper deposits which appear to have some possibilities. One near Viçosa, in Ceara, is said to have been under option to a United States company before the war. The story as told is interesting. I cannot vouch for the truth of it. This vein is said to occur in quartzite and to have a width of three to six meters. It is exposed for about a kilometer in length and is claimed by two parties. The old land grants were separated by a line running "to the plain" (*sertão*) from a well-defined tree on a ridge. One party claims the line runs from the tree in the direction which will reach the plain in the shortest distance, which is northwesterly. The other party claims the line should run northerly and southerly from the tree, the idea being that all lines run north and south, or east and west. The copper occurs in the angle made by these two lines. The antagonism between the two parties is such that one party declines to sell to any one who does business with the other party; therefore an effort to obtain an option from both parties was a failure.

FREIGHT HANDLING FACILITIES ON DOCKS AT RIO DE JANEIRO

Potash Found in Northeast Brazil

It is in this section of Brazil that potash deposits were discovered during the war, and I am told a concession for the mining of these is still retained in the United States. Fine specimens of columbite, mica, and wonderful pieces of rose quartz are shown from this part of the country. Some zircon minerals are also found here.

Passing southward into the State of Bahia more attention is given to mining. Here, near Bom Fim, W. H. Staver mined a large quantity of manganese ore for Lavino & Co. during the war, and there were many other smaller operations. Some of the manganese deposits of Bahia have been described by Dr. Branner[2] and by W. H. Staver.[3] Here are the diamonds, graphite, mica and saltpeter referred to by Dr. Williams. The Caraheyba copper property in Bahia is claimed to carry about 2 per cent copper and to cover a large area. It was under option in 1918, but after a little work was done the option was dropped.

To the south and west is the great central plateau extending into Minas Geraes, Goyaz, and Matto Grosso. Here diamonds and gold have been found, including a gold-bearing conglomerate which somewhat resembles that on the South African Rand. However, comparatively little gold mining has been done within the limits of the State of Bahia. Most of the black diamonds, or "carbons," come from Bahia. The government gives the production as from twenty to forty kilograms per annum.

---

[1] [illegible] 1920.

[2] [illegible]

[3] [illegible]

Another unusual mineral product, monazite, is obtained from the sands found along the coast of Bahia and of Espirito Santo, to the south. These sands are washed and concentrated magnetically, yielding a 90 to 95 per cent product. In addition to the thorium, the sands carry large quantities of cerium, as well as yttrium and lanthanum. Prior to the war their export was controlled largely by Germans. They were originally discovered, and for a long time shipped as ballast without paying any export duty, by a North American, and in recent years he has had a concession under which all shipments were obliged to pay him royalty if they originated within a certain territory.

MUCH MANGANESE ORE STOCKED ALONG CENTRAL OF BRAZIL RAILROAD

As may be seen on the map, Minas Geraes is separated from the Atlantic by two narrow states, Espirito Santo and Rio de Janeiro, neither being over 100 miles wide at any point. Approaching Rio, the overlying sedimentaries have been eroded, and the crystalline basement complex is exposed in a topography rarely equaled for scenic beauty. This is a rough country, and the Central of Brazil railroad, which supplies transportation from Minas Geraes to Rio, has many steep grades and sharp curves. Partly for this reason, and the resulting inability of the railroad to handle a large tonnage, thousands of tons of manganese ore mined during the war is still to be seen piled up at the mines and around the stations. The largest of these manganese mines, the Morro da Mina, near Queluz, has recently been purchased by the U. S. Steel Corporation. It has been described by Singewald and Miller.[9]

In this district, the ore, largely pyrolusite and psilomelane, occurs as lenses in the crystalline complex. As mined and shipped, with little sorting, it runs around 49 per cent manganese. At the time of my visit a fifth lens had been found, and the proved tonnage was in excess of 10,000,000. During one year of the war, shipments were approximately 300,000 tons. The deposits lie on a hill, and up to last year were worked by open-cut methods, though a tunnel has been driven about 300 ft. below the top of the hill, and from it raises have been made to the surface, preparatory to "milling" the ore down through them. The overburden rarely appears to be more than 20 ft. deep, and this too carries more or less manganese. The cost of mining should drop below 75c. a ton when the effects of the war decrease. The freight to Rio Janeirô, which was formerly 6 milreis, or about $1.50, a ton, had been raised to 22 milreis, or $5.50, but a decrease had been promised in 1920.

A ROAD IN THE INTERIOR OF BRAZIL

GOLD-BEARING SCHISTS AT JAMBEIRO, MINAS GERAES, BRAZIL, FORMERLY MINED. THESE ARE MINED AT MORRO VELHO

Further north are many other manganese mines in the overlying Algonkian quartzites and schists. These deposits, and some of those of Bahia, have been described by Harder.[10] These are near Burnier, Ouro Preto, and to the north. It is claimed that the phosphorus runs higher in the Bahia ores than in those from Minas. The average at Morro da Mina has been about 0.07 per cent. At the Wigg mine, near Burnier, it is less. The total production of manganese ore in Minas ran up to 550,000 tons in 1917.

Probably the most important mineral source of future wealth in Brazil is the iron ore. These ores have been described by Dr. Derby,[11] E. C. Harder,[12] and others. Harder says[13] that this district in Minas Geraes is roughly 100 miles square, with an aggregate tonnage up to three and a half billion. He states: "The principal orebodies occur as huge lenses interbedded with extensive layers of siliceous [illegible] iron-bearing formation, known as itabirite. . . . Another type of ore [illegible], occurring in surface 'canga' deposits formed by the weathering of the iron-bearing formation, is known as canga." Hard and soft ore are found in the interbedded lenses, the former averaging about 69 per cent iron, low in silica, and less than 0.02 per cent phosphorus. The soft ore contains from 60 to 68 per cent iron. The *canga* ores range up to 65 per cent iron and 0.1 to 0.3 per cent phosphorus. This iron district is about 225 miles north of Rio Janeiro and 250 miles west of Victoria. English, American, French, German, and Brazilian companies have investments there. To solve the transportation problem, an English company, in which the Rothschilds are interested, is building a railroad on a water grade up the River Doce from Victoria.

---

[9] "The Manganese Ores of the Lafayette District, Minas Geraes, Brazil," A. I. M. E., Vol. LVI, p. 7.

[10] "Manganese Ores of Russia, India, Brazil and Chile," A. I. M. E., Vol. LVI, 1916.

[11] "Iron Ore Resources of the World," International Geological Congress, Stockholm 1910.

[12] "The Iron Industry in Brazil," A. I. M. E., Vol. L, p. 143.

[13] "Certain Iron Ore Resources of the World," A. I. M. E., Vol. LVI, p. 116.

Harder and Chamberlin have made a thorough study of the geology of this region.[12] Much of central and western Minas Geraes lies in the basin of the São Francisco River, a stream flowing north through Bahia. This drainage is separated from that of the stream flowing more directly into the Atlantic by the Serra de Espinhaço, or Back Bone Range. To the east of this igneous rocks are dominant; to the west the plateau is underlain by both igneous and sedimentary rocks.

GOLD MINED IN MINAS GERAES BY EARLY PORTUGUESE

In the vicinity of this range the gold ores occur in the quartzites, schists, and iron formation, and occasionally in the crystalline complex. H. K. Scott[13] gives a good general description, with the details of some mines. In the same volume[14] Dr. Derby, the late head of the Geologico Serviço, discusses the mineral associations.

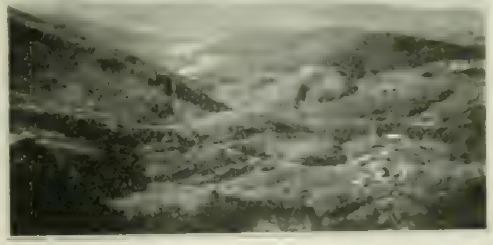
The original discoveries are said to have been made by expeditions sent out to search for silver and emeralds by order of a Portuguese king who had become jealous of the wealth obtained from Peru and Colombia by his Spanish contemporary. The mines were worked on a considerable scale during the eighteenth and early part of the nineteenth centuries, and several hundred million dollars has been taken out. A visit to this region indicates that they were probably worked with slaves, or extremely cheap labor, down to a point where the water could no longer be handled. Some of the old stopes are several hundred feet long. The walls are supported by pillars, which, on assaying, yield so low a value that the ore could hardly be worked at a profit today, with modern equipment, but with present wages. In 1919 only half a dozen gold mines were operating in this section, and of these only two are worthy of mention. Both are operated by English companies.

THE MORRO VELHO MINE

The St. John del Rey Mining Co. originally worked a mine near the town of that name, but in 1834 bought the Morro Velho, now the deepest mine in the world, near Villa Nova de Lima. This is but two hours from Bello Horizonte, the present capital of the State of Minas Geraes, and is connected with the Central railway by a short electric road. The topography is made up of hills, 300 to 700 ft. high, with a reddish [illegible] soil resulting from the weathering of the schists. Where exposed in cuts these are much sheared, dark, thin, and rather schistose. The outcrop of the orebody was long ago removed. The ore chimney dips with the slates at about 45 deg. down to the eighteenth horizon, or 5,400 ft. Below that it has gradually flattened to 30 deg. at the bottom. This chimney was 700 ft. long on the upper levels, but is now mined for a length of nearly 1,200 ft. The width has varied up to 40 ft.

The ore is pyrrhotite, quartz with mispickel, pyrite, arsenopyrite, dolomite, and calcite. An average analysis over a period of eight years was given me as follows: SiO_2, 24.10; Fe, 31.47; As, 2.32; S, 13.52; Al_2O_3, 3.0; MnO, 1.30; CaO, 3.08; MgO, 6.51; Cu, 0.21, and CO_2+O, 14.49.

The pyrrhotite forms nearly 30 per cent of the ore. The gold content is variable, but was averaging about $13 per ton in 1919. The silver is about one-fourth the weight of the gold. I was told that most of the gold occurs with the arsenic and the pyrrhotite, but Dr. Derby states that comparative arsenic and gold curves covering a large number of assays showed divergences quite as frequent as coincidences. There is little gold with the clean quartz, and this is sometimes thrown out on the sorting table.



NEAR MARIANNA, MINAS GERAES, BRAZIL, SHOWING OLD OPEN CUTS AT GOLD MINES

6,300-FT. DEPTH REACHED BY SERIES OF SHAFTS AND CROSSCUTS

The mine is now entered through a long adit to shaft D, which has a depth of 2,200 ft. From the bottom of that shaft there is a crosscut south 1,200 ft. to shaft E, 1,200 ft. deep, then another crosscut to shaft F, and another to shaft G, each 1,200 ft. At the time of my visit the next shaft was down to a vertical depth of about 6,300 ft. The crosscuts serve to overcome the distance covered by the dip of the vein and the rake of the ore shoot. I understand that an incline shaft was started at one time, but was abandoned on account of the change in the dip of the ore shoot. The annual report for 1920 states that because of the flattening of the vein a more economic and rapid scheme of development is proposed. The shafts are started in the hanging wall and pass through the vein into the foot wall. They are circular and 14 ft. in diameter. For the most part the walls stand without timber supports, except at the collar of the shaft. Where there is loose material, steel angle irons, with wooden boards behind them, are wedged in place. There are no [illegible]

[illegible]

[illegible]

[illegible]

hoists. All underground hoists were operated by air, but electricity was under consideration, and electric tramming was being installed.

Despite the great depth, and a rock temperature of 117 deg. at the bottom, the mine is for the most part surprisingly comfortable. An additional installation was being planned, consisting of another exhaust fan half way down the mine and a surface plant capable of reducing 80,000 cu.ft. of air per minute from an initial wet-bulb temperature of 72 to 43.5 deg. F. It is expected that with this completed the maximum wet-bulb temperature in the mine will not exceed 82 deg. C shaft is a parallel shaft, 50 ft. from D, for pipe, ventilation, and for use as an emergency exit. Here a big pump of the Cornish type was making three strokes and pumping 495 gallons per minute. Its duty varies from ⅔ of a stroke in dry seasons to a maximum of 4½ strokes per minute. There is no water below the 2,200 level.

The main drives, termed horizons, are 300 ft. apart. Formerly big stulls were used, but the mine was lost through fire. Later, pillars were left, and the mine was lost through caving. Now 9-ft. slices are worked out and filled with waste brought from the surface. It would seem that the work was expensive, but labor is paid only 50c. to $1.25 per day.

NOVELTIES MARK MILLING OPERATIONS

An endless chain takes the ore cars to the top of the mill, where they are dumped in a frame. The operation of the revolving picking table is a novelty. A half dozen women place the waste in small piles near the edge of the table, and a seventh woman pushes it off when the table has made three-quarters of a revolution. Beyond this are three jaw crushers in parallel, into which men shovel from the table the remaining ore. This is crushed by stamps and passes to canvas tables, of which there are nearly one hundred. It was interesting to see these spread out in this big mill with no one in sight except a small boy riding on an automatic tripper which comes along, shuts off the feed, tips the table on its edge, washes it off, turns it back, starts the feed, and passes on to the next. All the boy has to do is shut off the power if anything goes wrong. These concentrates are washed on vanners, where converging sprays finally deliver a golden stream about the size of the little finger, which is 55 per cent gold, and contains 70 per cent of the gold in the ore. Cone settlers, tube mills, cyaniding, the recovery of the zinc, and the making of a salable arsenic product are other features. At least the arsenic was salable until the Brazilian government increased the export tax.

The last report of this company which I have seen gives costs at 35s. per ton, of which 3s. 4½d. went to pay state taxes. Profit for 1919 was £108,605. However, one questions what this cost covers when one looks at the map and sees the large area of iron and manganese land acquired by this company, or observes that it has set out nearly two million eucalyptus trees.

I did not have the pleasure of meeting the manager, Mr. George Chalmers, but he certainly must be a mechanical genius, as evidenced by numerous appliances about the property, which is evidently managed with considerable foresight.

THE OURO PRETO COMPANY'S PASSAGEM MINE

The Passagem mine of the Ouro Preto Gold Mining Co. is situated near the town of Marianna, and about five miles east of Ouro Preto, the former state capital. In an air line it is about forty-five miles southeast of the Morro Velho. The first stamp mill ever erected on the South American continent was built here in 1819 by Baron Eschwege, a German. The mine has been described by the manager, A. J. Bensusan,[17] and by H. K. Scott (*Op. cit.*).

The lode lies between rather siliceous micaceous schists on the hanging and schistose quartzites on the foot wall. The hanging, called itabirite, has flat hematite scales parallel to the strata, is rather friable, and necessitates considerable care in mining. The ore includes quartz, mispickel, pyrrhotite, and in places a remarkable quantity of fine black tourmaline. This latter, and mispickel, when occurring near the foot wall, indicate ore of better grade. Sometimes the quartzite comes in and cuts off the ore.

Dr. Derby states that there are "included patches of kaolinized feldspar, or of mica," and considers this an extreme phase of granitic dike. The hanging wall is fairly constant, but the foot is irregular. The width varies up to 30 ft., but probably averages 8 ft. The dip is 18 deg. Three incline shafts diverge from the surface, the hoists being on the same platform. These are operated by water power, and hoist at a speed of 800 ft. per minute.

Near the surface the levels are 50 meters apart, but this is increased to 100 meters near the bottom. Auxiliary shafts are sunk from the 600 and 900 meter levels. The lowest level is the 1,040 (about 3,300 ft.). "Galleries" are driven out along the vein until an ore chimney is encountered. This is then crosscut and a raise put up to give an idea of the size. Some of the shoots appear to be 1,000 ft. or more in length. The mining method depends on the size, but because of the character of the hanging wall an exposed surface of 15 ft. appears to be the limiting width. Dry walls are used throughout. Prior to the war arched walls covering the drifts were built for less than $1 per linear foot, including the cost of quarrying the rock from the foot wall.

PASSAGEM ORE CONCENTRATED ON BLANKET STRAKES

The ore is crushed by stamps and concentrated on blanket strakes. These last about three weeks and formerly cost 75c. apiece. Boys clean them every half hour. The concentrates form about 7 per cent of the total weight of the ore and contain 60 to 70 per cent of the gold. They are cleaned and finally treated with nitric acid, I was told. The remaining concentrates, sand, and slimes are cyanided. The milling cost up to 1918 was around $1.25 per ton, including overhead expense. The extraction as 88 per cent. The yield for 1919 is given as £1 12s. 2½d. ($7.82) per ton. The profit for 1919 was £8,835 ($42,850). This is certainly an excellent showing on low-grade ore with the difficulties of 1919.

Women and boys are used in considerable numbers around these mills, some of the women even having shoveling jobs. They are paid from 25c. to 75c., and the boys receive about the same wages. Native men receive from $1 up. Further in the interior of Brazil these figures decrease (they are based on an exchange rate of four milreis to the dollar). Englishmen are numerous in the mills, and as bosses in the mines. They are well paid, and every three years have a five-months' holiday on half pay, with ticket to England furnished.

---

[17] "The Passagem Mine and Works," I. M. M., Vol. XX, October, 1910.

The reopening of other old gold mines was under consideration prior to the war, and some had been unwatered, but practically all of this investigation had been stopped and not resumed up to 1920. Near Passagem, the Maquinée mine was under option to North Americans in 1917, but is now being opened by the company operating the Passagem. Interests from the United States also had an option on several square kilometers near Ouro Preto. At this place, from a vein having nearly the slope of the hill, and from the gravel in the valley below, a great deal of gold was obtained in the early days. The name "Ouro Preto" is Portuguese for "black gold," the color being due to the palladium alloyed with the gold.

Diamond District 100 Miles North of Passagem Mine

Diamond mining is carried on in the region around Diamantina, 100 miles north of the gold mines referred to here. T. H. Lee says[18] that diamonds were discovered in 1728, and by 1731 the industry had developed to such an extent that the European jewelers, fearing the market would be flooded, induced the King of Portugal to give orders to stop work. As a matter of fact the production has never been large. In 1917 the exports were valued at $380,000. Mr. Lee states that the officially declared output is about 20,000 carats per annum, and it is claimed most of the stones are bought by the African producers.

The largest diamond ever found weighed 245 carats, and is reported to be a perfect stone. The majority of the stones have been obtained by washing the gravel of the rivers heading in the Serra do Espinhaço, though deposits of diamond-bearing conglomerate, or breccia, have been worked to some extent in the vicinity of Diamantina. David Draper, who had a large experience in South Africa, has expressed the opinion, in a privately circulated paper, that some of these deposits are undoubtedly breccia, or true pipes, and not conglomerate, as they have formerly been termed. This opinion is also held by A. M. Pontie in a recently published article.[19] Considerable effort has been made to find other pipes, with some success, but not always diamond bearing. The character of the stones is excellent.

Tourmaline, Aquamarine, and Topaz Found

In this same region are also found wonderful tourmalines and aquamarines. One crystal of the latter is described by Dr. Lee as nearly 2 ft. long, 11 in. thick, of a fine sea-green color, and perfectly transparent. Some dark topazes are mined near Ouro Preto, and may be seen with specimens of rock crystal, rutile, and many other minerals and semi-precious stones at the School of Mines there.

This institution, though not equipped like some of our larger colleges, is developing some good laboratories and collections, and has a competent corps of instructors. It must be remembered that the settlement of Brazil has proceeded only as far as that of the United States in 1850, and, as shown by the course in river navigation already referred to, an effort is made to fit the instruction to the condition of the country. Dr. J. C. da Costa Sena, the president, is entitled to congratulations on the work he is doing.

To the south of Minas Geraes is the State of São Paulo. This is the great coffee-growing state, and much manufacturing is carried on. Along the coast of São Paulo the Archean rocks are exposed down to Santa Catherina, extending inland from 25 to 150 miles. In these there has been some gold mining. Further inland they are overlaid with more recent sedimentaries. Some iron and other minerals occur in São Paulo.

Goyaz and Matto Grosso Almost Unexplored

To the west of all these states, but south of Amazonas, lie the great area of Goyaz and Matto Grosso, almost untouched by railroads, and largely unexplored. To some extent they are tapped by the Paraguay and by branches of the Amazon and Tocantins rivers. Gold was mined there one hundred years ago, and a 30-ft. quartz vein was under option to John Taylor & Co. when the war broke out. It is now being explored by an English syndicate. On the rivers of these states some dredging has been attempted, but I believe often with unsatisfactory results; in fact, they are said to have served as the basis of considerable Argentine and English wildcatting. Nevertheless, some North American people have concessions today covering gold deposits of possible value.

CLASS OF 1921 OF OURO PRETO SCHOOL OF MINES, OURO PRETO, MINAS GERAES, BRAZIL

Near Corumbá, at Urucum, is a large deposit of manganese ore which has been examined by several engineers. An analysis of this is given by Dr. Branner[20] and by Miller and Singewald.[21] Some day this will be mined and floated down the Paraguay 1,000 miles in barges and loaded on ocean-going vessels. Were it not for loss of barges at times of high water, competition with wheat exportation, and cost of returning empties, it might even now be handled almost as cheaply as the ore from Morro da Mina. Goyaz has produced some fine mica, and rock crystal is exported from there, but the lack of transportation is a serious drawback.

Principal Copper Mines in Rio Grande do Sul

The three southern states, Paraná, Santa Catherina, and Rio Grande do Sul, contain coal deposits and have produced some copper. The principal copper mines of Brazil are in the last-named state, but production is not large. There are no smelters in that country, and the concentrates have been shipped to England. In this section is found the only coal now mined in Brazil, high in sulphur and ash. From Rio Grande do Sul come the finer topazes and agate, and some diamonds have been mined in Parana.

---

[18] [illegible]

[19] [illegible]

[20] [illegible]

[21] [illegible]

Brazil is our one big brother to the south. No other country approaches it in area, which is almost the same as that of continental United States. Besides its 4,000 miles of coast line, it has thousands of miles of navigable rivers. Its climate varies from that of the tropics to that of North Carolina. Its broad interior plateaus offer wonderful grazing and agricultural possibilities. It has quantities of timber, of unusual and valuable woods.

Manufacturing is already developing. The immense iron deposits are certain to be a source of future strength and wealth. Though lack of coal and oil is a drawback, these may yet be found; and there is much water power. The laborers appear to be really willing to work. How ample the labor supply is I do not know. In the southern and central portions there appeared to be no excess in 1919.

COMMERCIAL OPPORTUNITIES ATTRACTIVE

I saw little of the north. The population there is more largely black. The people are courteous, businesslike, and generally dependable. They may cancel their contracts sometimes, as Mark R. Lamb suggests, but this has happened in the United States. On the other hand, when they ordered newsprint paper from the United States during the war, at high prices plus 20 per cent extra for prompt shipment, some of them waited ten months, and then on opening the bales found they had only wrapping paper. Their feelings for the United States are friendly, but they will not buy our products if European countries offer the same at half the price, and these countries are certainly making every effort to get back their trade.

The favorite word in Brazil is *paciencia* (patience). Though it is suggestive of the Mexican *mañana*, when coupled with perseverance it usually wins in the end. There have never been any revolutions in Brazil worthy of the name. The people of the country made an effort to be real allies in the war. If we of the United States can go down there and, with due regard for their customs and their patience (from which we can certainly learn to our advantage), furnish a little energy and perseverance, the combination should be mutually helpful and eventually hard to beat.

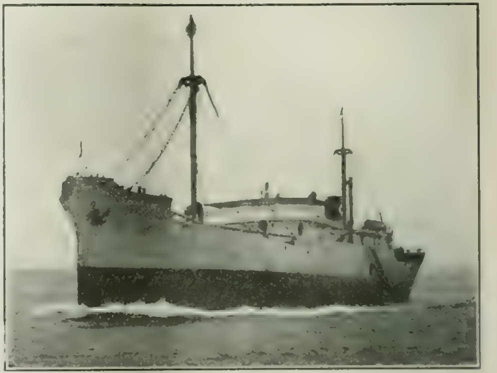
The Production of Leucite in Italy

Homer M. Byington, U. S. Consul at Naples, reports that a deposit of leucite, from which is derived a potash fertilizer, is in operation near Civita Castellana, provincia di Roma, in Italy. The deposit has an extent of about three square kilometers, and up to the present all workings are near the surface. Chemically, the raw product is a double silicate of potash and aluminum, containing 21.5 per cent of potash in the form of an oxide K_2O. The product is valuable as a fertilizer, as the potash is gradually released by the action of water and the weak acids present in plant roots. Leucite is now used extensively in Italian agriculture where formerly German potash was used, and has given excellent results in the cultivation of rice, potatoes, sugar beets, tobacco, rye, oats, and barley. By its use, soils too acid for cultivation have been reclaimed.

A Diesel-Driven Steel Ore Carrier

The construction of a 6,000-ton dead-weight capacity motor ship which has been designed primarily to carry ore between mines in Alaska and Chile and the Tacoma smelter was completed on March 17, 1921, having been built in fifty working days following the laying of the keel last November. The "Kennecott," which is owned by the Alaska Steamship Co., of Seattle (this company being affiliated with the Kennecott Copper Corporation), has an over-all length of 360 ft.; displacement, 8,425 tons; shaft hp., 1,800; indicated hp., 2,400; engine speed, 140 r.p.m., and averages 11 knots.

The following is an abstract of an article which appeared in the May issue of *Motorship*, which describes the "Kennecott": The machinery, which consists of two McIntosh & Seymour, 4-cycle, Diesel engines of 1,200 i.hp., or 900 b.hp., and all necessary auxiliaries, is fitted about one-third length forward of the stern, and the shafting is carried in the Lundberg design of stern. The forward and after peaks of the vessel are fitted for carrying water ballast, and fuel oil is carried in the double-bottom tanks, which extend from the forward and after peak bulkheads, and also in a tank fitted between the shaft alley extending from the tank top to the top of the shaft alley, making a total fuel capacity of 1,075 tons, giving the vessel a cruising radius of 22,000 miles. The tanks are made unusually large, so that the vessel can, if necessary, transport oil for cargo from one point to another or carry it to the company's mines. The cargo holds are so arranged that with transverses and widely spaced pillars, clear stowage, desirable in ore-carrying boats, is provided throughout.


A DIESEL-DRIVEN ORE CARRIER

The main interest to the engineer is in the engine room, which is one of the most interesting and completely equipped that has ever been designed for an American motor ship. It is only 44 ft. long. Every detail was carefully worked out in advance by the engineers of the Alaska Steamship Co. in co-operation with the designers of the Todd Dry Dock & Construction Corporation's Tacoma plant, and nothing has been overlooked. The main engines were selected by E. T. Stannard, general manager of the Alaska Steamship Co. Mr. Stannard, before accepting a post with the steamship company, was a mining engineer by profession, and had charge of the Kennecott interests in Alaska, which are still under his supervision.

Practical Use of Theoretical Knowledge

BY STRAUSS L. LLOYD, E.M.

(Written for Engineering and Mining Journal)

SOME TIME AGO, while attending a city government meeting, I was much amused at the remarks of one of the engineers, who was making a plea for his company, to secure a certain contract for placing a system of water-works and sewers. This engineer, in making his plea for the job, stated that the work under consideration would be handled by "practical" engineers, and that the city officials could rest assured that no "textbook" engineers would be employed to make a botch of the work.

In thinking over this statement I was reminded that more than half a century has elapsed since Rankine, in the "Dissertation," prefixed to his classical work on "Applied Mechanics," found it necessary to point out the fallacy, bequeathed to us by the philosophers of antiquity and by the schoolmen, that there is a radical antagonism between scientific knowledge and practical knowledge. He lamented the fact that this fallacy was not yet dead and forgotten. Were he living now, he would find, at least in our country, little to make him change the substance of what he then wrote. We have, indeed, many men who are at the same time eminent practitioners and profound scientists, and we have many engineers who are guided in the exercise of their profession by those scientific principles and methods that the ignorant contemptuously call "theory." But it must be confessed that such men form but a small minority, especially among that numerous class of average engineers which may be described as the rank and file of the profession.

PERNICIOUS INFLUENCE OF SO-CALLED "PRACTICAL MEN"

The prevailing opinion among uncultured men engaged in engineering work seems to be that their scanty knowledge of mathematics, physics, and mechanics is all the "theoretical knowledge" that an engineer needs. They may, without knowing, make a blunder which, on account of the insignificance of their work or the ignorance of their employers, remains undiscovered; and they may waste much time and money by using the clumsy and awkward methods that characterize the operations of an untutored mind. Yet they think that because they do their work, whether well or badly, they are authoritative representatives of good engineering practice. The influence of these men on young engineers is most pernicious; for young engineers are too prone to believe that the way in which things are done by one who has perhaps grown old in the profession is the way in which things are done "in practice." This statement I make from my own observation, both as a practitioner and as a teacher.

I had as a co-worker not long ago a hydraulic engineer who had been successful in his specialty. He was a college graduate, but prided himself on having banished from his mind all the "theory" he had learned in college; for, as he said, he had found that practical men do everything by means of a few tables and one or two pocket books. He had designed several water-works, filled some important positions, and been praised by city and town officials, and even by engineers of high standing; and his ability seemed to be attested by the fact that he was a member of the American Society of Civil Engineers.

This man, in designing a pipe line that divided into two branches between the source of supply and the points of delivery, computed the velocity and discharge at the point of bifurcation by the same formulas that give those quantities for a pipe discharging freely into the open air; that is, he applied the same rules to water discharging against pressure that are used for water discharging into the atmosphere. His method of designing a conical foundation for a standpipe was to determine, by a pocket-book formula, the dimensions of a cylindrical foundation that would satisfy the conditions, and then to "transform," as he said, the resulting cylinder into a conical frustum having the same *weights;* his idea being that stability depended on weight only. In plotting an equation of the form $y^2 = ax$, he would make the ordinates proportional to the abscissas, apparently not knowing the difference between a straight-line formula and a parabolic formula. Yet he boasted of his ability, and above all, of his practicality, and if anyone pointed out his blunders, he would simply say, with an air of superiority: "In practice, things are done in this way. It may be different in theory, but I am a practical man." If a college graduate can be so influenced by ignorant practitioners, what can be expected of the young man who derives from them all his knowledge or learns under the guidance of that class of man?

I had once a pupil in surveying whose father was an engineer of some repute in his own town. This pupil wished to begin his studies with transit surveying, saying that he had a good practical knowledge of elementary mathematics, and that he had worked as a computer in his father's office, under the direction and instruction of that gentleman. We had not proceeded far before we came to simple problems in ordinary triangulation. I explained to him the field operations, assuming that he knew how to solve an oblique triangle. I was surprised to see that he divided the triangle into two right triangles, and used natural functions exclusively. I asked him if he knew no other method, and he said he did not. When I told him he should learn a little more trigonometry and become familiar with the use of logarithmic functions, he looked at me with a compassionate and contemptuous smile, and informed me that his father, who had practiced engineering for many years, never used logarithms nor solved an oblique triangle except by dividing it into two right triangles; and he added that he did not wish to learn useless theory, but "how things are done in practice." The following day I received a note from him in which he stated that he had decided to discontinue his lessons. Obviously he and his father had found that I was not a "practical man."

Nor was this an isolated case. Many students object to learning the use of logarithms, adducing as an argument the fact that they know surveyors and engineers who thrive without burdening their brains with what they call superfluous theory.

The majority of so-called practical men and the public in general seem to think that an engineer is mainly a man who knows how materials should be mixed and placed, how the members of a structure should be put together, and other similar matters, which, although they should no doubt be known by every engineer, are equally well known by every builder and foreman. In the opinion of those who have thus degraded engineering, making of it nothing but a routine "trade," the essential qualification of a mechanical engineer is that he should know how to run an engine; of a railroad engineer, that he should know how to lay or bend a rail, to ballast a track or to remove a tie with his own hands; and of a mining engineer, to dig minerals out of the earth with a shovel and pick. This is called "practical knowledge," and believed to be *sufficient* knowledge to entitle a man to call himself a member of the profession.

Having exhibited what may be termed a pathological condition in the engineering profession, or, rather, in some of its members, I shall endeavor to point out a few of the principal causes of that condition.

There was a time when the application of science to the physical wants of man, and the employment of knowledge as a means of procuring a livelihood, were regarded as a degradation of the lofty objects of pure reason. "Archimedes," says Rankine, "to the character of the first geometer and arithmetician of his day, might add that of the first mechanician and physicist; he might by his unaided strength, acting through suitable machinery, move a loaded ship on dry land; he might contrive and execute deadly engines of war, of which even the Roman soldiers stood in dread; he might, with an art afterward regarded as fabulous till it was revived by Buffon, burn fleets with the concentrated sunbeams. But that mechanical knowledge and that practical skill, which in our eyes make that great man so illustrious, were, by men of learning, his contemporaries and successors, regarded as accomplishments of an inferior order to which the philosopher, from the height of geometrical abstraction, condescended, with a view of service of the state."

ERRONEOUS IDEAS REGARDING THE OBJECTS OF EDUCATION

In modern times there has been a strong reaction against this irrational attitude of the ancients; but the reaction, as often happens when man shakes off a yoke that has oppressed him for many centuries, has been too violent. By the law of oscillation, the pendulum has swung to the opposite extreme, and we have come to attach so great importance to the practical applications of science that we often regard them as independent of science itself, thus forgetting, in our eagerness to attain an end, the only means by which that end can be truly and surely attained. In our efforts to emphasize the value of practical knowledge, we are apt to place scientific knowledge in the background, as a thing of little usefulness. Education itself is by many considered as exclusively a device for money making, and study as exclusively a commercial investment. Such exaggerated teachings necessarily produce an attitude of mind which, to say nothing of its morally materialistic effects, tends to narrow the limits of scientific training, thereby greatly impairing that utilitarian value itself which is regarded as the only object of an education.

It is today a generally accepted axiom among educated technical men that theory and practice, far from being irreconcilable foes, are the necessary complements each of the other; and that neither a lifetime of book study nor a lifetime of blind experience is sufficient to make a competent, reliable practitioner. These two forms of activity are but two branches of the same tree; or, perhaps, we may more properly say that one is the root and the other the trunk; and that neither can the trunk bear fruit without the root, nor the root fructify without trunk. Yet these educated men themselves, though recognizing the truth of the axiom in the abstract, and knowing from their own experience the necessity of the harmony and interdependence that must exist between scientific knowledge and good practical work, allow their praise of experimental knowledge to *appear* so unqualified that the student and the beginner are misled into the belief, and the ignorant practitioner is strengthened in the conviction, that all scientific knowledge, being barren, is, for that reason, unprofitable.

And it should be further kept in mind that, on account of the lack of regulation in the practice of engineering, and of the general carelessness with which much of our work is done, the fact that a man has been successful does not prove his competence. Witness the hydraulic engineer mentioned heretofore. Nor does the fact that thousands of men have done a certain thing in a certain manner for hundreds of years prove that that is the best way to do a thing. Witness the multitudes of surveyors that do not know the use of logarithms.

PRACTICABILITY OF SCIENTIFIC INSTRUCTION

The underrating of scientific knowledge appears also in proposed schemes to subordinate the teaching of science to practical requirements. Especially is this the case with the teaching of mathematics. Misguided by crude conceptions of practicability, some writers imagine that to make mathematics "practical" it is necessary and sufficient to illustrate principles by "practical examples"; and by this they mean that instead of asking a student of engineering, while he is learning arithmetic, to find the sum of three apples and ten apples, we should ask him to find the sum of three foot-pounds and ten foot-pounds, or perhaps of three volts and ten volts; and that, in explaining the principles of the calculus, the textbook writer and the teacher should search the whole field of engineering for appropriate applications; it matters not that these applications are taken from higher geodesy or from the most recondite domains of electricity and thermodynamics, subjects that the student cannot grasp before he is master of the calculus itself; the important thing seems to be to employ "practical" terms and solve "practical" problems, although both the terms and the real import of the problems may be like Hebrew to the struggling student.

There is no doubt that all branches of mathematics lend themselves to a treatment in which abstract propositions and formulas can be exemplified by such concrete illustrations relating to physics and engineering as can be reasonably assumed to be within the student's reach; and this treatment, if judiciously employed, is much to be commended. But in this, as in all else, wisdom requires discrimination, lest a sound principle should extend beyond the limits of its applicability, and be made to serve methods that are at once inefficient, incongruous, and illogical.

And here we have another evil effect of the gospel of practicality. This gospel has been so sweeping and so loudly preached that even the pure mathematician has been awed into submission by its popularity; and he believes it his duty to satisfy the ambition of those who think that all things can be learned at once. The uneducated practical man, not knowing the necessary interdependence and subordination of engineering subjects, is likely to think that he can learn higher branches without learning the lower, or can learn them at the same time as the lower. This error, perhaps somewhat purified and in a form not so gross, is at the bottom of the conception that some educators, or would-be educators, have of what "practical" textbooks ought to be.

The words "theory" and "theoretical" are so commonly misapplied, and there are so many persons in whose minds they evoke erroneous associations, that it would be advisable to banish them from the vocabulary of engineering. In reality a "theoretical" engineering formula does not differ from a "practical" formula; or, rather, they may both be called either theoretical or practical. Neither term has any well-defined meaning, as it seems to imply a distinction that does not exist. The formula $v = \sqrt{2gh}$ is as empirical as the formula $v = 0.96\sqrt{2gh}$, and the latter is as theoretical as the former; only they apply to different conditions. The factor g is no less empirical than the factor 0.96, although the former can be more readily obtained than the latter, and its variations can be more easily and simply formulated.

All laws of physics are ultimately founded on observation, experience and experiment, and therefore all formulas relating to these laws are, from their very nature, empirical. If anyone applies a formula to conditions to which the formula does not apply, and is disappointed at the result, let him blame himself for his ignorance, and not the mathematician for his theory.

Above all, let it be remembered that the man of no education is easily led into unwarranted generalizations, and that, from the constant overstress laid on the value of practice, he may conclude, to his own detriment and to the detriment of the profession, that science is an oppressive yoke, or perhaps, at best, only a gaudy ornament.

The beginner should be careful as to those with whom he takes counsel. He should remember that, as I have already stated, *practice* and *good practice* are not synonymous; that many things done "in practice" ought not to be done, or ought to be done differently; and that success is not by itself a certain sign of ability. He should regard with distrust the man who, claiming to be a good engineer, boasts of his ignorance of mathematics; for that man is likely to know engineering no more than a quack doctor knows medicine.

Osmiridium Deposits in Tasmania

Recent exploration and development have revealed large deposits of osmiridium and gold-bearing gravels in the valleys of the large rivers of the western division of Tasmania, which is the sole producer on a large scale of point metal osmiridium. Tasmania, Russia, Colombia, and Papua are the four principal osmiridium-producing countries of the world, and Tasmania is by far the most important of these. In March, 1920 the local price reached £42 10s. per oz., states the London *Times Trade Supplement*.

Methods of Purifying Small Water Supplies

Liquid Chlorine, Bleaching Powder, or Violet Ray Apparatus All Held Efficient—Storage and Sand Filtration Adapted to Large-Scale Treatment

BY A. J. LANZA

Written for Engineering and Mining Journal

PURE DRINKING WATER may be defined as water free from objectionable or dangerous content; it is further desirable that it be free from turbidity, and of pleasant taste. Chemically pure drinking water is non-existent; also, drinking water is seldom free from some turbidity.

Water, according to its source, is classified as surface water and ground water. Practically no surface water is free from pollution, and ground waters may be, and often are, polluted, especially if water from shallow wells is included in this classification.

The appearance of water, unfortunately, is no criterion as to its quality. A turbid surface water may be free from disease-causing germs, and the water of a well, contaminated by a near-by latrine or barn, may be of crystal clearness and delightful taste. As far as the prevention of disease is concerned, water purification has to do with making a contaminated or potentially dangerous water safe to drink. Clarifying muddy water, softening hard water, and removal of other foreign content, such as iron, may be desirable and occasionally necessary, but these conditions are not concerned with the prevention of disease. I am not discussing here lead and other metallic poisons that occasionally must be considered as water polluters, nor the contamination of water by various types of industrial wastes; these latter are problems for the chemical engineer.

TYPHOID FEVER MOST DANGEROUS MENACE

The principal and most important water-borne disease in this country is typhoid fever. Next come the intestinal disorders of the dysentery class, which are often serious. Cholera, so important as a water-borne epidemic in other countries, is not a health problem in the United States. The occurrence of a case of typhoid fever, to put it more forcibly than elegantly, implies a short circuit between the bodily discharges of one human being and the stomach of another. Water is frequently the medium of transmission, the unsanitary latrine taking first place as the villain in the plot. An unsanitary latrine may drain or seep into a near-by well, or may be situated on a watershed. Where this is the situation one typhoid patient may contaminate the water supply of an entire community and cause a number of deaths. A defective or improperly constructed water system, whereby sewage may gain access to the water pipes or an unsafe supply be bypassed around the purifying plant, has frequently been responsible for typhoid epidemics.

METHODS OF PURIFICATION

The problem, then, is to purify by disinfection a water supply which is being, or may possibly be, contaminated somewhere along the line. This can be accomplished by a variety of processes, acting independently or in combination. Water tends to purify itself if given the opportunity, and merely storing it will eventually free it from disease germs. Storage and slow sand filtration are effective, but are applicable only to large supplies and will not be further considered here. Rapid sand filtration, chemical disinfection, and sterilization by the ultra-violet rays are the methods of purification most in use; and they are often combined.

Rapid sand filters, of which a variety are on the market, have attained a high degree of efficiency. Turbid waters are first clarified by the addition of aluminum sulphate in settling tanks, and the water is then forced through the filter at a high rate of speed. This method is applicable to large volumes of water, and the average cost is quoted at $6 per million gallons (E. O. Jordan, *Journal* A. M. A., Feb. 16, 1916). The effluent is often further treated by chemical disinfection. Rapid sand filters need careful and expert supervision, and should never be left in charge of unskilled attendants.

The chemical disinfection of water is accomplished by the use of chlorine, either in the form of liquid chlorine or bleaching powder. The ease, simplicity, and cheapness of this method have made it popular, especially in time of epidemics, when it is necessary to disinfect immediately a water supply which may be grossly contaminated. Chlorine is easy to obtain and is effective in minute quantities, and the protection it gives is practically absolute. It may be objected to at times on account of the taste it imparts to the water. If the water is clear, one-half part per million will usually suffice; if the water is turbid, four to five parts per million may be necessary. For all ordinary work, three parts per million will give safety.

CHLORINE AN EFFECTIVE DISINFECTANT

Liquid chlorine is put on the market in cylinders, and for its use simple types of apparatus have been devised. These comprise a device for equalizing the pressure from the cylinder, a meter for measuring the flow of chlorine, and a diffuser. This is a most satisfactory method for small water supplies; the apparatus is not expensive, and it requires a minimum of care for its upkeep. Depending upon the turbidity, the estimated cost of treatment varies from 17 to 50c. per million gallons of water.

Chlorine can also be applied in the form of bleaching powder. This method is easy, cheap, and particularly useful in emergencies. Twenty-five pounds per million gallons of water will usually suffice. A mixer and a regulating device for feeding the solution into the water line, both easily made from small barrels and a plumber's float, are the only pieces of apparatus necessary. Bleaching powder is more likely to give the water an unpleasant taste than liquid chlorine. For details of making an emergency chlorinator, the reader is referred to Reprint 222, Public Health Reports, which may be obtained from the Surgeon General, U. S. Public Health Service, Washington, D. C.

In recent years the sterilization of water by the ultra-violet rays is increasing in popularity. It is especially applicable where the water is clear. The apparatus is now being made in compact form and gives absolute sterilization without changing the taste or appearance of the water. It consists, essentially, of a mercury vapor lamp around which the water flows in a thin film so as to be continuously exposed to the rays. The cost of the apparatus is not excessive, but the cost of treatment is considerably higher than with chlorine. With current at the rate of 2c. per kilowatt-hour, one manufacturer of violet-ray apparatus estimates the cost of operation at from $6 to $10 per million gallons.

To determine definitely that water is unsafe for drinking, laboratory tests are necessary. The detection of the typhoid bacillus is almost impossible in water, but the presence or absence of the colon bacillus may be determined. This germ is a normal inhabitant of the intestinal tract, and when found in water it is fairly definite proof that the water is contaminated.

Where there is doubt as to the safety of the water supply, especially in small or isolated communities, the proper course of procedure is to communicate with the state Board of Health. The state Board of Health is usually in a position to make the proper investigation and tests and to take steps for improvements. The information contained in the Public Health Bulletin 222, before mentioned, however, will enable anyone to safeguard water in an emergency.

Colloidal Pitch the Latest Flotation Reagent

For two or three years metallurgists interested in flotation have heard reports of a mysterious new flotation reagent which was said to be giving remarkable results in an experimental way. A few knew that the discoverer was a Mr. Luckenbach, whose headquarters were in Brooklyn, N. Y., and a still smaller number were permitted to visit his laboratory and see demonstrations. The actual composition of the reagent used has been carefully concealed until recently, however, until the publishing of the British patent specifications (*Engineering and Mining Journal*, June 25, 1921).

Mr. Luckenbach has named his discovery "Rex"—meaning "king" of course. It is common pine pitch added to a solution of caustic soda. This is to be sold as a plastic mass, it is understood, which is to be mixed with water at the mill and added to the flotation circuit. The pitch does not go into solution, but forms a colloidal suspension, and is said to have remarkable properties as a frother and collector. It has not yet been used on a commercial scale, but has been thoroughly tested out in the Luckenbach laboratories, and also by some of the Cobalt mining companies and by the Canadian Department of Mines at Ottawa. Comparative tests at Ottawa on 1,600-lb. samples crushed to 80 mesh are said to have given the following results:

	LUCKENBACH REAGENT Per Cent Cu			CALLOW "XX" REAGENT Per Cent Cu		OIL Per Cent Cu
	Test 1	Test 2	Test 3	Test 1	Test 2	
Feed...	1.65	1.55	1.60	1.72	1.49	1.35
Concentrate	10.63	13.95	13.95	6.70	8.50	10.70
Tailings	0.19	0.26	0.19	0.20	0.28	0.62
Recovery	90.1	89.8	89.9	90.8	84.3	57.6

The ore on which these tests were run was from Anyox, B. C., and the mineral was chiefly chalcopyrite. Excellent results are also claimed on carbonate ores, without sulphidization.

Just what success this reagent will have on a large scale remains to be demonstrated, as it has never been used as regular practice in a commercial mill. It is said to retain practically all of its virtues in the return water, undergoing scarcely any decomposition with use. We are reliably informed that pitch in all of its various aspects was thoroughly tested out in the many experiments which were conducted at the Mellon Institute and was found not as desirable as some other reagents, but the experiments of Mr. Luckenbach have no doubt been much more exhaustive.

BY THE WAY

Platinum in Tennessee

"News of a platinum strike near Memphis, Tenn., has created a considerable amount of excitement and reports of the richness of the discovery would seem to indicate that an extensive deposit of the precious metal has been opened," says *Raw Materials*. "The mine is near Sulphur Rock and was discovered by Pat Adams on a 40-acre tract of land recently purchased by him. Samples of the ore were taken to Denver by Mr. Adams and a thorough assay was made proving the mineral to be very rich in platinum. A smelting plant is to be built in the near future."—This is very careless on the part of our esteemed contemporary. Mr. Patrick Adams' far-famed bonanza was in Arkansas one hundred or so miles from Memphis. Also when Pat said "platinum" he was thinking of something else. Before he builds that smelter, he is going to build a mine plant, to say nothing of a mill. But first he is going to make a pond to keep the suckers he has caught. In spite of Admiral Sims, Pat is no jackass, but his platinum is strictly hypothetical.

Lighter Than Air

A discovery so marvelous that it makes Peruna look like a soft drink has been reported from Seattle. It is that of the so-called "odic-activity ray" and is credited to Prof. Edgar L. Hollingshead, if we may believe all that we read. The principle of the thing is ridiculously simple. This ray makes heavy things light, to as great a degree as any one may wish. The idea is not exactly new, as more than one Jules Verne has conceived of a force that would counter and then overcome that of gravitation. It is predicted that steel vessels of the air will thus be made as light as bubbles. This is old stuff and we can suggest these more valuable uses: Making heavyweights weightless. Imagine Dempsey and Carpentier each with a chunk of this ray in his shoes. It would be better than fighting on the moon. Then again, talking of fighting, the ray would make newly-weds' biscuits lighter than seafoam, and lastly, flotation would be backed off the map. Where would Minerals Separation be then, poor thing!

Selecting a Name

The man that thinks up names for Pullman cars never had a rival until Admiral von Tirpitz forced us to build ships so fast that merely naming them took all the time of a dollar a year volunteer. The Pullman expert is still busy and rolling stock is short at that. The signing of the Armistice, however, naturally made the Government man's work unnecessary. But so fascinating had the occupation become that he decided to continue it "on his own" and has since hung out his shingle as a consulting specialist in nomenclature, restricting his field so as to include only the devising of names for race horses and cable addresses for mining companies and engineers. What's in a name? Much, we reply. In racing, a jinx of a name would make an also-ran out of what might otherwise prove a Man O' War. A name, too, is an advertisement, especially where cable addresses are concerned, for these are names in a way. The selection of a cable address then is a matter of great importance and the specialist's services are not to be sneezed at, even if sneezing in public were sanitary and hygienic, which it isn't. A few samples will show what we mean: Are you a missionary in Darkest Africa and wish to put a zinc roof on the Hottentot Reformed Church and don't know where to get it? Drop a cable to "Makitozinc" and the American Zinc Institute will inform you not only where to get it but how to put it on. Then again, all will recognize E. P. Mathewson in "Bigsmoke" and Bulkeley Wells in "Beaumaris." The connection between "Oceanology" and John Hayes Hammond is too deep for us. But our specialist had nothing to do with that, which undoubtedly accounts for it. North Star Mines is "Ursamajor" to the cable company and the Copper Queen at Douglas goes by her Aztec, or is it Inca, sobriquet of "Cqco," the unpronounceable name often affected by copper-colored royalty. Camp Bird is "Charmingly," but our specialist, again, had nothing to do with that. Enough has been said to show that the matter is of grave importance and that a specialist's services may easily be of almost incalculable value.

Calls Us a Pill

"I want to express my appreciation of the quality of the humor that has appeared on your 'By the Way' page in recent issues," says one of our readers. "I think that the little high-light such a department gives to a technical magazine is most important—a sugar coating that makes the pill easy to take."

Lost Treasure

From Oakland, Calif., comes a tale of one John Meyeroff, prospector of the accepted classical type, who has discovered three sheets of worn parchment that are inscribed with the presumably authentic account of an unfortunate party of Spanish explorers and treasure hunters of the 16th century. Although the ink has faded to an extent that renders much of the quaint Spanish text almost illegible, Professor Herbert E. Bolton, of the University of California, is quoted as stating that these papers may form the missing link in the historical record of one of the tragedies of the Southwest. The manuscript purports to have been written in 1553; recounting adventures of a party of Spaniards who joined forces with some shipwrecked Frenchmen and finally discovered a mine that yielded much gold and silver ore of astonishing richness. The mules and oxen of the party were laden with treasure, the lucky possessors starting out on foot to guide their caravan to the outposts of civilization. But, alas! A band of some 4,000 Indians surrounded them and the transportation department was perforce converted into a commissary corps. When the last pack animal was eaten, the men of the party dwindled one by one. A small group buried what may prove to be the mealticket of some venturesome spirits of the present or future generation, the secretary of the mining expedition evidently jotted down an account of the proceedings and inserted the precious documents under a large hollow rock that happened to be conveniently near. Then the last despairing rush was made to escape the tomahawks of copper-hued natives. Recently Meyeroff [illegible] the old [illegible] took over, and the location of the treasure is to be deciphered, though this process may prove to be difficult.

HANDY KNOWLEDGE

Determination of Bismuth

BY O. A. CRITCHETT

Written for Engineering and Mining Journal

Every chemist should be glad to know of a method for the determination of bismuth in ores which gives accurate results and at the same time avoids the use of a hydrogen sulphide generator, and potassium cyanide. So far as I know this method has never been published:

Weigh up from ½ to 1 gram of ore (in case of very low-grade ores more may be used), decompose with nitric and hydrochloric acids, using them as best adapted to the ore, add 20 c.c. of 1—1 sulphuric acid, and evaporate to dense fumes. Cool, dilute to 75 c.c., add one drop hydrochloric acid to precipitate any silver, boil, and filter, washing with 1—10 sulphuric acid.

To the filtrate in a No. 3 beaker add a piece of aluminum foil and 10 c.c. of a saturated solution of sodium hyposulphite. Boil twenty minutes, filter, remove the aluminum if clean; if not, allow it to remain in the beaker, wash the precipitate well with hot water. Wash precipitate back into the beaker with hot water, add two to three grams of stick potassium hydrate; if aluminum is still in the beaker the action of the hydrate quickly loosens the particles of precipitate still adhering, when the aluminum should be removed and washed. Boil the solution containing the precipitate, hydrate and other material for ten minutes. The excess sulphur and any arsenic, antimony or tin present are dissolved. Filter through the same paper and wash with hot water.

Put the paper back into the beaker, add 10 c.c. nitric acid and 6 c.c. sulphuric acid, evaporate to fumes, or until the solution turns black, owing to carbon; add 5 c.c. more nitric acid and evaporate again; repeat this until the carbon is all driven off—three times should be sufficient. Dilute to about 50 c.c., coil and filter; wash filter with a little 1—10 sulphuric acid.

Heat the filtrate, make slightly ammoniacal, boil one to two minutes and filter, washing with hot water. Dissolve the precipitate through the paper with 5 c.c. nitric acid and 20 c.c. very hot water into a clean No. 3 beaker. Wash with a little 1—5 nitric acid.

The bismuth in the filtrate may be determined by any one of the three following methods:

1. Nearly neutralize the filtrate with ammonia, leaving it just acid; add a small excess of ammonium carbonate, heat until the precipitate settles well, filter and wash with hot water. Dissolve the precipitate through the paper into a weighed porcelain or platinum dish with 1—3 nitric acid. Evaporate to dryness, ignite and weigh at Bi_2O_3. This weight times the factor 0.8966 gives the equivalent of bismuth.

2. Add ammonia to the filtrate until the solution becomes just opalescent but contains no precipitate. Add 1 c.c. 1—3 hydrochloric acid. Bismuth will be precipitated as bismuth oxychloride. In the event of a low bismuth content, dilute the solution to be certain that the bismuth is precipitated. Keep the solution at about 80 deg. C. for an hour, and filter through a weighed Gooch crucible. Wash with hot water, dry, ignite, and weigh as BiOCl. This weight times the factor 0.8018 will give the bismuth.

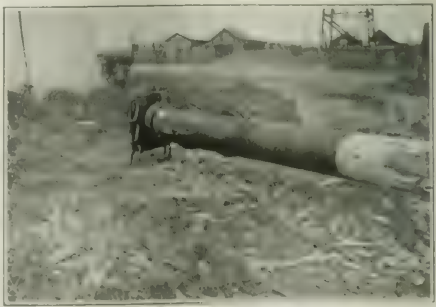
3. Dilute the filtrate to about 150 c.c., add five grams of ammonium oxalate or oxalic acid, boil five minutes, allow precipitate to settle, decant supernatant solution through close filter; add 50 c.c. hot water to precipitate in beaker, boil, settle and decant. Repeat this treatment with successive portions of 50 c.c. water three or four times; wash precipitate onto filter and wash well with hot water. If bulk of precipitate is large, wash most of it back into the beaker; if small, dissolve directly through the paper with 2 to 5 c.c. of 1—1 hydrochloric acid, wash with hot water, heat to solution, dilute to 250 c.c., neutralize solution with ammonia, make slightly acid with sulphuric, and titrate with potassium permanganate solution. One cubic centimeter N/10 permanganate solution equals 0.0104 gm. bismuth. To make N/10 $KMnO_4$ solution, dissolve 3.163 grams potassium permanganate in one liter of water. The iron factor of permanganate multiplied by 1.844 equals the bismuth factor.

In this precipitation of bismuth and separation from other second group metals the use of hydrogen sulphide and potassium cyanide is avoided. The final determination may be made by any one of the three well-known methods given, but I have always used the gravimetric operations myself. I have used this method for bismuth for about four years, checking against other methods, and my experience is that the results have been very satisfactory.

Mast Top for Boom Derrick

Written for Engineering and Mining Journal

The boom derrick finds considerable application about a mine surface plant, particularly where heavy timbers have to be handled. Although the castings and fittings required in the construction of the derrick can be purchased, in many instances they are made at the mine shops. In the illustration a home-made mast top is shown. This was constructed of a piece of casing, which was slotted as shown and slipped over the head of the mast. The axles of the sheaves project through the casing and are held by split pins. The top of the casing is fitted into a cast-iron collar made of a steel plate with links for fastening the guy ropes.



DERRICK MAST TOP MADE FROM CASING

THE PETROLEUM INDUSTRY

Detecting Small Quantities of Petroleum*

By E. Theodore Erickson†

Written for Engineering and Mining Journal

THE INCREASING DEMAND for petroleum, and the fortunes made by its discoverers, have stimulated an active search for oil not only by trained geologists and oil men but by men who do not know its natural appearance and characteristics, so that the discoveries of substances that were erroneously believed to be petroleum have led to the fruitless expenditure of money and time in regions where there have not been even surface indications of petroleum. Simple tests will prove that many of these substances contain no petroleum. On the other hand, in some places where no surface indications of petroleum can be found, the results of simple tests—the heat test and solvent test of the rocks—will indicate a possible occurrence of petroleum, so that drilling for oil may be justified.

The tests described in this paper are designed to indicate whether samples of rock and similar material contain petroleum or other bitumen. The term "bitumen" in a generic sense includes the varied types of petroleum and hydrocarbons, either natural or artificial (i.e., oils, asphalts, resins, mineral waxes), that are soluble in neutral solvents such as choloroform, carbon disulphide, carbon tetrachloride, and like substances. The meaning of the term has been extended to include natural occurrences of organic substances of a hydrocarbon nature that are insoluble in the above-named solvents, but that will yield true bitumens artificially when subjected to destructive distillation. The latter group has been conveniently designated as pyrobitumen. It includes therefore, by definition, the relatively large amount of insoluble organic matter in the "oil shales" of Utah and Colorado—a comparatively small part of the organic matter being slowly soluble—the softer coals, such as peat lignite, and some bituminous coal. The soluble parts are due more or less to some of the humic matter and slightly to the resins, and, with soluble mineral waxes and fossil resin, belong to the first group of true bitumens. The tests described below should be applied to the petroleum variety and other closely related bitumens.

PREPARATION OF THE SAMPLE

Small Sample Representing the Richest Material.—(1) A sample of oil-bearing rock, sand, or oil shale that represents the richest material to be tested should weigh at least 2 oz.; that is, it should be about the size of a pecan or hickory nut; (2) crush the specimen to a fine powder with a mortar and pestle on a smooth surface of iron, stone, or other material; (3) dry the finely crushed sample by spreading it on a porcelain plate and placing it in the sun or near a hot radiator. A convenient field method is to place the powdered sample in a porcelain evaporating dish (Fig. 2) and dry for the least necessary amount of time upon a moderately heated stone or brick. The sample may be advantageously stirred with a metal spatula during the drying. Higher temperatures than those thus obtained should be avoided, for they may drive volatile petroleum constituents from the sample.

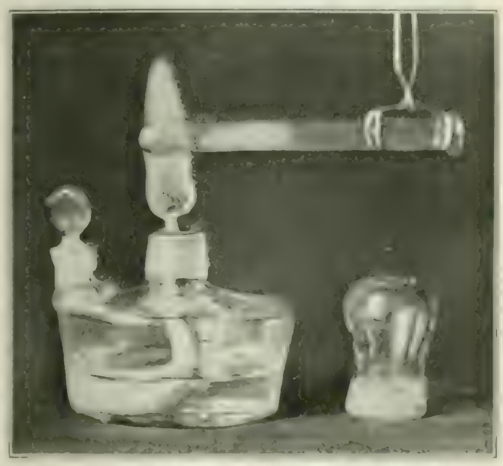


FIG. 1. HEAT TEST [illegible]

[illegible]

Sample Representing an Average of Large Masses of Rock.—Select a sample weighing 10 lb. or more to represent a large volume of rock. Crush to pieces not more than a quarter of an inch across and then thoroughly mix. Further select from the crushed sample a pound or more of the mixture at random and crush until it is as fine as sand and again thoroughly mix. From the latter mixture the final sample, weighing 2 oz., is obtained, crush to a powder and dry as described above.

Place one-third of a teaspoonful of the dry powdered sample in a glass test tube sealed at one end. Hold the tube in horizontal position as shown in Fig. 1, and heat slowly in the moderately hot flame of a soldering torch, large alcohol lamp or gas jet until the sample and the lower part of the glass tube become dull red. If the sample contains petroleum one of three things will happen, depending upon the quantity of oil in the sample: If the quantity is small, a cloud of white fumes will gather in the tube between the sample and the mouth of the tube; if the quantity is larger, the cloud will be very thick and tiny drops of oil will condense upon the walls of the tube, and if the quantity is great, enough oil will condense to form small drops that will gather to make a body of oil large enough to be poured from the test tube. The fumes will have an odor of petroleum. This smell may vary from that of a petroleum having a paraffin base to that of a petroleum having an asphaltic base, and will accordingly cover a wide range, but after the odor has once been recognized it can easily be detected.

---

*Published by permission of the Director of the U. S. Geological Survey.

†Assistant Chemist, U. S. Geological Survey.

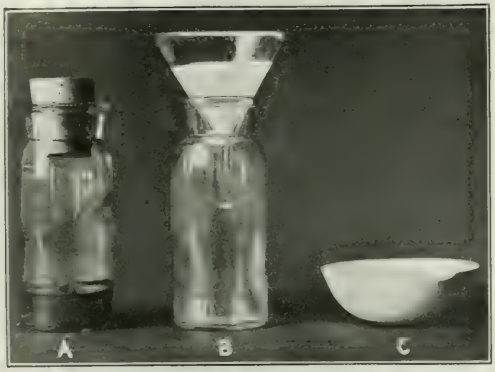


FIG. 2. FIELD APPARATUS FOR SINGLE SOLVENT-TEST WITH CHLOROFORM OR CARBON TETRACHLORIDE

Two 4 oz. bottles, one cork, one evaporating dish 2¾ in. wide, and a 2½-in. inner diameter glass funnel holding a folded filter paper. The field equipment should include a package of Whatman's No. 40 filter papers (9 c.m.) and a supply of chemically pure chloroform or carbon tetrachloride, depending upon the amount of testing to be done.

This heat test will apply to rocks containing free petroleum and also to rocks such as oil shales, coals, and similar substances, in which there may be practically no petroleum or small amounts of other true bitumen, but from which oil can be obtained by destructive distillation. In general, it may be said that rocks and sands containing more than a small trace of petroleum will yield a definite light-colored cloud within which well-defined drops of oil will condense. When petroleum is present in a very slight amount, the vapor cloud, though well defined, is less intense, and its odor characteristics must be relied upon to confirm its presence. Commonly, some moisture condenses during the heat test, but its colorless appearance distinguishes it from the condensed oil. When substances such as a moderately rich oil shale that contains at best a small amount of true bitumen that will yield, because of the presence of much pyrobitumen, quantities of oil by destructive distillation are heated, the vapor cloud given off is more voluminous and dark colored, and commonly emerges freely from the test tube. A tarry oil condenses on the test-tube walls, but appears to form from the voluminous vapor cloud at a slower rate than the oil which condenses from rock that contains free petroleum. This characteristic may be observed after a little experience.

Certain heat tests when applied to earthy material containing organic matter derived from decomposed vegetation will give a visible vapor cloud similar to the cloud produced by heating a purely mineral rock containing a slight amount of free petroleum or other bitumen. However, the odors given off when decomposed vegetable matter is heated are of a penetrating nature totally unlike those of the different types of petroleum and distillates such as are obtained from oil shale. As the similarity of the two vapor clouds may lead to confusion, the rock sample should be free from moss, lichens, or other adhering growths. Should the rock contain sulphur, the usual white vapor cloud will appear when the heat test is applied, but the sulphurous odor identifies the nature of the substance from which the cloud emanates.

In general, the heat test described requires the selection of appropriate samples in which the interference feature mentioned will have a minimum effect; otherwise, the results obtained cannot be said to indicate positively the presence of small amounts of petroleum, other true bitumens, or pyrobitumens.

TESTING WITH CHLOROFORM OR CARBON TETRACHLORIDE

The first step in the chloroform or carbon tetrachloride test is to thoroughly clean, dry, and rinse with a small amount of the pure solvent the funnels, bottles, evaporating dish or china saucer, or any other apparatus to be used. Either pure chloroform or pure carbon tetrachloride may be used as a solvent for this test. The best grades obtainable of these solvents, that leave the smallest possible amount of residue upon evaporation, are manufactured by the Baker & Adamson Chemical Co., of Easton, Pa.; Merck & Co., of New York City; Eimer & Amend, of New York City; Mallinckrodt Chemical Works, of St. Louis, Mo.; and J. P. Baker Chemical Co., of Phillipsburg, N. J. No matter from whom the chloroform or carbon tetrachloride is purchased, its purity should be tested by passing three teaspoonfuls through a folded filter paper (apparatus *B* and *C*, Fig. 2), after the usual precautions have been taken in cleaning the utensils. Then allow the filtered liquid to stand exposed to the air, and warm gently with artificial heat until it is evaporated to dryness (see succeeding statements on the evaporation of chloroform and carbon tetrachloride). If the solvent is pure, no appreciable residue will remain in the dish.

The apparatus and chemicals necessary for this test can be ordered through almost any druggist, or they may be obtained at almost any high school or college where courses in chemistry are given.

Place in a 4-oz. bottle (Fig. 2 *A*) one teaspoonful of the powdered air-dried sample and three teaspoonfuls of chloroform. Shake the mixture by whirling at intervals for at least an hour, taking care that the liquid does not touch the cork. The dry cork is likely to contain substances that are soluble in the solvent and thus leave a residue the composition of which will give incorrect results.

Place a glass funnel holding a folded filter paper in the neck of a second bottle (Fig. 2 *B*). After the chloroform in the first bottle has acted upon the sample for an hour or more, pour upon the folded filter paper, taking care that the filtrate—the liquid that runs through the filter paper and drops from the end of the funnel into the second bottle—is free from sand or other visible particles. If the filtrate contains petroleum it will be colored a shade of amber or yellowish brown, the exact shade generally depending upon its quantity in the sample. If the sample contains only a slight trace of petroleum, the filtrate will be a very pale yellow; if it contains considerable quantities the filtrate will be yellowish brown or brown.

Pour the filtrate—the contents of the second bottle—into a shallow porcelain dish (Fig. 2 *C*) or china saucer and allow it to evaporate in a warm place or near an open window, taking care that no dust or other foreign substance drops into the saucer. If the original sample contained petroleum the dish will show a yellowish or amber-colored stain, the darkness or intensity of which will depend upon the quantity of oil in the sample.

This test is conclusive only if it is applied to material containing petroleum, asphaltic paraffins, or vegetable waxes and resins. It is of no practical value if applied to oil shales, peats, lignites, or other minerals from which oil is obtained by destructive distillation, except that they may contain some true bitumen. Unfortunately, many of the softer coals and some carbonaceous shales contain resin, and therefore the chloroform test if applied to them will certainly not indicate the presence of petroleum. The amber color and gummy residue shown are much more likely to be due to petroleum than the vapor cloud and the oil obtained by the heat test. The latter may produce the petroleum indications because of the presence of a slight amount of pyrobitumen. The final results of both tests will enable a general differentiation of true bitumens and pyrobitumens.

If on a certain sample of rock the heat test gives a considerable production of oily distillate, and at the same time the chloroform test indicates the presence of a slight amount of true bitumen, there is evidently present in the sample considerable insoluble pyrobitumen that has yielded the oil in the heat test by destructive distillation. The oil shales especially behave in this manner. The heat test is so conveniently carried out that both tests should be made, even if free petroleum only is sought. A safer final conclusion may be derived from the results of both tests.

Infrequently the color intensity of the chloroform extract may be considerably lighter than the general amber color referred to above. An instance has occurred in which a weathered rock tested in the U. S. Geological Survey laboratory yielded a colorless paraffin-like substance. Although infrequent, these latter results should be held in mind as a precaution.

PRECAUTIONS TO BE OBSERVED IN EVAPORATING CHLOROFORM AND CARBON TETRACHLORIDE

If the work is done under field conditions it is suggested that an ordinary brick, or a stone equivalent in size, with at least one surface approximately flat, be heated on a kitchen stove or opposite an open fire and then transferred to some other place where the air is quiet and dust particles are not flying about. Iron wire provided with a handle arrangement wrapped about the brick or stone will make it possible to transfer it easily for the evaporation. When the stone or brick is moderately hot, the porcelain evaporating dish containing the solvent and the extract from the sample may be placed upon it and slowly evaporated. Five or seven minutes are required to evaporate chloroform and about double the time if carbon tetrachloride is used as the solvent. Allow the solvent to slowly distill away during the evaporation. Violent boiling should be avoided; but unduly slow evaporation may bring about contamination of the results by dust particles entering from the air. It is most important that the manipulations and especially the final evaporation in the above solvent test be conducted where the air is quiet and dust particles are not flying about. Note the results just as soon as the evaporation is complete and avoid further heating of the residue.

It is unsafe to evaporate chloroform or carbon tetrachloride in a slightly ventilated room, for the vapors coming in contact with a free flame or heated metal surface will produce obnoxious gases, such as chlorine, phosgene, and other irritating compounds. Phosgene is highly poisonous.

OIL FILMS ON SPRINGS AND POOLS

A few substances leave films on water that may be mistaken for an indication of petroleum. Most of these films can be distinguished from oil films by their brittleness. If stirred or struck a sharp blow they will break up into separate patches having sharp corners and jagged, irregular edges. If sharp, narrow cracks are made across the film they have little tendency to close. On the other hand, if an oil film is stirred or struck it may break into separate patches, but these patches will have smooth edges and tend to be rounded or gently curved. The film will generally resist being broken, and, although it may become streaked and show twisted, folded bands of color, long, narrow cracks are not likely to be broken in its surface, and if some do form they may tend to close after having been open a short time.

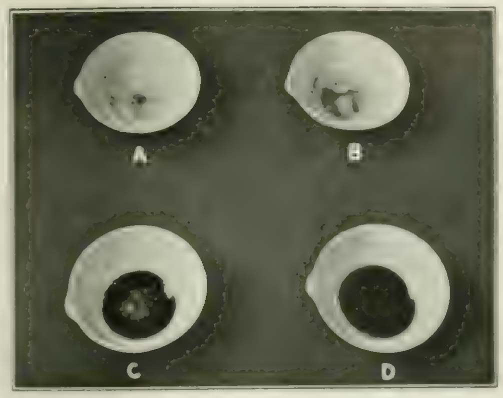


FIG. 3. RESULTS OF SOLVENT TESTS

The results obtained by the simple test outlined above may be confirmed by making the chloroform or carbon tetrachloride solvent test on a sample of the film or scum skimmed from the surface of the water by means of a flat dish, saucer, or a large spoon. In collecting the sample carefully exclude all sediments and decomposed vegetable matter. Fill a clean glass bottle provided with a new cork and which will hold about half a gallon, two-thirds full of the skimmings for the following solvent test: Add three teaspoonfuls of chloroform to the sample of skimmings, cork and shake until the solvent comes into contact with all parts of the sample and the walls of the bottle. If the film on the surface of the water is due to petroleum, the chloroform will become more or less amber colored. This coloring may be easily observed, for the chloroform does not dissolve in the water, so that when the bottle is allowed to stand until the two substances tend to separate sharply with the water on top, vigorous shaking will break up the chloroform layer into small globules settling to the bottom.

The next step is to pour off the extracted water from the chloroform layer and wash by agitation with several additions of clear water until the chloroform part seems clear. Transfer the chloroform with the smallest amount of adhering water to a clean evaporating dish (Fig. 2) and evaporate on a moderately hot brick or stone by an open window. Petroleum, if present, will be indicated by the character of the residue—a more or less amber colored stain, together with odor and other visible qualities of petroleum.

Frequently the chloroform layer does not become perfectly clear by the method of washing by agitation with small additions of water. If cloudiness persists, the evaporation should be conducted as usual until water is no longer appreciably present. The solvent, because of its lower boiling point, evaporates ahead of the water. The residue may then be re-extracted with a small amount of the solvent, filtered by means of apparatus *B*, Fig. 2, and evaporated when the results warrant so doing. As chloroform will not filter through a filter paper the pores of which contain water, the above procedure is given.

The difficulties of cloudiness referred to have been experienced in the chemical laboratory of the U. S. Geological Survey on water samples sent in for petroleum examination that contained precipitated iron and other mineral matter. In many instances these samples, when left in an undisturbed condition for a few days and at the same time exposed to the air, developed a surface scum, somewhat resembling the visible appearance of an oil film. The mineral scum usually proved to be the result of the oxidation of ferrous iron in the sample. The films were invariably brittle, and when the water sample was extracted with chloroform the iron precipitate persisted along with the chloroform after considerable washing. The above method remedied the difficulty.

It is unlikely that serious errors will be introduced owing to the evaporation of the petroleum or bitumen during the operations described. Petroleum in saturated rock outcrops is commonly considerably oxidized, resinified, and polymerized, into a viscous substance of asphaltic character. It contains smaller amounts of the constituents that are volatile at ordinary temperatures.

The tests described in this paper were developed primarily for use by the Section of Geology of Oil and Gas Fields of the U. S. Geological Survey, following a suggestion of K. C. Heald, geologist in charge, to whom thanks are due for his co-operative interest during the preparation of the paper. Credit also is due to Dean E. Winchester for helpful suggestions regarding methods of manipulation.

Graham Island Shales Under Test

SPECIAL CORRESPONDENCE

The oil-shale deposits of Graham Island, Queen Charlotte Islands, are being thoroughly tested, a small plant having been installed for the purpose. Although the results are not yet known, those responsible for the work are confident of success. It is thought that it can be demonstrated that shale running 20 gal. to the ton can be profitably handled. Surface shale is reported to show an oil content of from 7 to 10 gal. to the ton, but much work must yet be done in prospecting and determining the limits of the belt of oil-bearing shales. The deposits are on the west slope of the island.

Salt Creek Field, Wyoming, Shows Eastern Extension

SPECIAL CORRESPONDENCE

Two wells were completed recently in the Salt Creek field at about 2,350 ft. depth, making from 1,200 to 1,500 bbl. of oil per day flush production. These are of importance, as they indicate an extension of the present known field to the east. One well was drilled by the Inland-Fensland-Carter interests and the other by the Midwest Refining Co. Both are on Sec. 30-40-78 and are offsets of each other.

Because of the overproduction of oil from this field and the low price, $1 per barrel, an effort was made to have the sale of Government leases at Douglas, Wyo., on June 15 postponed. Under the terms of the sale, drilling must begin within three months on this acreage, which is now idle. This will, of course, necessitate offset drilling on adjacent properties which would not otherwise be worked at this time, and the overproduction will only be aggravated, and the royalty to the Government will be less than when oil sells at a higher price again.

Oil Exploration in Alberta, Canada

SPECIAL CORRESPONDENCE

A. M. McQueen, vice-president of the Imperial Oil Co., states that the company is drilling ten wells, only one of which is at Fort Norman. One is in the Pouce-Coupé country west of the Spirit River, north and east of the headwaters of the Peace. The others are more in the central and southern parts of Alberta, including wells at Irma, Czar, and Monitor, and one well is being driven at Rush Lake, just across the boundary in Saskatchewan. There is another on the provincial boundary and there are two wells in the Pincher Creek and Nanton districts.

Mr. McQueen states that as regards southern Alberta the question is not so much whether oil is there, which he considers has been demonstrated, but whether it occurs in commercial quantities.

Changes in Mackenzie River Oil Regulations

SPECIAL CORRESPONDENCE

Some important changes have been made in the Mackenzie River oil regulations. Permit holders who became entitled to a lease of one section of the four covered by the permit are given the prior right to the lease of the three other sections. Another provision is that until adequate facilities exist for the transportation of oil to market, the lessee may be relieved from the requirement of continuous pumping contained in the first regulation.

The lessee may be granted two years from the issue of his lease to install machinery, in place of one year where transportation difficulties render the extension necessary. It is believed that these changes remove all serious objections to the regulations and will render it easier to interest capitalists in the oil fields.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Engineering Educators Meet at New Haven

Professor Burr Advocates Liberal Education as Basis for Engineering Study and Declares Society Neglects Fundamentals

A paper by Prof. William H. Burr, formerly professor of civil engineering in Columbia University, pleading for a professional plane for engineering courses and declaring that the society was wasting its time on details and neglecting the fundamental features of engineering education, was the chief feature of the twenty-ninth annual meeting of the Society for the Promotion of Engineering Education at Yale University last week.

The registered attendance was about 280, representing 72 institutions. The largest attendance at previous conventions was 238.

The following officers were elected for the ensuing year: President, Charles F. Scott of Yale; vice-presidents, H. J. Hughes of Harvard and E. J. McCaustland of the University of Missouri; secretary, F. L. Bishop of the University of Pittsburgh; treasurer, W. O. Wiley, New York City; members of the council, P. H. Daggett, University of North Carolina; J. H. Dunlap, University of Iowa; M. L. Enger, University of Illinois; J. C. L. Fish, Leland Stanford Jr.; F. E. Gieske, University of Texas; Morris Knowles, Pittsburgh, Pa.; O. M. Leland, University of Minnesota.

The University of Illinois was announced as the place for the next convention.

The main contention of Professor Burr's paper was that the engineering profession could never take its proper place on a plane with law and medicine, until engineering education was put in a professional category. He explained "professional" to mean a series of technical and related courses resting on a foundation of liberal studies. He advocated a six-year course following high-school preparation, three with a liberal arts and three with an engineering content. He called the present four-year course a "college scientific course." He admitted that it had served a necessary purpose, but contended that engineering educators should be setting for themselves and their students a higher goal. On the matter of time required, he argued that engineering students could afford it just as well as law and medical students.

He criticized the society severely, saying that it had neglected a great opportunity to bring engineering education to a higher plane. It had devoted its energies and its publications to details, rather than to a consideration of fundamentals.

A chance to discuss Professor Burr's paper was not afforded, President M. E. Cooley holding that it was better to let the significance of the paper sink in rather than immediately to indulge in adverse criticism. He believed that the older men would agree with Professor Burr.

At a later session it was resolved to discuss Professor Burr's paper at next year's convention. Informal discussion indicated much agreement with Professor Burr's main contention.

The round-table discussion brought out the fact that some schools are giving "problem courses" in which the freshmen must solve actual engineering problems. The purpose is to give the beginners some comprehension of what an engineer actually does. Next year, similar but more advanced courses will be given to the three upper classes, also.

Other excellent papers were presented by Prof. George F. Swain of Harvard, by Prof. P. A. Daggett of North Carolina; and by Prof. J. W. Hallock of Pittsburgh, on "Some Results of the Co-operative System." Following Prof. Hallock's paper there was active discussion, all of it endorsing the co-operative plan. Dean Hughes stated that they were much encouraged by the first year's experience with it at Harvard.

Wilkes-Barre Meeting of A. I. M. E. Promises Many Interesting Papers

Plans for the Wilkes-Barre meeting of the American Institute of Mining and Metallurgical Engineers are being perfected rapidly. The tentative program for daily sessions and excursions was outlined on another page last week. Every effort is being made by the officers of the meeting and by Secretary Sharpless to make the sessions interesting, attractive and valuable to all who attend. Over a dozen papers have been submitted so far, for presentation at the meeting, and the following are among those accepted:

"Petroliferous Rocks in the Sierra da Bahia, Brazil," by E. P. De Oliveira; "Flotation Milling Process for [illegible]," by Enrique [illegible]; "[illegible]," by J. Morris [illegible]; "Geology of the [illegible] Coal Fields, [illegible]," by [illegible]; "Underground Mine Development," by J. B. Dilworth; "Flotation of Pyrite," by Walter E. [illegible]; "Geology of [illegible] Mining District, Mexico," by C. I. [illegible]; "Making 5 Per Cent Nickel Cast Iron Alloy in the Electric Furnace," by D. N. [illegible]; and "Anthracoal, a New Domestic and Metallurgical Fuel," by Donald Markle.

Several of these papers have already attracted very favorable comment and are believed to be of considerable importance, for example Mr. Markle's paper on a fuel that bids fair to greatly prolong our coal life.

The following chairmen of committees will direct the detailed arrangements for the meeting:

General chairman, R. V. Morris; general secretary, Paul Sterling, care Lehigh Valley Coal Co., Wilkes-Barre; finance committee, C. F. Huber; automobiles, J. M. Humphrey; hotels, R. A. Quin; reception, Eli T. Conner; excursion, J. B. Warriner; entertainment, Charles Dorrance, Jr.; papers and sessions, Douglas Bunting; printing and publicity, Paul Sterling; banquet, T. S. Barber; Hazleton district, W. S. Ayers; Lackawanna County, Eli T. Conner; Schuylkill County, W. J. Richards; ladies' committee, Mrs. R. V. Norris, chairman; Mrs. Paul Sterling, secretary.

London Engineers Form a City Club

Applications Come From All Quarters of the Globe

Engineers who hail from London have been agitating for some years the practicability of founding an engineers' club in that metropolis. The long-deferred proposal seems about to ripen into actual accomplishment. On June 2 last a general meeting of those who have been supporting the proposition was held at the Hotel Cecil under the leadership of E. Manville, M. P.

Over 1,600 applications for membership had been received from all over the world. Postmarks on letters have recorded interested engineers in Canada, the United States, South America, Australia, New Zealand, India, South Africa, Egypt, and Italy, as well as in Spain, France, Belgium, Denmark, and Holland. The [illegible] of June [illegible] states that it is proposed to acquire a [illegible] house in a central part of London, the need for such a resort being proved by the known fact that there are between 800 and 1,000 British engineers abroad without club places to call their home when they are in London.

The meeting on June 2 was crowded, those in attendance representing all branches of engineering, and the resolution constituting the club was greeted with enthusiasm. The provisional committee which had organized the meeting was constituted the general committee of organization, and [illegible], of [illegible] Street, S. W. 1, was appointed the honorary secretary.

MEN YOU SHOULD KNOW ABOUT

J. M. Callow, of Salt Lake City, Utah, has been spending some time in New York City recently.

C. M. Weld, consulting mining engineer of New York City, has been examining coal properties in West Virginia.

W. J. Prowell, of Philadelphia, Pa., sales agent for the Great Eagle Mining Co.'s flourspar property, is inspecting the mine and the new mill.

Carl J. Schober, of Jackson, Mich., has been making examinations in the Lordsburg and Silver City districts, N. M.

William S. Noyes, of San Francisco, Cal., president of the Presidio Mining Co., is inspecting the company's Shafter silver mine, at Shafter, Texas.

R. P. Rogers, formerly manager of the Coniagas mine, has been selected to superintend the construction of the Northern Light Railway in Ontario.

Dr. Edwin T. Hodge, of the University of Oregon, will spend the early part of the summer in mine-examination work in British Columbia.

Errol MacBoyle, mining engineer, of San Francisco, Cal., has gone to Alamo, Baja California, Mexico, to reopen some gold mining properties.

J. B. Still, mining engineer, recently with the Braden Copper Co., Rancagua, Chile, is now at Antofagasta, Chile, for the American Smelting & Refining Co.

E. C. Elliott, chancellor of the University of Montana, was in Washington recently on business with the U. S. Geological Survey and the U. S. Bureau of Mines.

Arthur E. Eddy, of Billings, Mont., announces the dissolution of the firm of Eddy & Walsh. He has opened an office as consulting geologist at 502 Electric Building, Billings, Mont.

Chester F. Lee, mining engineer, of Seattle, Wash , is examining the Boswell and Boswell Extension properties at Grant's Pass, Ore., for Seattle and Portland, Ore., interests.

A. H. Burroughs, Jr., has been elected managing director of the Armstead Mines, Inc., at Talache, Ida. **Colonel H. H. Armstead**, president of the company, spent June at the mines.

Murray Innes, mining engineer, of San Francisco, Cal., was seriously injured on June 7, when an automobile backed into the car on the running board of which he was standing.

Hugh B. Lee, recently in charge of the chrome-ore mining operations of the Mutual Chemical Co., at Black Lake, Que., is now general manager of the Phosphate Mining Co., at Nichols, Fla.

Corey C. Brayton, mining engineer, of Berkeley, Cal., who is with the American Manganese Steel Co., has returned from his trip through the mining districts of Arizona, Utah, Montana, and Idaho.

Dr. J. J. O'Neill has been appointed acting assistant professor of geology at McGill University, Montreal, during the absence of Dr. J. A. Bancroft. He is at present in the Mackenzie River oil fields, but will return in time to enter on his new duties in October.

Richard Lewis Lloyd, vice-president of Dwight & Lloyd Sintering Co., and of the like-named metallurgical company, recently received the degree of M. Sc. from Washington University, St. Louis, Mo., in recognition of his success in perfecting new smelting methods.

Moffett, Chicago

WALTER CURRAN MENDENHALL

Walter Curran Mendenhall, geologist and chief of the Land Classification Board of the U. S. Geological Survey since 1910, has been designated by the Secretary of the Interior as his agent in administering the naval oil reserves recently transferred by executive order from the Department of the Navy to that of the Interior. Mr. Mendenhall has been on the staff of the Geological Survey since 1894, and ranks as geologist since 1901. Although he was one of the earliest Survey men to be sent to Alaska after the gold strike at Nome, he has also devoted much time to ground-water investigations and to the study of the petroleum fields of this country.

Prof. R. C. Wallace, Commissioner of northern Manitoba for several years, will retire from that position on Sept. 1, and resume his duties as professor of geology and mineralogy at Manitoba University. At present he is with a party examining the Pasqui oil fields of Manitoba.

S. C. Thompson, mining engineer, of New York City, is consulting engineer to the Kirkland Lake Proprietary Co. **W. R. Thomas** is manager of the Tough-Oakes, and **Charles Richardson**, of the Aladdin Cobalt properties, which are now controlled by the Kirkland Lake Proprietary.

Robert G. Wilson, chief of the tax division of the American Mining Congress, and **William Huff Wagner**, valuation engineer in the office of the U. S. Commissioner of Internal Revenue, have formed a partnership for private practice as consultants. They will specialize in taxation problems, with an office in the Munsey Building, Washington, D. C.

Emmanuel Lemaire of Mons, ingénieur en chef and directeur de la 2me. classe des mines, has been appointed director of the National Institute of Mines at Frameries, Belgium. M. Lemaire, who has been in charge of the special accident service of the Administration des Mines, is forty-nine years old, an officer of the Order of Leopold, and has twice been awarded the "Médaille civique pour acte de dévouement."

Mining engineers and geologists visiting New York recently included: **W. Spencer Hutchinson**, of Boston, Mass.; **Marino Davila**, of Madrid, Spain; **Olof Wenstrom**, of Boston, Mass.; **Herbert G. Officer**, of Santiago, Chile; **William F. Ward**, with the Carib Syndicate, Cartagena, Colombia; **F. L. Schmidt**, with Old Dominion Mining & Smelting Co., Globe, Ariz.; **Paul R. Cook**, Constantinople, Turkey; **George M. Enos**, of Rapid City, S. D.; **E. F. Burchard**, of the U. S. Geological Survey, Washington, D C.

SOCIETY MEETINGS ANNOUNCED

The Michigan College of Mines Alumni Association has announced its reunion dates for this summer as Aug. 5 and 6.

OBITUARY

Arthur Kinney Adams, geologist and chief engineer in charge of the boundary survey of a Sinclair Consolidated Oil Corporation concession in Costa Rica, died at San Jose, C. R., on Nov. 2, 1920, at the age of thirty-seven. Mr. Adams had held responsible professional positions in many sections of the Americas. His professional work included positions with the Socorro Mining & Milling Co., the Inspiration Consolidated Copper, and the Andes Copper Mining companies, as well as with Guggenheim Brothers in Bolivia. He joined the A. I. M. E. in 1906, and was a member of several other organizations.

THE MINING NEWS

LEADING EVENTS

WEEKLY RESUME

At Washington, it is expected that [illegible] of the Tariff [illegible] the House [illegible]. [illegible] *Petroleum* [illegible].

Judge [illegible] *the* [illegible] *Superior and* [illegible] *accounting to be made by the former, has appointed a master and ordered that* [illegible] *accounting based on the "standards of* [illegible]*"* [illegible]. *The suit of Oscar B. Goon against the Anaconda Copper Mining Co. over the alleged poisoning of cattle by smelter fume has resulted in a mistrial. At Bisbee, Ariz., employees of the Copper Queen Branch of the Phelps Dodge Corporation have voted to adopt a plan of employee representation that has been considered for some time.*

At [illegible] *the* [illegible] *smelter has closed down, owing to an* [illegible]*. At* [illegible]*, Nev., steps have been taken to protect the miners against violence by the strikers. About thirty state police and private detectives have been brought in. On the Gogebic Range, Michigan, the Woodbury shafthouse* [illegible] *was damaged by fire.*

Suit Against Anaconda Company for Cattle Poisoning Ends in Mistrial

The suit of Oscar B. Goon against the Anaconda Copper Mining Co. for damages for alleged injury to cattle caused by poisonous smelter fumes resulted in a mistrial, the jury disagreeing after the trial had lasted thirty days. The case was heard at Helena, Mont. Goon is said to have had the backing of the Farmers' Association of Cascade County.

Survey of Big Cottonwood District, Utah, To Be Completed

The United States Geological Survey expects to complete during the present season the geological survey of the Big Cottonwood mining district in Utah, begun a number of years ago, the work being then in charge of B. S. Butler. The survey will be completed by F. C. Calkins, who has arrived in Salt Lake.

Minnesota Steel Co. Shuts Down Furnaces

The furnaces at Duluth have been shut down and all manufacturing operations indefinitely suspended at the plant of the Minnesota Steel Co., affecting 1,100 men, but 1,400 of the men will be retained on the construction program.

Employee Representation Plan Adopted at Copper Queen

907 Out of 923 Workmen of Phelps Dodge Corporation, Eligible To Vote, in Favor of New Scheme—Constitution Calls for Senate and House of Representatives

A plan of employee representation that has long been under consideration was adopted by the employees of the Copper Queen Branch of the Phelps Dodge Corporation on June 28, when the proposition was voted upon. Of 923 men eligible to vote, excluding foremen and bosses, 907, or 81.4 per cent, voted in favor of it. This was 80.2 per cent of the total number eligible to vote. Of fifty-one foremen and bosses forty-six voted in favor of and five against the plan. As submitted to the men the plan was in its final form, having already been passed upon by the directors of the company. Although operations are considerably curtailed at present, Grant H. Dowell holds that the time is opportune to give the new scheme a tryout.

The preamble of the Employees Representation Plan reads as follows:

"We, the employees and officials of the Phelps Dodge Corporation, Copper Queen Branch, Bisbee, Ariz., in order to promote closer relations between the employees, the management and the stockholders, to insure a square deal to every employee, official and the company, to encourage loyalty, co-operation and efficiency, to promote our mutual welfare and insure the blessings of industrial peace to our selves and this community, do hereby adopt and establish this Constitution of the Employees' Representation Plan for the Copper Queen Branch."

THE LEGISLATIVE DEPARTMENT

Under the constitution just adopted the employees of the company are to have a voice in the adoption of rules and regulations governing their work and the conditions of their employment through their own representatives chosen by secret ballot. All legislative powers are vested in a Congress consisting of a House and a Senate.

Members of the House are to be elected every six months for a term of one year by the employees. Qualifications of a Representative are that he shall be twenty one years old or over, [illegible] English and have been [illegible] months in the company's employ [illegible]. Foremen, bosses and those whose duties are of a supervisory nature are barred from voting or serving as a Representative. Membership in the House of course ends if a man leaves the company's employ.

Representatives are apportioned on the basis of one for every 100 employees as shown by the pay roll one month prior to the election. The following electoral divisions are created:

1. Southwest, Czar, Holbrook, Uncle Sam and Cuprite Division.
2. Sacramento, Lowell, Gardner, Dallas, C. & C., White Tail Deer Division.
3. Mechanical Department Division.
4. Sacramento Hill, American Division.
5. Sacramento Hill, Mexican Division.
6. Engineering and Metallurgical Division.
7. Clerical Division.
8. Miscellaneous Surface Departments, American Division.
9. Miscellaneous Surface Departments, Mexican Division.
10. Medical Department Division.

Each division has at least one representative. Elections are to be held twice a year, notices thereof being given two weeks in advance. Vacancies are filled for the unexpired terms by election or by appointment by the so-called House Committee on Election. The House chooses its own officers and assembles at least once a month or in special session when called by the manager.

THE SENATE

A Senator must be twenty-one, a citizen speaking English and must have been with the company one year before his election. Only foremen, bosses and those whose duties are of a supervisory nature are eligible, with the exception of superintendents or major department heads, who are barred. If a Senator leaves the company his office becomes vacant; likewise if he is transferred to another department.

Senators are apportioned among the various electoral divisions as follows:

1. Each underground division [illegible] is entitled to one Senator to be elected by and from among the shift bosses of the division.

2. One Senator is elected by and from among the foremen and [illegible] of all underground divisions [illegible].

3. [illegible] are apportioned and elected by and among the [illegible] of the surface divisions as follows:

Mechanical Department Division, two Senators.

Sacramento Hill Division, one Senator.

Engineering and Metallurgical Division, one Senator.

Clerical Division, one Senator.
Miscellaneous Surface Departments, two Senators.
Medical Division, one Senator.

Elections to the Senate are held semi-annually by secret ballot under the direction of the Election Committee, who also are empowered to fill vacancies. The Senate likewise chooses its own officers and adopts its own rules of procedure. It also may punish its members for misbehavior and, with a two-thirds vote may expel a member. It assembles monthly and when called in special session by the manager.

Each house is the judge of the election returns of its own members and of their qualifications. Two-thirds constitutes a quorum but a majority vote of the members of each house is necessary to enact any measure. Each house must keep a record of its proceedings and publish them except where there are good reasons for secrecy.

An important feature of the Constitution is that no Senator or Representative may be penalized by the company or officials for any speech or debate in either house.

All measures to be effective must be passed by both houses and signed by the manager of the Copper Queen Branch. If vetoed a measure may be made effective by a two-thirds vote of each house.

CONGRESS HAS WIDE POWERS

Broad powers are given to the Congress. They are briefly stated as follows:

1. To enact a code of safety rules and enforce them.
2. To make rules governing employment and discharge and enforce them.
3. To provide rules controlling promotions to higher rank and increases in pay up to the position of shift boss.
4. To provide rules for the equitable division between company and men of any saving in cost of operation resulting from increased labor efficiency or economy in the use of supplies when compared with a fair standard.
5. To pass measures necessary to provide a voluntary pension system and a benefit association, the company paying half and the employees half.
6. To appoint a grievance committee consisting of three Representatives and two Senators. The recommendations of this committee are referred to the manager and, if he does not concur, to the Supreme Court. An employee may appeal to this court if not satisfied with the settlement of his grievance.
7. To pass measures necessary to provide for an educational course in practical mining methods and management, the graduates from which shall be preferred for higher positions.
8. To pass measures for establishing an Apprentice Plan to give the young men of the community a chance to learn a trade under proper supervision.
9. To pass measures necessary for settling peacably differences between employees and company.

All other powers not specified are reserved to the company.

No one is to be denied work because of race, creed or membership or nonmembership in an organization whose principles are in accord with the law.

It is stipulated that the company has the unquestionable right to increase or decrease production or the scale of its operations as it sees fit.

EXECUTIVE AND JUDICIAL DEPARTMENTS

The executive power is vested in the president of the Phelps Dodge Corporation and the general manager conducting the company's routine business. The president may create an executive department to represent him, the head of which is to be the manager of the Copper Queen Branch. With the latter will be associated an advisory cabinet including the assistant manager, and the superintendents of the mining, reduction and concentration departments.

The executive department must consider all measures passed by Congress and approve or disapprove of them within ten days. The manager will also keep Congress advised of such matters as may be of interest regarding the company's work, and recommend expedient measures from time to time.

It is the manager who nominates, with Congress' consent, the judges of the Supreme Court and other officers not provided. He also has the power to pardon an employee for offences against the rules made by Congress.

The judicial powers are vested in the Supreme Court of the organization, which consists of three judges to be appointed by the manager, with the consent of Congress. These will hold office during good behavior.

The Supreme Court has original jurisdiction in cases in which the constitutionality of any measure is in question. It also has appellate jurisdiction in cases arising out of grievances.

The Constitution may be amended only upon written recommendation of at least three members of either house. A two-thirds vote of the members of each house is necessary to such amending, which must be approved by the manager.

This plan may be terminated after six months' notice by a two-thirds vote of the employees or by action of the board of directors of the company.

Hurricane Damages Plants of Sulphur Companies

The tropical hurricane which was reported in the Gulf of Mexico off the mouth of the Rio Grande Grande River on the night of June 21 traveled north and northeast, striking the main land at the head of Matagorda Bay the next morning. The Texas Gulf Sulphur Co. suffered considerable damage to derricks and equipment in the field. The storm then passed on to the northeast, causing some damage to the Freeport Sulphur Co., and farther to the northeast to the Goose Creek oil field, where about 150 derricks were blown over.

Court Asked To Limit Standard of Comparison in Butte & Superior Accounting

Minerals Separation Claims Results of Water Concentration Must Be Compared With Those of Flotation

At a hearing on the accounting in the case of Minerals Separation against the Butte & Superior Mining Co., at Helena, Mont., before Federal Judge G. M. Bourquin, Louis P. Donovan, an attorney of Butte, was appointed master, and a return by the Butte & Superior on a "standard of comparisons" sought by Minerals Separation was directed by the court.

In its argument Minerals Separation took the position that the law is that the standard of comparison must be something which was in the art at the time that the invention was made, while the defendant contended that the standard of comparison might be anything which was open to the art at the time of the infringement, which would necessarily be at a time subsequent to the time of the invention.

The U. S. Supreme Court, in the Butte & Superior case, found that the operations of that company, when using oil in an amount of 1 per cent or more, was not an infringement of the Minerals Separation patent, so that apparently, in accordance with this understanding, the Butte & Superior company had set up the metallurgical results obtained by them, when using this plus 1 per cent oil process, as its standard of comparison appearing in a preliminary statement brought forth in the accounting. Minerals Separation officials contend that the process as used with plus 1 per cent of oil is not within the prior art available as a standard of comparison, and it seems to be their object to have the Court so instruct the Master.

The defendant's counsel in argument sets forth the positions of the parties disclosed by the motion and answer, as follows:

"(1) That, under the law, the only proper standard of comparison is a process or processes known and available at the date of the issuance of the patent in suit which would have given the best results with the defendant's ore if used by the defendant; and that in any event the standard of comparison must be a process or processes known and available prior to the commencement of infringement by the defendant. . . .

"(4) That for the infringing acts of the defendant during the few days in January, 1917, after Jan. 9, 1917, and the greater part of Feb., 1917, during which defendant infringed the patent in suit, the proper standard of comparison is water concentration.

"(5) That for the infringing acts of defendant from some time in May, 1917, to and including June 5, 1919, the proper standard of comparison is water concentration."

The defendant in its answer says:

"(1) The statement of law contained in the first paragraph of plaintiff's motion is neither accurate nor complete. Anything free and open to be used at the time of infringement is a proper standard of comparison, and defendant has the right, if it desires, not only, to set up alternate standards of comparison, but to introduce evidence going to the question of reasonable or established royalty, so that the Court, after hearing the evidence submitted, may determine what measure of damages or profits best fits the facts of the case and is most just. . . .

"(3) Defendant admits that all those forms of water concentration which were free and open, to be used during the infringing period, are available standards of comparison, but it denies that they are the only proper standards of comparison.

"(4) Defendant further says that there are several standards of comparison available in this case, one of which has already been presented provisionally by defendant in its statement of [illegible] and another of which is the electrolytic process, and defendant asserts that it has the right to introduce evidence as to each and every available standard of comparison upon which it desires to rely, as well as evidence looking to the question of determining a reasonable or established royalty, and all other evidence germane to the issue.

"(5) Defendant further says that there is no evidence in the case as to what is the best standard of comparison, and that the present motion is an attempt to have the Court rule on the admissibility of evidence, before it has been tendered by the defendant. Defendant avers that the questions arising on this accounting in this connection are complicated and cannot be justly determined until all the evidence is in and a complete case made out."

The plaintiffs, according to defendant's counsel, expanded their motion in argument, and contended for a much more contracted instruction on the availability of standards of comparison. The plaintiffs denied this and insisted that their motion and argument were consistent.

The Court said that if he were taking the accounting himself, he would be disposed to give the defendant considerable latitude in the instruction of evidence on the question of availability of standards, with the end in view of having the case definitely settled when it got to the appellate courts, but that he would take the motion under advisement and would give counsel permission to file briefs.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Tariff Bill To Be Speeded Through House

Senate Reported Not Pleased With Draft and Many Changes Are Expected

Every effort is to be made to expedite the course of the tariff bill in the House. Under the rules of that body there will be no difficulty in securing this result. That there will be an unusually protracted discussion of the bill in the Senate is regarded as a certainty.

The Senate is not at all pleased with the bill reported by the Ways and Means Committee. Even the members of that committee are perfectly willing to admit that it will be difficult to recognize their bill when it is returned to them from the Senate. The principal provisions of the metal schedule, by paragraphs, stripped of provisos and all but the principal articles, are as follows (these include those given in last week's issue):

Paragraph 301, iron in pigs, spiegeleisen $1.25 per ton.

302. Manganese ore or concentrates, containing in excess of 30 per cent of metallic manganese, 1c. per lb. on the metallic manganese contained therein. Molybdenum ore or concentrates 75c. per lb. Tungsten ore or concentrates [illegible] per lb. Ferromanganese containing in excess of 1 per cent of carbon, 2½c. per lb. Manganese metal and ferromanganese containing less than 1 per cent of carbon, [illegible] per lb. and [illegible] per cent ad valorem. Ferromolybdenum, metallic molybdenum, $1.25 per lb. and 17 per cent ad valorem. Ferrotungsten and metallic tungsten, 72c. per lb. and 15 per cent ad valorem. Ferrochromium containing 3 per cent or more of carbon, [illegible] per lb.; less than 3 per cent of carbon, [illegible] per cent ad valorem.

374. Aluminum in crude form, 5c. per lb.; in plates, sheets, etc., 9c. per lb.

375. Metallic magnesium, $1 per lb.

376. Antimony as regulus or metal, 1½c. per lb.

383. Quicksilver, 7c. per lb.

385. Nickel in pigs or ingots, 5c. per lb.; in bars, rods, etc., 30 per cent ad valorem.

386. Tin in bars, blocks or pigs, 2c. per lb.

388. Lead-bearing ores and mattes, 1½c. per lb. on the lead content.

389. Lead bullion, lead in pigs, bars, etc., 2⅛c. per lb.; in sheets, pipe, etc., 2⅝c. per lb.

390. Zinc-bearing ore, containing less than 10 per cent of zinc, free; 10 per cent or more of zinc, and less than 20 per cent, ½c. per lb; 20 per cent and less than 25 per cent, ¾c. per lb.; 25 per cent of zinc or more, 1c. per lb. A provisional tariff for two years is to provide the following rates: Zinc-bearing ores containing 10 per cent or more of zinc and less than 20 per cent one-half of 1c. per lb., containing 20 per cent and less than 25 per cent, 1c per lb., and containing 25 per cent of zinc or more, 1½c. per lb.

[illegible] Zinc in blocks or pigs, 1¾c. per lb.; in sheets, 1⅞c. per lb., in sheets 1⅝c. [illegible]. A provisional [illegible] for two years provides for zinc in blocks, pigs, etc. and old, 2c. per lb.; in sheets, plates, etc., [illegible] per lb.

Crude petroleum is to be dutiable at [illegible] per bbl. A duty of [illegible] per bbl. is provided for fuel oil. The statement in *Engineering and Mining Journal* of last week that petroleum had been placed on the free list by the committee was based on an advanced copy of the bill which had been furnished the press. Crude petroleum was removed from the free list after last week's issue had gone to press.

Action Expected on War Minerals Relief Bill

The Committee on Mines and Mining of the House is on the point of taking important action on the bill to liberalize the War Minerals Relief Act. As this is written no decision has been reached as to just what action will be taken. Representative Rhodes, the chairman of the committee, expects to discuss the matter at length with the Secretary of the Interior first.

The committee conducted a hearing on July 1 at which representatives of claimants and of the attorneys interested in war minerals relief claims, as well as of the American Mining Congress, were present. Judge Ira E. Robinson, the new war minerals relief commissioner, conferred with the committee in executive session.

Over Half of Railroad Tonnage In 1920 from Mines

Products of mines furnished [illegible] per cent of the total tonnage carried on the class 1 railroads of the country (those whose operating revenues exceed $1,000,000 per year) during the calendar year 1920. Products of mines furnished [illegible] tons out of a total of [illegible], which represents all the freight carried by the class 1 roads during 1920.

Products of agriculture furnished [illegible] per cent of the total tonnage. Products of animals furnished 1.99 per cent. Products of forests furnished [illegible] per cent. Manufactures and miscellaneous furnished [illegible] per cent. Merchandise (less than carload freight) furnished [illegible] per cent.

Subdivisions under the products of mines are as follows: Anthracite coal, [illegible] or [illegible] per cent of the grand total; bituminous coal, [illegible], or [illegible] per cent.

NEWS BY MINING DISTRICTS

London Letter

Over Third of Great Boulder's Receipts from Gold Premium—Dividends on South African Shares Disappointingly Low—Disposal of ex-Enemy Shares Not Yet Decided Upon.

By W. A. Doman

London, June 23—Of the £428,713 receipts from gold obtained by the Great Boulder Proprietary Gold Mines last year, no less than £123,500 was on account of the so-called premium. As total expense amounted to £215,713, it is evident that without the premium the profit would have been only some £90,000. For the last four years the revenue at standard price has been on the down grade, due, however, not so much to a diminution in gold content as to a reduction in the quantity of ore treated. Apart from the premium profits have decreased in the same way, and dividends have been cut from 150 per cent to 75 per cent. In the main this is attributable to increased working costs. The rise is very serious as can be seen from the fact that for the last four years expenses have averaged 28/8, 32/6, 35/8 and 41/9 per long ton. Constant labor strikes, higher wages, reduced hours of working, inefficiency and rise in cost of materials afford the explanation. Development has not proceeded on a very extensive scale, and for some years the ore extracted has not been replaced by an equal quantity. For instance, in 1918, 152,196 tons was milled, and only 110,404 tons was added. In 1919, 106,952 tons was stoped and 86,547 was opened up. Last year the position was even worse, only 20,629 tons being developed as against 100,756 tons crushed. The ore reserves consequently are being depleted, the figures for 1918 being 345,719 tons, for 1919, 325,314 tons and for last year 245,187 tons. Values, however, have kept up remarkably well, the three years showing the following averages: 14.49 dwt., 14.565 dwt. and 14.75 dwt. The highest grade of ore in the reserves is between the 800 and 900 levels main shaft, where 15,410 tons averages 37.37 dwt. Between the 1,750 and 2,350 levels a very substantial improvement in values is shown, for whereas from 1,750 to 1,900 ft. the average is only 9.29 dwt., it is 22.27 dwt. from 2,200 to 2,350 ft. The gold content falls off again from 2,350 to 2,500 ft., the average being only 11.5 dwt. During the year the Great Boulder management purchased the O. K. mine at Norseman and very encouraging results have been obtained. The 200 level, extended east and west for 145 ft., discloses an average width of ore of 2 ft., and for the whole length along the floor of the level the vein assays fully 2½ oz. per ton, and both ends of the level look well.

It is announced that the Geduld Proprietary No. 7 shaft struck the reef at a depth of 2,450 ft. The assay was only 0.6 dwt. over 36 in. It was somewhat unfortunate that the shaft got down on a poor patch, as so much was expected from the strike. No importance, however, is attached to the result as workings in the immediate neighborhood have proved a very large tonnage of ore with gold content of 16.1 dwt. over 66 in. In fact, in this particular area 66 per cent of the reef opened up will pay to mine at a profit. The ore runs in shoots, and a bad patch was struck.

Dividends on South African gold mining shares are now being declared for the first half of the current year, and they are of a disappointing character. The total amount to be disbursed is £3,291,096 so far for twenty-nine companies. Many holders are of opinion that higher rates could be paid, and it is suggested that they are purposely kept low. There does not, however, appear to be any truth in the allegation. The "premium" on gold has not averaged so much as at the end of last year, and working costs are not yet down to a reasonable level. From certain figures that have been worked out a decline of 40 per cent in some materials has taken place since January. As a further fall is expected the companies should soon feel the benefit, though the main item is still that of wages.

As regards the disposal of ex-enemy shares, I understand no arrangement has yet been made. If the balance of debts is in favor of Germany, it is possible that the shares may be returned to their former owners. Otherwise it seems quite likely that the big groups will form a trust and purchase from the Public Trustee in this country and the Custodian of Enemy Property in South Africa, the whole of the shares en bloc.

CANADA

British Columbia

Standard Silver-Lead Sold to New York Interests

Riondel—A small crew is employed on development of the Kirby group, which adjoins the Blue Bell mine. Locations on the Kirby were made comparatively recently, and surface work done to date is distinctly encouraging. Values are in silver and lead.

Silverton — Following negotiations which have been in progress for some time, and a tentative arrangement entered into a few weeks ago, stockholders of Standard Silver-Lead Mining Co. have formally endorsed a proposition for the sale of the mine, mill, equipment and all holdings of the company at Silverton, to New York interests on a bond and lease. The consideration is $75,000, and the option to be exercised within thirty days of the meeting. Surprise is manifested in many quarters at disposal of the property on this basis, because the mill, as it stands, probably represents that value alone in removable machinery. The transaction will leave the company with a cash surplus of about $400,000, which it is planned to use in development of any other promising ground.

Nelson—The British Columbia Prospectors' Association has made representations, as the result of a meeting held within the past month, to the provincial government, urging some action with regard to making a re-survey and mapping under government auspices of all mineral areas of any consequence in the province. Within the past thirty years thousands of mineral claims have been staked in British Columbia, and a large proportion of these have been crown granted. About half of the crown granted claims have reverted to the crown for non-payment of taxes. Under provincial legislation passed four or five years ago, these claims may be leased for a nominal sum and prospected by the lessee, with provision made for their purchase by him should he discover anything of value. It has been found that some of these claims may be readily located, where they are in the vicinity of ground that has been steadily worked and survey lines or posts kept up; on the other hand claims that are isolated have in most cases had all signs of posts, boundary lines or other indications of their locality obliterated, hence the desirability of having some sort of a survey made that will more clearly define the areas that may be acquired under the provisions of the legislation providing for their lease and purchase.

Victoria—The first application under the "Radium Act" of 1914 has been received by the Provincial Department of Mines. A prospector claims that he has discovered radium-bearing mineral in place on Vancouver Island and wants the reward offered by the terms of the act. No particulars of the deposits are given, the bald statement being made that the discovery has been made and that the staker is prepared to have the fullest investigation made to establish the truth of his assertion. The act referred to covers "all deposits of carnotite, pitchblendes or other ores containing radium in sufficient quantity for commercial extraction."

Stewart—No active mining operations are in progress at the Premier mine. The mill is being completed and the tramway being put in shape to handle the output. Over 1,000 tons of ore has been sacked and awaits shipment.

In explanation of the closing down of

the Spider Group, as well as of the failure of the Algunican company to continue development plans on other properties in the Portland Canal District, it is said that the rate of exchange against Belgian capital finally forced investors of that country to close down on advances.

Hartley Bay—The Drum Lummon Mines, Ltd., henceforth will be known as the Douglas Channel Mines, Ltd., this change having been decided upon at a recent meeting of the shareholders held in Vancouver. John Broatch was elected president. It is probable that the plant will be overhauled and altered.

Ontario

Timmins Overcrowded by Influx of Miners

Cobalt—At the annual meeting of the shareholders of the Mining Corporation of Canada June 29, President J. P. Watson, in speaking of the acquisition of a controlling interest in the Flin Flon copper property in Manitoba, stated that it contained 16,000,000 tons of assured ore and additional possible and probable ore of another 9,000,000 tons.

Timmins—Owing to the continued influx of miners and others since the mines resumed activity, the town of Timmins is greatly overcrowded and many people are unable to find accommodation except under canvas. A project is under consideration for the erection of a number of small houses which could be sold at a reasonable profit for about $2,000.

Kirkland Lake—At the Wood-Kirkland surface exploration is being carried on. A mining plant will be installed to enable underground work to be proceeded with.

The Ontario Kirkland has placed orders for electrical equipment for their mill to the amount of $22,000.

West Shining Tree—The interests controlling the Atlas, Wakenda and Miller Adair properties are preparing to carry on active work on all three with A. P. McDonald of Cobalt in charge. The money required for the further development of the Atlas has been secured. The machinery for the Atlas mill has been forwarded.

Larder Lake—A Toronto syndicate headed by S. J. Thomas has taken up options on 17 claims and holds 11 more under option. It is understood that their plans are largely dependent upon the construction of the proposed light railway and that should it be built as expected a townsite will be laid out and the claims actively developed.

KOREA

Unsan—The May cleanup of the Oriental Consolidated Mining Co. was $91,000 as compared with $97,000 in April. The conditions in the Taracol mine resulting from the stope fire there have improved since April 15, and practically no gas has been generated since April 25. Forty stamps ran during April.

NEW CALEDONIA

Noumea—The Société des Hauts-fourneaux, of New Caledonia, is under the necessity of continuing its search for chrome ore in the Haute Coulée district of that island. The Marie Louise mine has exhausted its ore after producing 6,000 tonnes, while the Jeannette, which will yield about 4,000 tonnes in all, is still in active operation. The Superbe, the Crépuscule, and other mines will be opened up, and the 12-km. railway already in operation will be extended into the upper valley of the Coulée. A regular development of this region of interesting nickel and chrome deposits and of numerous forests, is to be anticipated, according to the *Bulletin du Commerce de Nouvelle Calédonie*.

The Société de Tiébaghi has exhausted its great stock of chrome ore and there remain but six or seven thousand tonnes on the mine platform at Paagoumène. The daily extraction adds 70 to 75 tonnes to the stock. Stripping operations are under way at the pits, with a view to enlarging the levels and to avoid all danger of slides.

BURMA

Namtu—Lead production of the Bawdwin Mines of the Burma Corporation for May was 3,620 tons gross; refined lead production was 2,781 tons and that of refined silver approximately, 353,003 oz.

MEXICO

Durango

Mining Operations in State Generally Suspended Since Jan. 1—Numerous Denouncements Made

Durango—Mining operations have been suspended in Durango since Jan. 1. The real cause is not exactly known; whether on account of the present financial crisis of the world, or by reason of the international situation remaining unsettled between United States and Mexico, the fact is that all mining companies operating in the state, at one time decided to shut down.

The Governor of Durango has been doing his utmost to encourage mining, but so far with no results. A few mining deals have been signed recently in this city comprising some minor properties.

Despite the present crisis in mining, numberless denouncements have been recently filed in all the mining agencies of the state.

Guanaceví—The Soto Mines Co. operating at San Pedro, shut its mill down this month. So did the Cía. Minera de Peñoles, S. A., which holds the Atlántida and Santa Cruz groups. The San Rafael Mining Co., under the management of Reginaldo Cepeda, is running its little mill, employing not over 100 men. They will shut down soon.

F. K. [illegible] is about to shut down his little custom mill. H. McLeod Cobb will resume operations in the [illegible] San José and San Valentín if circumstances justify it.

The Paleros and Mexicana groups are now in the hands of Mexico City interests. Investigations have been recently conducted for the purpose of finding a place near Guanaceví to install a hydro-electric plant.

Topia—This camp has been dead for nearly three years. Some talk has been going on about operating the near-by mines at Pilones and Portilla.

San Dimas—The San Luis Mining Co., of Tayoltita, has continued its operations and is shipping bullion through Mazatlán. Ventanas, Candelaria and other camps in the district are all shut down. The important Gavilanes mines have recently been the object of examination by engineers of the Las Dos Estrellas Co.

Santiago Papasquiaro—The Santa Cruz Mining Co. is still working its mine under the management of Lawrence Elder; they are preparing to build a small 50-ton mill. The Bacis Gold & Silver Mining Co. continues operating and shipping ores and bullion through Durango.

Indé—The Indé Gold Mining Co. is trying to resume operations. Necessary machinery has been ordered according to report that reached Guanaceví.

Cuencame—The Asarco and Velardeña plants of the American Smelting & Refining Co. have been shut down for a long time, and there is no indication when they will resume.

Mapimí—Work in Peñoles, Ojuela and Mapimí by the Cía. Minera de Peñoles, S. A., has been suspended for nearly a year. The mine and plants still remain shut down.

ARIZONA

Verde Central's Work Stopped When Hoist Building Burns

Jerome—Just as the new west crosscut had cut 10 ft. into good ore, work has had to be suspended at the Verde Central property through the destruction by fire of the hoist building. The head frame, fuel storage tanks and other surface improvements were saved.

The Dundee leaching process is said to be of the simplest sort. The ore is crushed very fine and then mixed with dilute sulphuric acid in two large tanks, whence the acid solution is drawn off for precipitation on scrap iron.

Suit to quiet title has been brought by the Arizona-Jerome Copper Co. against Thomas Stuart. The property affected includes the Bell, New Jerome, [illegible], Copper King, [illegible] and claims Nos. 4, 5, 9, 10 and 11 located about a mile and a half southeast of Jerome.

Phoenix—The Southern Pacific Co. has announced a reduction of [illegible] a ton, to [illegible], on a combination rail-water basis via Galveston, from Arizona [illegible] points to the Atlantic seaboard [illegible] The rate will be effective July 15, from Clifton, Globe, Miami, Haden, Ajo and other points in Arizona and from Cananea, Sonora, applying to copper and lead bullion and ore.

Globe—The Miami Copper Co. has made a change to its new hoisting and crushing plant, which has been under construction for a year. The old plant, menaced by settling ground on the north end, has been abandoned and will be dismantled.

Inspiration Consolidated has bought twenty claims for $44,000 in the Pinto Creek section, adjoining the Cactus Mining Co.'s holdings.

In Richmond Basin the old Gila Monster's ten-stamp mill has been put in condition and has had a trial run. It can handle 50 tons a day. Much ore is available, 600 tons being on the dump of the Silver Plume mine.

Oatman—Practically all the buildings of Oatman between the Tom Reed and United Eastern mills were destroyed by fire June 27. Among the few business structures saved were those of the Arizona Stores Co., Central Commercial Co., a bank and a restaurant, all near the Tom Reed property. No damage was done to any of the mining plants. The property loss is estimated at above $250,000. Most of the buildings were of flimsy wooden construction, hurriedly erected a few years ago in the boom days of the camp. The water supply, received from springs through a 2-in. pipe, is hardly adequate for ordinary uses and was utterly inadequate for fire fighting. Oatman's population has approximated 1,500 recently.

Globe—Water, to the limit of 660,000 gal. a day, is to be furnished the city of Globe by the Old Dominion Copper Mining & Smelting Co. at a charge of 12½c. per 1,000 gal. Eight thousand feet of 8-in. supply main will be built from the mine to connect with the city mains. The city water system, on which $400,000 has been spent, has proved inadequate in present drought conditions. Water from the mine proves better than that from the city wells.

Prescott—A 50-ton mill, planned for the United Gold & Silver Mining Co., on its property in the Hassayampa section, is to have a tube mill, plates for the free gold, Wilfley tables and cyaniding for the slimes. The average grade of ore milled is expected to be around $18, all in gold, as other metallic values are immaterial. President J. B. Tomlinson, an experienced southwestern miner, is in charge. Ed. L. Tomlinson will be superintendent of the mill.

A small mill has been bought by Joseph Cavenaugh for his Blue John mine in the Walker district.

Milling is to be resumed on ores from the Gillespie mine in the Canyon district, a property handled by S. A. Hobson.

Humboldt—Report has come to Humboldt that a sufficient number of stockholders of the Consolidated Arizona Smelting Co. have accepted the plan of transfer to the new Southwest Metals Co., on the basis of $20 a share of the new organization.

NEW MEXICO

Gold Strike Reported on Reservation Property at Gold Hill

Tyrone—The Phelps Dodge Corporation has ordered all excess equipment and supplies to be shipped from the Burro Mountain Branch to Bisbee, Ariz., and Dawson, N. M. One hundred cars of lumber will be sent out. The mine pumps are still working.

Lordsburg—The Scott-Montague interest in the Nellie Gray mine has been purchased by R. M. Reynolds and Ves Chase, who are now sole owners of this property. Patent surveys are now being run.

Gold Hill—A gold strike has been made on the old Reservation property by H. O. Hildahl, who has just completed a 110-ft. tunnel cutting a 12-in. quartz vein at 80-ft. depth showing considerable free gold.

COLORADO

Gold Crown Mill at Ouray Destroyed by Fire

Ouray—The Gold Crown mill at Ouray was totally destroyed by fire of unknown origin the night of June 21. This mill, under the superintendency of C. R. Wilfley, had just been overhauled and put in shape for regular operation and was to start milling the following morning. Ore from the Two Kids mine was to be treated first; this mine, belonging to the owners of the mill, was to be operated regularly if the test run proved successful.

The mill was also to operate as a custom mill. The principal idea of the owners was a commendable intention to take care of numerous small operators in the neighborhood, hoping thus to develop and foster new mining in the district; milling charges were to be practically at cost. For this reason, the loss will be felt keenly by the town and by several operators who had begun mining and storing ore for custom mill runs. Among these were Carey and Alexander, and Hutter and van Houten, at the Newsboy mine. The loss is given out as about $100,000, partly covered by insurance. The fire probably started in the laboratory.

The Whitecloud M. & M. Co. has appointed Bert Humphrey manager and is starting work again on the Monas Queen where good ore was struck in the main crosscut last year. It is probable that a small compressor and air drills will be put in soon.

Lessees at the Barstow are milling the ore mined last winter. This ore, a new orebody, turned out to be exceptionally good gold ore and is yielding the richest concentrates ever made at this mine, which has been producing steadily for eleven years. This is the only mine operating in the Red Mountain district and will be badly handicapped by the refusal on first demand of the Silverton Railway Co. to operate any trains this summer over the Red Mountain line.

UTAH

International Smelter at Tooele Closed Down

Salt Lake City—The International smelter, at Tooele, closed down July 1, and will remain so, it is announced, until there is an adequate supply of ores. The copper smelter was closed down last fall, and lately two out of the five blast furnaces have been working, treating silver-lead ores. About 295 men are effected by the closedown.

There are three lead furnaces in blast at the Murray plant of the American Smelting & Refining Co., and the United States Smelting Co. at Midvale has four lead furnaces—including one on matte concentration—in operation.

The net proceeds of Utah mines in 1921, for taxation purposes as compiled by the state board of equalization, amounted to $7,024,629. The total decrease in the value in 1921 from 1920 amounts to $2,633,270.

Eureka—More siliceous silver ores are being received by the smelting companies, as a result of which conditions are improving in the Tintic district, where many mines produce dry silver ores. This is evidenced in the increase in shipments from the district for the week ended June 25 to 145 cars as compared with 137 cars the week preceding; and in the greater general activity. Tintic Standard shipped 46 cars; Chief Consolidated, 42; Iron Blossom, 14; Eagle & Blue Bell, 12; Dragon, 8; Iron King, 7; Gold Chain, 4; Swansea, 3; Gemini, 2; Eureka Bullion, 1; Mammonth, 1. The working of the Pittman Act, fixing silver at $1 an oz., has been of inestimable value to this section of Utah, which is a producer of silver and lead ores chiefly, the silver content making it possible under present conditions to ship ores carrying lead also, and making good the loss from the latter metal. However, for some time, owing to the inability of the smelters to continue taking siliceous silver ores, the district has been heavily handicapped, and a number of properties either closed down or greatly lessened operations. These properties are again able to send out their dry silver ores.

New men have been put on at the Victoria, Eagle & Blue Bell, Tintic Standard, Swansea, and others. The Chief Consolidated has been keeping up its steady pace throughout the summer. The Swansea has been lately reopened, and is shipping low-grade ores to the Tintic Milling Co. at Silver City. The Eagle & Blue Bell has put on a night shift.

The failure of the Bursum bill to pass is speeding up assessment work in this camp as elsewhere, although the feeling is that its passage allowing more time, etc., would have aided the industry under present conditions.

The Chief Consolidated is resuming work at its Water Lily shaft in East Tintic and by this work will take care of its assessment requirements for the 2,000 acres, which it owns in this section of the camp. The shaft, which is [illegible] of the company's [illegible] shaft, and east of the Tintic Paymaster, is down [illegible] ft., and will probably be driven another 300 ft. this summer. It is a three-compartment shaft with a manway, and is being driven under contract by Walter Fitch, Jr. The Apex Standard is putting up new buildings. The Eureka Lily is resuming work.

Park City—Shipments of ore and concentrates for the week ended June 25 amounted to 1,755 tons as compared with 887 tons the week preceding. Silver King Coalition shipped 660 tons; Judge allied companies, 570; Ontario, 335; Naildriver, 180.

IDAHO

Dollar Silver Bringing Argentine Property to Life—Sunshine Mill Nearing Completion

Wallace—Dollar silver is the only thing that sustains life in the lead mines of the Coeur d'Alene district. It is doing more than that. It is restoring life to mines long dead, the latest one to receive its quickening influence being the Argentine. A quarter of a century ago this old property was quite an extensive shipper of silver ore, which was a very desirable smelting product on account of the large percentage of spathic iron. After all these years of inaction, the Argentine has now passed in the hands of Rush J. White, mining engineer of Wallace, under a lease and bond for a term of years. Men are now employed cleaning up the workings and Mr. White expects to recover the ore shoot from which high-grade silver ore was shipped years ago.

The Sister is another property, almost in the suburbs of Wallace, never a success and long abandoned, that is showing unmistakable evidence of becoming a producer under the energetic development of the Sisters Leasing Co., which has a lease and bond on the property. A shoot of lead-silver and zinc ore has been proved for over 100 ft., in places showing 3 ft. of solid ore that carries from 60 to 70 oz. of silver. Five carloads of ore has been shipped, smelter returns for which averaged 33 oz. silver, 32 per cent lead and 16 per cent zinc.

At an adjourned quarterly meeting of the Board of Directors of the Callahan Zinc-Lead Co. held in New York June 27, the following officers were elected: John Borg, president; [illegible], first vice-president; [illegible], second vice-president; [illegible], secretary-treasurer. [illegible] John Borg, M. C. [illegible], Joseph B. Cotton, Donald A. [illegible] and [illegible] were elected to the Executive Committee for the ensuing year.

Since Jan. 1 the wage scale for mine labor has been reduced approximately 30 per cent in the Coeur d'Alene District. When the Callahan company resumes capacity shipments the scale now in effect will result in an approximate saving of $240,000 per annum in this item alone, it is claimed.

Kellogg—The 50-ton mill being constructed by the Sunshine Mining Co., operating on Big Creek, is nearing completion. For the present it will be used to treat ore produced by lessees, of which about fifteen outfits are working on the property. The ore is chiefly gray copper with some galena, carrying high values in silver.

At the Sidney, on Pine Creek, where an important strike was recently made, about 100 tons of ore is on the dump, and a tramway is being put in to convey it to the wagon road for shipment to the Bunker Hill smelter. The ore is lead-silver.

Elk City—A crew of about seven men has been put on at the American Eagle mine, and considerable development has been planned.

Hope—Two shifts are being maintained in crosscut tunnel work of Auxer Gold Mining Co. Efforts are being made to get money to buy a small compressor equipment.

Bonners Ferry—The Idaho-Montana Amalgamated Mining Co., whose property is on the Great Northern R.R. about 9 miles east of this point, has arranged to drive a 2,600-ft. tunnel to open up the ground at a vertical depth of 1,250 ft.

MONTANA

Rumored Anaconda Fertilizer Plant May Resume Soon

Butte—The fertilizer plant at the Washoe reduction works of the Anaconda Copper Mining Co. will resume operations in advance of copper mining, according to unofficial information. About eighty carpenters were placed at work at the Washoe plant the past week, and a general repair program is under way. At the mines little else is being done aside from getting all copper properties in good shape for production. Con. F. Kelley, president of the company, visited the properties during the week.

Shipments of about two carloads monthly are being made from the Crystal Copper's Goldsmith mine by lessees. Values are running about $50 a ton. A carload shipped recently returned approximately [illegible].

[illegible] on the 2,300 level of the [illegible] mine of the Davis-Daly company, where from 5 to 6 ft. of ore running around 15 to 16 per cent copper was opened some time ago, is continuing. Shaft sinking from the [illegible] level is under way at the [illegible].

A moderate amount of development work on some of the lower levels continues at the [illegible] Mountain with no [illegible] of [illegible].

Elkhorn—Two large gyratory crushers of [illegible] tons capacity have arrived for the [illegible] concentrator of the [illegible] & Montana Development Co. Machinery is arriving and is being installed. About [illegible] men have been added to those working on the mill.

WASHINGTON

Farmers Threaten Northwest Magnesite Co. With Injunction Suits —Day Mines Shipping to Trail

Chewelah—Hope of resumption of calcining operations at the plant of the Northwest Magnesite Co. have had a setback due to possibility of the company being forced to defend injunction suits likely to be brought by local agricultural interests if calcining is resumed, even on a small scale. About the middle of the month it was announced operations would be resumed with one unit of the plant to take care of a limited quantity of magnesite from quarries of American Mineral Products Co.

Northport—A [illegible] has been placed at work on development of Keystone Lead Mining Co.'s property adjoining the Gladstone and Electric Point.

Republic—Improvement in prospects for mining activity in this camp have been noted lately, and a gradual resumption of operations is looked for. Northport Smelting & Refining Co. has commenced shipping ore from the Day properties to Trail, B. C., for treatment. It is stated a contract has been entered into for the handling of 10,000 tons. Seven men are working at the Knob Hill. Other Republic mines working in a small way are Republic (leased) Quilp and Old Republic.

Yakima—At the annual meeting of Swauk Mining & Dredging Co., held here recently, it was decided to buy a bucket dredge of 7½-cu.ft. capacity and costing $250,000.

OREGON

Sumpter Smelter Being Overhauled Preparatory to Operation

Sumpter—Operations to rehabilitate the Sumpter smelter by a Washington state corporation, in which Eastern capital is said to be heavily interested, are now definitely under way. A crew started work June 20 cleaning up, repairing equipment and improving the water supply.

Full control of the E. & E. mine at Bourne was taken over the middle of June by the Blue Mountain Mines Co. This property was long owned by [illegible] poration.

The [illegible] mine, [illegible] miles north of Sumpter, is to be placed on a production basis. The [illegible] property on [illegible] Creek is putting its mill in shape. Operations have been resumed on the [illegible] group, [illegible] last year.

NEVADA

Steps Taken To Protect Workers at Tonopah from Violence

Virginia City—The two-mile railroad spur to the portal of the main haulage tunnel of the United Comstock Mines Co. is about one-half completed and work is being rushed. The haulage tunnel is progressing satisfactorily. Connection has been made between the Jacket and the Con Imperial. The two headings from the Knickerbocker shaft are making good progress. Connection will be made shortly between the Jacket and Belcher, and at the portal end excellent advance is being made. At this end a storage battery locomotive and Hoar shoveling machine facilitate the work.

Manhattan—Lessees on the Little Grey recently milled 12 tons of ore which netted over $100 per ton. This is the result of two weeks' operations. Lessees on the Mustang have opened up some promising ore and many new lease blocks are being granted. The 800 level crosscut from the White Caps shaft has about reached the projected position of the west orebody and developments are being watched with interest.

Tonopah—On account of apparent lack of protection by local authorities for men who have been imported to work in the mines of this district during the present labor trouble about thirty state police and plain-clothes men arrived in Tonopah on June 27. Two men employed by the Belmont company were waylaid at night and badly beaten, and several minor acts of violence reported. The new employees are to be allowed freedom of the city and given full protection. The Tonopah Extension is now operating twenty stamps and general conditions throughout the camp are regarded as improving.

Divide—It is reported that the Divide Extension, which has been operating on a contract basis since the strike of April 16, resumed work on a wage basis on June 24, paying the old scale. The Reorganized Belcher Divide has resumed work on contract, and a crosscut is to be driven to cut the Hearst ledge. This ledge should be encountered in about 200 ft.

Tule Canyon—The cyanide plant of the Silver Hills Mining Co., which has been treating tailings for a month with satisfactory results, is now operating on mine ore. The hoisting equipment and compressor have been moved from No. 1 to No. 3 shaft, on account of the former having been sunk in the main orebody so that it now interferes with ore production.

Round Mountain—The May cleanup of the Round Mountain Mining Co. amounted to $26,000. Yardage moved was 24,000, which means the gravel being worked at the present time averages about $1 per yd. There is still plenty of water and June operations are said to be good. It is likely that the water supply will last into August.

MICHIGAN

The Copper Country

Equalized Valuation of Mining Property Reduced About 30 Per Cent This Year

Houghton—There have been no copper shipments out of the Lake Superior district in the last week. Calumet & Hecla has only a small quantity of mineral on hand at the smelters and only enough cupola blocks to keep the plant operating another month with five out of twenty-four furnaces. When this supply is exhausted there will be no necessity of continuing unless special orders are received in the meantime. The smelters are turning out anodes from cupola blocks and the cathodes that are returned from the electrolytic plants are either smelted into bars or ingots or held in reserve for resmelting into special shapes. On the present basis of production at the smelters, Calumet & Hecla could turn out as much as 120,000 lb. of copper per day in special sizes if necessary. At this rate it would not take long to fill even large orders from Germany, which usually call for cakes of unusual size. A plentiful supply of ingots and bars is piled upon the smelter docks.

Quincy's new furnace, having a capacity of 150,000 lb. of copper daily, will be completely equipped within a month. It has been partially in use but installation of its casting equipment has not yet been completed. The furnace is of a type similar to those in use at the Michigan and Calumet & Hecla smelters, with certain improvements which contribute to economy of operation. All material to complete the furnace is on the ground but the work is being proceeded with leisurely as there is no particular necessity for speed.

The study of Lake Superior copper deposits is the object of an extensive geological survey undertaken about two years ago by the Calumet & Hecla. A corps of geologists and mineralogists have been engaged in this work.

Many men are being given employment in road work, the highway program in both Houghton and Keweenaw counties having been greatly enlarged to tide over the unemployment crisis. No extensive construction or repair work is being done at any of the mines, but Calumet & Hecla will take advantage of the plentiful labor supply to extend its Lake Superior water system from Calumet to Ahmeek, which will furnish water to subsidiary locations such as Centennial, Kearsage, Allouez and Ahmeek. The extension calls for the laying of 50,000 ft. of pipe and a considerable number of men will be employed.

It is unlikely that the reclamation plant to be built on the Tamarack conglomerate sands by Calumet & Hecla will be started this summer, although steel and other material, ordered before the depression in the industry set in, has been arriving. There are 12,000,000 tons of sand in the Tamarack deposit, carrying from 10 to 12 lb. of copper per ton.

At the Calumet & Hecla smelter there are several carloads of mass copper from various subsidiary mines, among which are numerous slabs of almost pure metal from the mass fissure vein in the Ahmeek mine. This vein lies north of No. 2 shaft.

The equalized valuations of the Lake Superior copper mines, which are based on the market values of the various shares, show an average reduction this year of 30 per cent. The values have just been announced. These have been determined in other years in October, but under a new Michigan law will be fixed in June hereafter. The equalized valuation for Houghton County, the greater part of which is mining property, is $64,081,653 as compared with $91,878,050 last year. Keweenaw County's equalization values have been fixed at $16,000,000, which compares with $21,000,000 last year. The tax rates will not be set until fall. It is known they will be higher than last year but the mining companies still will benefit as a result of the reduced valuations.

Chronology of Mining

June, 1921

June 1—Cleveland-Cliffs Iron Co. reduced operations, and independent operators of Lake Superior iron mines cut wages 10 per cent.—An agreement reducing pay at Virginia City and Gold Hill, Nev., went into effect.

June 3—Floods caused great losses in Colorado, principally in Pueblo.

June 4—U. S. Steel Corporation filed reply to charges of unfair competition made to Federal Trade Commission.

June 6—The case of the Union Sulphur Co. vs. the Texas Gulf Sulphur Co., had a preliminary hearing at Galveston, Tex., and case was postponed to the October session.—Nicholson bill for a Department of Mines (S. No. 1957) was introduced in Senate.

June 15—Tonopah Extension started milling on 10-stamp basis, following the recent strike.

June 16—Mount Lyell Mining & Railway Co., Tasmania, closed down.—Oliver Iron Mining Co. announced an immediate reduction of its force amounting to 25 to 30 per cent.—Homestake Mining Co. announced that on July 16 it would cut all pay by 50c. per day.—Steel companies of Pittsburgh and Youngstown put into effect a general reduction in wages and abolished overtime.

June 20—Oliver Iron Mining Co. reduced its operations one-half.

June 24—F. F. Sharpless, secretary of the Mining and Metallurgical Society of America, appointed secretary of the A. I. M. E., succeeding Bradley Stoughton, who resigned on May 17.

June 27—Part of Oatman, Ariz., destroyed by fire, loss being estimated at $250,000.

June 30—New tariff bill reported to the House of Representatives by Chairman Fordney of Ways and Means Committee.

THE MARKET REPORT

Daily Prices of Metals

June	Copper, N. Y., net refinery* Electrolytic	Tin [illegible]	[illegible]	Lead N. Y.	Lead St. L.	Zinc St. L.
30	12.50	[illegible]	[illegible]	[illegible]	4.15@4.25	4.20@4.25
July 1	12.375–12.50	[illegible]	[illegible]	4.40	4.25	4.20@4.25
2	12.375–12.50	[illegible]	[illegible]	4.40	4.25	4.25@4.30
4					......	......
5	12.375–12.50	[illegible]	[illegible]	4.40@4.50	4.25@4.35	4.25@4.30
6	12.375–12.50	[illegible]	[illegible]	4.40@4.50	4.25@4.35	4.30

*These prices correspond to the following quotations for copper, "delivered": [illegible]

The above quotations are our appraisal of the average of the major markets based generally on sales as made and charged for by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

June	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
30	71⅛	71½	75	[illegible]	169¼	[illegible]	23	27¼	27[illegible]
July 1	71[illegible]	72⅛	75[illegible]	[illegible]	171	[illegible]	23⅛	27⅜	27[illegible]
2			..					.	
4	71[illegible]	72[illegible]	75[illegible]	170[illegible]	172[illegible]	23	23	26[illegible]	27[illegible]
5	72[illegible]	72[illegible]	75[illegible]	172[illegible]	174[illegible]	23[illegible]	23¼	26⅞	27¼
6	72	72⅛	75[illegible]	[illegible]	[illegible]	23⅛	23⅛	26[illegible]	27[illegible]

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

June	Sterling Exchange	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	July	Sterling Exchange	Silver New York Domestic Origin	Silver New York, Foreign Origin	Silver London
30	372	99¼	59	[illegible]	4				35⅞
July 1	372⅞	99¼	59⅛	[illegible]	[illegible]	374½	99¼	59[illegible]	[illegible]
2	373	99¼	59[illegible]	[illegible]	[illegible]	[illegible]	99¼	59[illegible]	[illegible]

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Monthly Average Prices for June

Copper:	
New York Electrolytic	[illegible]
London Standard	71.852
London Electrolytic	75.682
Lead	
New York	[illegible]
St. Louis	4.293
London	[illegible]
Silver:	
New York, Foreign	[illegible]
New York, Domestic	[illegible]
London	[illegible]
Sterling Exchange	377.236
Zinc:	
St. Louis	[illegible]
London	26.750
Tin:	
99 per cent	[illegible]
Straits	29.423
London	[illegible]
Antimony	[illegible]
Quicksilver	[illegible]
Platinum	[illegible]

Metal Markets

New York, July 6, 1921

The week-end holiday was not conducive to much trading during the last week, and the volume of sales has continued small, with narrow price changes. The provisions of the proposed new tariff, which were outlined in the *Engineering and Mining Journal* last week, seem to have had no appreciable effect on the market for any metal. It is more than likely that many changes will be made before the bill is ready for the President's signature.

Copper

Demand continues weak, with [illegible] occasional order for as much as [illegible]. One lot of this size had sold last Friday for 12.675c., delivered, and the same day another lot for a somewhat larger tonnage at 12.75c., delivered. These prices represent the price range through which business was actually [illegible] for the week. The [illegible] included metal for delivery as late as September, which brings a [illegible]. Most of the larger producers are quoting [illegible] delivered, to the general [illegible] trade, but we have heard of no business being done at the figure. [illegible] the small producers and [illegible] who are [illegible] to sell at the prices [illegible] enough copper to meet [illegible] demand. Export business is also weak, with [illegible] quotations [illegible] New York. [illegible] Most of the copper now being sold is in the form of wire bars, the wire business being the only one which consumes copper that is at all active. The brass mills continue virtually out of the market.

Lead

Demand has fallen off materially over that of last week, the incipient buying movement apparently having run out. Producers are optimistic, however, with the stronger tendency in London, and many are unwilling to sell at the prices of a week ago. The higher prices are caused by a holding off on the part of sellers rather than increased buying. Chemical lead is probably not obtainable for less than 4.35c., St. Louis, today, and not from all producers even at this figure. Lead for August delivery is nominal at slightly higher prices.

Zinc

Owing to the fact that the larger producers of zinc have withdrawn from the market, the price of zinc has shown a slight upward tendency, but only small amounts of metal have been sold, offerings being made at 4.35c., East St. Louis. The sentimental effect of the tariff, regardless of the date of its future enactment, has also possibly been a factor in the improvement. The cut [illegible]

Tin

[illegible]

current rates of production, which seem to be pretty well maintained. Electrolytic is also weak at or slightly below the price for Straits. There is really no quotable difference in the prices for spot and futures.

Arrivals of tin, in long tons: Total for June, 1,565.

Gold

Gold in London: June 30, 110s.; July 1, 110s. 1d.; 4th, 110s. 3d.; 5th, 110s. 1d.; 6th, 110s. 4d.

Foreign Exchange

The exchange market has been generally quiet, with the business incident to the end of the half year completed. Compared with a year ago, the exchange of almost every foreign country has depreciated in terms of the dollar, with the exception of Denmark. In the cases of Austria, Portugal, Greece, Poland, Jugo-Slavia, Finland, and Brazil the decline has been over 50 per cent. On Tuesday, July 5, francs were 8.0075c.; lire, 4.8975c.; and marks, 1.345c. New York funds in Montreal, 13 3/16 per cent premium.

Silver

Owing to the holidays in Shanghai and Hongkong on July 1 and 2, the China demand fell off considerably, with silver quoted 35⅜ to 35¼d. in London, and 59 to 58½c. in New York. The Fourth of July holiday here also prevented any local activity. Buying by China was given as the reason for the advance in London the 4th and 5th, but the New York market did not respond to the advance, as London was not bidding, its orders being filled, and China exchanges did not warrant purchases on the basis of the London parity. Apparently the rise in London was overdone, as the price reacted sharply on July 6. The market closes dull with tendency uncertain and sterling weak.

Mexican Dollars—June 30, 45¼; July 1, 44⅞; 2d, 44⅞; 5th, 45⅝; 6th, 45⅝.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 22@23c. per lb.; 22½c. for imports, duty paid.

Antimony—Chinese and Japanese brands, 4¾c.; market dull. W.C.C. brand, 5¾@5⅞c. per lb. Cookson's "C" grade, spot, 9@9¼c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500-lb. lots

Cadmium—Range $1@$1.10 per lb., in 1,000 lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $3@$3.25 per lb.; black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $165@$185 per oz.

[1]**Molybdenum Metal**—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$60@$65 per oz.

Platinum—$72@$75 per oz.

Quicksilver—Nominally, $45@$47 per 75-lb. flask. San Francisco wires $47.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal. Market very dull.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55. Prices have been reduced $1 per ton for the 1921 season.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50. Price reductions of 95c. to $1 followed the drop in Lake Superior ore prices.

Manganese Ore—25c. per unit, seaport; chemical ore (MnO_2) $55@$60 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports. Nominal.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]**Zircon**—Washed, iron free, 8c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., July 2—Zinc blende, per ton, high, $25.35; basis 60 per cent zinc, premium, $21; Prime Western, $20; fines, $18.50; slimes, no sale; calamine, basis 40 per cent zinc, $10. Average settling prices: Blende, $22.93; calamine, $13.25; all zinc ores, $22.88.

Lead ore, high, $53.45; basis 80 per cent lead, $40; average settling price, all grades of lead, $42.99 per ton.

Shipments for the week: Blende, 4,263; calamine, 22; lead, 1,292 tons. Value, all ores the week, $153,580.

Though buyers quote the premium basis price, based on Oklahoma purchases, it is understood that on account of freight differential and cheaper loading $1 more attaches to the price at Waco, in Missouri. Purchases of blende were 1,100 tons less than last week, with sellers withholding ore from the market.

Platteville, Wis., July 2—No market for zinc or lead. Shipments for the week: Lead, 38 tons. Shipments for the year: Blende, 11,461; lead, 978 tons. Shipped during the week to separating plants, 285 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1, $1,700@$2,000; No. 2, $1,200@$1,500; spinning fibers, $400@$800; magnesia and compressed sheet fibres, $275@$400; shingle stock, $95@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga. Prices largely nominal.

Bauxite—French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $7@$9; washed, $9@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $20@$25, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

---

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Feldspar — Crude, $7@$9 per [illegible] ton, f.o.b. Maryland and North Carolina points; [illegible] 50, [illegible] ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine. No. 1 Canadian, $26@$28, f.o.b. cars. Market quiet; prices largely nominal.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $18 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $13.50, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $30, New Mexico. Good demand for ground grades in West.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7@8c. per lb.; chip, 5½@6c.; dust, 3@4½c. No. 1 flake, 6½@7c.; amorphous crude, ¾@2½c. Market quiet.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60. Builders' strike is affecting western production. All California plants are shut down awaiting resumption of building activities.

Dead Burned — $[illegible] per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick — See Refractories.)

Mica—India block mica, slightly stained, per lb.; No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $[illegible] $6.50 Clear block: No 6, 50c., [illegible] $1 75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending [illegible] quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $6.75; 68 per cent, $6.25; 68@66 per cent, $6.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 3@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $8@$12 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic — White arsenic, 6½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $18@$20 per ton, f.o.b. Western mines, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.50@$1.75 per unit, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 14c. per lb. of chromium contained; 4 to 6 per cent carbon, 15c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, [illegible] f.o.b. furnace; [illegible] English, $75@$80, [illegible] Spiegeleisen, [illegible] per cent, [illegible] f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works. Imported [illegible]

Ferrosilicon—For 10 to 15 per cent, [illegible] f.o.b. works, [illegible] per cent, [illegible] per cent, $140 [illegible]

Ferrotungsten—Domestic, 70 to 80 per cent W., [illegible] per lb. of contained tungsten, f.o.b. works. Foreign, [illegible] f.o.b. Atlantic ports.

Ferro uranium—[illegible] to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$5@$6 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 21¼@21½c. per lb.; wire, 14¼@14½c.

Lead Sheets—Full lead sheets, 8.25c.; cut lead sheets, 8¾c. in quantity, mill lots.

Nickel Silver — 31¾c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets 17¾c.; sheathing, 16¾c.; rods, ⅜ to 3 in., 14¾c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $60@$65 per net ton, shipping point; arches, keys, wedges, $66; splits, soaps, $84.

Fire Brick—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $70@$75 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, July 5, 1921

The dullness in the steel market has not increased, and it is taken as a favorable augury that the advent of the traditionally dull midsummer season seems to have had no influence. Mill operations are at about 20 per cent of capacity, the Steel Corporation being above this rate and the independents below it. Few independents except the [illegible] furnished.

Liquidation continues in stocks of [illegible] manufacturing consumers of steel, and [illegible]

Pig Iron—A Valley [illegible] iron [illegible] a price [illegible] carload [illegible] W. P. [illegible] Valley [illegible] The average [illegible] foundry iron was $[illegible].42.

Coke

Connellsville — Furnace, [illegible] $3 [illegible] $4 [illegible]

---

[1] [illegible] Mineral Co., Philadelphia, Pa.

COMPANY REPORTS

Ray Consolidated Loss, $181,296

A statement of operations of Ray Consolidated Copper Co. for the first quarter of 1921 states that the total net production was 8,563,596 lb., compared with 10,617,651 lb. for the last quarter of 1920. The average cost per pound of net copper produced was 15.65c., which does not take into account any credit for the value of gold and silver or miscellaneous income, but includes 15c. per ton for retirement of mine-development expense. Miscellaneous income, including net income from gold and silver produced, amounted to 0.309c. per lb. which, applied as a deduction from operating costs, results in a net cost of 15.34c. per lb. of copper, as against a cost of 14.54c. for the preceding quarter.

The financial results of operations for the quarter are shown in the statement submitted below, all fixed and general items of expense, other than depreciation, being included as operating costs:

	First Quarter, 1921	First Quarter, 1920
Operating loss	$207,811 19	$587,165 50 (a)
Miscellaneous income, including payment for precious metals	26,515 16	50,134 39
Net loss for quarter	$181,296 03	$637,299 89 (a)
Disbursement to stockholders	....	394,294.75

(a) Profit.

The operating loss for the quarter is based upon an average carrying price of 13.22c. per lb. of copper, as compared with 14.59c. for the previous quarter.

International Nickel Co.

A report of operations of the International Nickel Co. for the fiscal year ended March 31, 1921, states that net profits after all charges were $2,029,399.83, equivalent to 69 per cent on the preferred stock and about 3.6 per cent on the common stock of the company. Consolidated general profit and loss statement follows:

Earnings of all properties after deducting manufacturing, selling expense, ordinary expense, ordinary repairs and maintenance, before deduction of foreign taxes		$4,059,607 54
Other income		1,106,973 69
Total income		$5,166,581 23
Deduct administrative and head office expense		
General office expense	$487,351 29	
Reserved for U. S. and foreign taxes (estimated provision)	491,379 96	978 731 25
Net income		$4,187,849 98
Deduct—		
Provision for depreciation of plants	$1,577,312 59	
Mineral exhaustion	569,837 56	
Foreign companies not included	11,000 00	2,158 150 15
Profits for the year ending March 31, 1921		$2,029,699 83
Deduct—		
Preferred dividends for the year		534,756 00
		$1,494,943 83

Surplus April 1, 1920, was $10,391,233.38, to which the balance of $1,494,943.83 was added.

Santa Gertrudis Paid £150,000 Dividends

A report of operations of the Santa Gertrudis Co., Ltd. (British), for the fiscal year ended June 30, 1920, indicates that 23,070 oz. of gold and 4,430,433 oz. of silver were produced from 447,075 tons of ore milled by the Compañia Beneficiadora de Pachuca, S. A., a subsidiary, and partly mined by the Compañia de Santa Gertrudis, S. A. The average price received for silver sold was $1.201 per oz. (U. S.). Dividends totaling £250,000 were declared by the subsidiary company.

Profit of the Santa Gertrudis Co. amounted to £172,381 6s.; surplus carried forward from the last report was £8,322 [illegible]; giving a total of £180,706 8s., from which two dividends of £75,000 each, and a directors' remuneration amounting to £1,7[illegible] 17s., were paid, leaving a balance of £[illegible],92[illegible] 11s.

Amparo Mining Co. Net Profit, $114,417

A report of operations of the Amparo Mining Co. for 1920 states that 1,258,985 oz. of silver and 27,176 oz. of gold were produced, compared with 1,249,722 oz. of silver and 33,959 oz. of gold in 1919. Profit and loss account follows:

Income		Expenses	
Sale of bullion, concentrates, etc.	$1,688,564 39	Cost of mining and development	$467,022 58
Premiums and interest	1,586 81	Transportation of ore to mill	30,029 75
Liquidation of bars and concentrates, 1919	5,897 41	Cost of milling	350,936.15
Miscellaneous adjustments, sales, etc.	49,243 08	Expenses, marketing	106,730.29
Profit on sale of silver certificates	3,089 90	Taxes, Mexico	183,084.53
		Military protection, watchmen	20,808 60
		Exploration and prospecting	26,357 48
		Damages and losses	15,661 35
		Depreciation	31,998 55
		Miscellaneous	79,905 00
		General expenses	88,961.66
			$1,401,495.94
		Depletion	115,128.86
			$1,516,624.80
		Net profit	231,756.79
	$1,748,381 59		$1.748,381.59

Profit on operations		$231,756.79
Expenses at Philadelphia office	$17,478 36	
Less interest on investments	29,350 98	
Excess of income	$11,872 62	
Taxes paid and accrued	92,263 57	
	$80,390 95	
Loss on inventory of silver on hand (316,584 oz.)	36,948 93	117,339 88
		$114,416.91

Surplus Jan. 1, 1920, was $1,307,179.97. Adding net profit of $114,416.91 and subtracting a dividend of $400,000 gave surplus Dec. 31, 1920, of $1,021,596.68.

The Mining Corporation of Canada

The seventh annual report of the Mining Corporation of Canada, Ltd., states that 1,664,018 oz. of silver was produced in 1920, an increase of 433,365 oz. over the previous year. Mines account follows:

Extraction	$214,684 79		Values	$1,610,218 00
Development	26,333 42		Other income	5,022 05
Exploration	6,256 15			
Milling and reduction	456,927 36			
Freight, transportation, smelting and realization	87,394 54			
Administration and general	78,809 28			
	$870,405 54			
Special expenditure	29,189 38			
		$899,594 92		
Profit at mine		715,645 13		
		$1,615,240 05		$1,615,240 05

Net profits amounted to $579,569.96, derived by adding interest amounting to $77,825.42 to the mines profit of $715,645.13, and subtracting head office expenses of $213,900.59. Surplus balance Dec. 31, 1919, was $3,311,577.32. Adding net profits of $579,569.96 and subtracting three equal dividends totaling $622,518.75 left a surplus balance Dec. 31, 1920, of $3,268,628.53. Cost of production was 62.6c. per oz., compared with 59.78c. per oz. in 1919.

Waihi Gold Mining Co.

A report of operations of the Waihi Gold Mining Co., Ltd. (British), for 1920 states that gold and silver to the value of £341,432 10½s. were produced. Sundry receipts brought total income up to £383,904 13½s. Expenditures were £237,093 8s. 4d., leaving a balance of £146,811 5s. 2d. Four quarterly dividends of 1s. per share, or a total of £99,181 8s., were paid during the year. Location, New Zealand.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York 1920	New York 1921	London 1920	London 1921	Sterling Exchange 1920	Sterling Exchange 1921
January	132 827	65 950	79 [illegible]	39 985	367 082	372 650
February	131 [illegible]	[illegible]	[illegible]	34 745	[illegible]	[illegible]
March	125 [illegible]	[illegible]	74 194	32 479	[illegible]	[illegible]
April	119 779	[illegible]	[illegible]	34 250	[illegible]	[illegible]
May	102 585	[illegible]	[illegible]	[illegible]	383 360	396 580
June	90 957	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
July	91 [illegible]		[illegible]		385 538	.....
August	[illegible] 168		[illegible]		[illegible]	
September	93 [illegible]		[illegible]		[illegible]	
October	83 480		[illegible]		[illegible]	
November	77 734		[illegible]		[illegible]	
December	64 774		[illegible]		[illegible]	
Year	100 900		[illegible]		[illegible]	

New York quotations, cents per ounce troy, [illegible] London, pence per ounce sterling silver, 925 fine.

Copper

	New York Electrolytic 1920	New York Electrolytic 1921	London Standard 1920	London Standard 1921	London Electrolytic 1920	London Electrolytic 1921
January	18 [illegible]	12 597	118 [illegible]	[illegible]	123 238	79 119
February	18 [illegible]	12 [illegible]	12[illegible]	[illegible]	126 950	75 [illegible]
March	18 [illegible]	11 97[illegible]	10[illegible]	[illegible]	118 348	71 [illegible]
April	18 [illegible]	[illegible]	[illegible]	[illegible]	111 500	71 786
May	18 484	12 742	[illegible]	[illegible]	109 200	74 298
June	18 [illegible]	12 697	87 [illegible]	[illegible]	101 909	[illegible]
July	18 576		[illegible] 148		106 455	
August	18 345		93 [illegible]		111 143	
September	18 144		96 381		111 905	
October	15 934		93 327		104 905	
November	14 257		84 867		94 614	
December	13 188		75 702		85 905	
Year	17 456		97 483		108 839	

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York 1920	New York 1921	St. Louis 1920	St. Louis 1921	London 1920	London 1921
January	8 561	4 821	8 300	4 747	47 095	23 387
February	8 814	4 373	8 [illegible]	4 228	50 256	20 650
March	9 145	4 084	8 894	4 000	46 054	18 9[illegible]
April	8 902	4 355	8 614	4 272	39 225	20 589
May	8 576	4 952	8 352	4 754	38 488	23 399
June	8 323	4 485	8 169	4 [illegible]	34 330	22 [illegible]
July	8 338		8 283		34 960	
August	8 687		8 725		36 304	
September	8 177		8 160		35 452	
October	7 070		7 018		35 238	
November	6 159		6 127		32 483	
December	4 727		4 717		24 [illegible]	
Year	7 957		7 830		37 832	

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York 99% 1920	New York 99% 1921	New York Straits 1920	New York Straits 1921	London 1920	London 1921
January	61 596	36 000		[illegible]	376 512	190 464
February	58 466	28 534	59 932	[illegible]	395 750	16[illegible]
March	61 037	27 296	61 92[illegible]	28 [illegible]	369 489	156 024
April	61 120	28 990	62 115	[illegible]	345 450	16[illegible]
May	53 230	31 431	55 [illegible]	[illegible]	294 813	177 [illegible]
June	46 125	28 514	48 327	[illegible]	250 614	[illegible]
July	45 798		49 154		261 [illegible]	
August	43 856		47 [illegible]		274 048	
September	41 940		44 [illegible]		27[illegible]	
October	39 310		40 [illegible]		258 190	
November	35 [illegible]		36 8[illegible]		241 [illegible]	
December	33 [illegible]		34 [illegible]		212 44[illegible]	
Year	48 273		49 [illegible]		295 [illegible]	

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	St. Louis 1920	St. Louis 1921	London 1920	London 1921
January	[illegible]	[illegible]	58 [illegible]	[illegible]
February	[illegible]	[illegible]	61 [illegible]	24 [illegible]
March	[illegible]	4 [illegible]	[illegible]	[illegible]
April	[illegible]	[illegible]	47 [illegible]	[illegible]
May	[illegible]	[illegible]	45 [illegible]	[illegible]
June	[illegible]	[illegible]	41 [illegible]	[illegible]
July	[illegible]		41 [illegible]	
August	[illegible]		41 [illegible]	
September	[illegible]		39 [illegible]	
October	[illegible]		39 [illegible]	
November	[illegible]		33 [illegible]	
December	[illegible]		[illegible]	
Year	[illegible]		44 [illegible]	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York 1920	Antimony (a) New York 1921	Quicksilver (b) New York 1920	Quicksilver (b) New York 1921	Platinum (c) New York 1920	Platinum (c) New York 1921
January	10 577	5 258	90 [illegible]	48 44[illegible]	154 23	73 400
February	11 588	5 250	84 432	49 545	151 59	70 227
March	11 056	5 282	92 [illegible]	[illegible]	138 56	72 463
April	10 [illegible]	[illegible]	102 192	45 423	127 04	73 404
May	9 655	5 [illegible]	89 560	47 000	97 50	73 740
June	8 289	[illegible]	90 154	46 846	85 19	74 942
July	7.500		90 333		[illegible]	
August	7 177		83 [illegible]		[illegible]	
September	7.113		7[illegible]		[illegible]	
October	6 723		[illegible]		[illegible]	
November	6 [illegible]		[illegible] 417		84 [illegible]	
December	5 534		49 577	....	[illegible]	
Year	8 485		81 123		[illegible]	

(a) Antimony quotations in cents per lb. for [illegible] (b) Quicksilver in dollars per flask. (c) Platinum [illegible] per ounce.

Pig Iron, Pittsburgh

	Bessemer 1920	Bessemer 1921	Basic 1920	Basic 1921	No. 2 Foundry 1920	No. 2 Foundry 1921
January	$40 47	33 96	$3[illegible]	[illegible]	$39 85	[illegible] 88
February	42.95	28 96	42 61	26 96	43 40	[illegible]
March	43 40	28 16	42 90	26 46	43 40	27 85
April	43 72	26 96	44 22	24 46	43 90	26 77
May	44 00	[illegible]	44 88	[illegible]	45 36	25 56
June	44 89	24 96	45 41	22 66	46 40	[illegible]
July	47.21		47 42		46 56	
August	48 90		49 88		[illegible]	
September	50 46		50 46		51 96	
October	49.21		44 38		48 58	
November	41 26		39 20		42 61	
December	36.96		34 90		37 73	
Year	44 45		43 85		44 93	....

In dollars per long ton

Monthly Crude Copper Production

	1921 February	1921 March	1921 April	1921 May
Alaska shipments	5.482.962	4.985.259	5.615.500	4.216.920
Arizona Copper	2 000 000	2 000.000	2 0[illegible]	2[illegible]00
Calumet & Arizona	3,330,000	3,455,672	2 204 000	[illegible]
Con. Ariz. Smelting	[illegible]	(a)	(a)	(a)
Inspiration	4 500 000	5 000 000	1 100 000	(a)
Magma	600 000	650 000	378 900	(a)
Miami	4 20[illegible]	4.572.000	4 262 625	4 [illegible]00
New Cornelia	1,975 918	2,220,186	1 864 772	1 [illegible]27 415
Old Dominion	1 882 000	2.199.000	984 000	[illegible]
Phelps Dodge	5,712.000	6,959 000	1 461 000	[illegible]
Shattuck Arizona	[illegible]	(a)	[illegible]	[illegible]
Ray	2,976 000	2.940 000	[illegible]	[illegible]
United Verde	3.450 000	4.115.000	2 [illegible] 000	[illegible]
United Verde Extension	3 [illegible]	2,951,390	3 [illegible] 746	[illegible]
Calumet & Hecla	7,395 084	9.147 000	[illegible]	[illegible]
Other Lake Superior	5,000 000	5 000 000	5 000 000	4 [illegible] 000
Anaconda	9,000 000	11,600 000	2 935 840	[illegible]
East Butte	1,500 000	1,000 000	1,047,140	1 [illegible] 176
Nevada Cons	3 [illegible]	3 100 000	(a)	(a)
Chino	2 978 934	3 051 838	(a)	(a)
Utah Copper	7 500 000	7 500 000	(a)	[illegible]
Eastern Smelters	1,500 000	1,500 000	1 500 000	1,500 000
Others, estimated	9,300 000	7,100 000	10,900 000	[illegible]
Total United States	86 [illegible] 941	91 04[illegible] 145	4[illegible]	[illegible] 511
Imports: Ore and concentrates, matte, etc	1[illegible] 550 [illegible]	9 865 917	[illegible]	[illegible] 207
Imports of blister, unrefined, etc	19 424 207	12 448 8[illegible]	[illegible]	[illegible]
Imports of refined, etc	[illegible]	[illegible] 172	[illegible]	[illegible]
Grand total	127 [illegible]	11[illegible] 72[illegible]	[illegible]	[illegible] 14
British Columbia				
Granby Cons	2 274 530	2 617,702	2,459,250	22,519 000
Mexico				
Boleo	813 [illegible]	618 222	728 000	[illegible]
Cananea	(a)	(a)	(a)	[illegible]
Phelps Dodge Mexican properties	1 870 000	2 285 000	407 000	[illegible]
Other foreign				
Cerro de Pasco	4 174 000	4 200 000	[illegible]	[illegible]
Chile	[illegible]	[illegible]	[illegible]	[illegible]
Katanga	3 283 960	[illegible]	[illegible]	[illegible]
Backus & Johnston	[illegible]	1 642 000	[illegible]	[illegible]

(a) No copper produced during [illegible]

Comparative Annual Copper Production

	[illegible]	1920	1921
January	[illegible]	121 [illegible] 744	[illegible] 507
February	[illegible]	11[illegible]	[illegible] 241
March	[illegible]	[illegible]	[illegible]
April	[illegible]	11[illegible]	[illegible]
May	[illegible]	114 [illegible]	[illegible]
June	[illegible]	11[illegible]	
July	[illegible]	10[illegible]	
August	[illegible]	11[illegible]	
September	[illegible]	(a) 104 [illegible]	
October	[illegible]	10[illegible] 571	
November	[illegible]	10[illegible] 170	
December	10[illegible]	95 [illegible] 009	.

(a) [illegible]

MINING STOCKS

Week Ended July 2, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Adventure	Boston	....	....	....	....	
Ahmeek	Boston	47½	47½	47½	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*48	*40	*40	....	
Allouez	Boston	29	29	29	Mar. '19	1.00
Anaconda	New York	38	36	37½	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2¼	2¼	2¼	....	
Ariz. Com'l	Boston	7	7	7	Oct. '18,	.50
Big Ledge	N. Y. Curb	*50	*13	*17	....	
Bingham Mines	Boston	9	9	9	Sept. '19, Q	.25
Calumet & Arizona	Boston	48	46	46½	June '21, Q	.50
Calumet & Hecla	Boston	229	219	220	June '20, Q	5.00
Canada Copper	N. Y. Curb	*28	*25	*25	....	
Centennial	Boston	8½	7	8½	Dec. '18, SA	1.00
Cerro de Pasco	New York	25¼	25	25⅜	Mar. '21, Q	.50
Chile Copper	New York	10⅝	10⅜	10⅜	....	
Chino	New York	23⅝	22½	23¾	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	‡....	....	26½	....	
Con. Arizona	N. Y. Curb	*1	*1	*1	Dec. '18, Q	.05
Con. Copper M.	N. Y. Curb	1⅛	1⅛	1⅛	....	
Copper Range	Boston	33½	32	32½	Sept. '20, Q	.50
Crystal Copper (new)	Boston Curb	*36	*32	*35	....	
Davis-Daly	Boston	6	5⅞	5⅞	Mar. '20, Q	.25
East Butte	Boston	8	7½	7¾	Dec. '19, A	.50
First National	Boston Curb	*53	*50	*52	Feb. '19, SA	.15
Franklin	Boston	....	....	2	....	
Gadsden Copper	N. Y. Curb	....	....	*25	....	
Granby Consol	New York	20	20	20	May '19, Q	1.25
Greene-Cananea	New York	20⅞	20⅞	20⅞	Nov. '20, Q	.50
Hancock	Boston	....	....	3¼	....	
Howe Sound	N. Y. Curb	2⅜	2¼	2¼	Jan. '21, Q	.05
Inspiration Consol	New York	32¾	31¾	32¼	Oct. '20, Q	1.00
Iron Cap	Boston Curb	5	4¾	5	Sept. '20, K	.25
Isle Royale	Boston	19½	19	19½	Sept. '19, SA	.50
Kennecott	New York	19	18⅜	19	Dec. '20, Q	.50
Keweenaw	Boston	....	....	1¼	....	
Lake Copper	Boston	....	....	2⅝	....	
La Salle	Boston	....	....	2	....	
Magma Chief	N. Y. Curb	....	....	*21	....	
Magma Copper	N. Y. Curb	18½	17½	17½	Jan. '19, Q	.50
Majestic	Boston Curb	....	....	*12	....	
Mason Valley	Boston	....	....	1⅞	....	
Mass Consolidated	Boston	2	1½	2	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	3⅞	3½	3⅝	....	
Miami Copper	New York	21	20½	21	May '21, Q	.50
Michigan	Boston	....	....	2	....	
Mohawk	Boston	49½	47½	49½	Nov. '20, Q	1.00
Mother Lode (new)	N. Y. Curb	5½	5½	5½	....	
Nevada Consol	New York	11⅛	10⅞	11	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3	....	
New Cornelia	Boston	15	14½	15	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5	....	
North Butte	Boston	9½	9	9	Oct. '18, Q	.25
North Lake	Boston			½	....	
Ohio Copper	N. Y. Curb	*7	*6	*6	....	
Old Dominion	Boston	21	20	21	Dec. '18, Q	1.00
Osceola	Boston	26½	26	26	June '20, Q	.50
Phelps Dodge	Open Mar.	†160	†145	....	July '21, Q	1.00
Quincy	Boston	38	38	38	Mar. '20, Q	1.00
Ray Consolidated	New York	12¾	12½	12¾	Dec. '20, Q	.25
Ray Hercules	Boston Curb	....	....	*24	....	
St. Mary's Min. Ld.	Boston	32½	32½	32½	June '20, K	2.00
Seneca Copper	Boston	....		14	....	
Shannon	Boston	*90	*80	*90	Nov. '17, Q	.25
Shattuck Arizona	New York	6⅛	6⅛	6⅛	Jan. '20, Q	.25
South Lake	Boston	....	....	1	....	
Superior Copper	Boston	....	....	3½	Apr. '17,	1.00
Superior & Boston	Boston	....		1⅛	....	
Tenn. C. & C. cfs.	New York	7⅞	7⅛	7¾	May '18, I	1.00
Tuolumne	Boston	*60	*60	60	May '13,	.10
United Verde Ex.	Boston Curb	24	22½	24	May '21, Q	.25
Utah Consol.	Boston			3¼	Sept. '18	.25
Utah Copper	New York	48⅝	47	48¼	June '21, Q	.50
Utah Metal & T.	Boston	1¼	1⅛	1⅛	Dec. '17,	.30
Victoria	Boston	1⅜	1¼	1¼		
Winona	Boston		..	*40		
Wolverine	Boston	....	..	9	....	
		NICKEL-COPPER				
Internat. Nickel	New York	14¼	13¾	14¼	[illegible] '19,	.50
Internat. Nickel, pf.	New York		.	82	[illegible] '21, Q	1.50
		LEAD				
National Lead	New York	74½	74½	74½	June '21, Q	1.50
National Lead, pfd	New York	100	100	100	June '21, Q	1.75
St. Joseph Lead	New York	12	12	12	June '21, Q	.25
Stewart Mining	Boston Curb	..		*6	Dec. '15,	[illegible]
		ZINC				
Am. Z. L. & S.	New York	8	8	8	May '20	1.00
Am. Z. L. & S. pfd	New York			24	Nov. '20, Q	1.50
Butte C. & Z.	New York	4½	4	4½	June '18,	.50
Butte & Superior	New York	12	10⅞	12	Sept. '20,	1.25
Callahan Zn-Ld.	New York	4½	4⅜	4⅜	Dec. '20, Q	.50
New Jersey Zn	N. Y. Curb	114	112½	112½	Mar. '21, Q	2.00
[illegible]	N. Y. Curb	....	.	*2½	Feb. '16,	.03
Yellow Pine	Los Angeles	....	....	*55	Sept. '20, Q	.03

* Cents per share. † Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	½	½	½	....	
Alaska Juneau	New York	1⅝	1⅝	1⅝		
Carson Hill	N. Y. Curb	....	....	13½	....	
Cresson Consol. G.	N. Y. Curb	1 11/16	1⅝	1⅝	June '20, Q	$0.10
Dome Extension	Toronto	.	.	*75	....	
Dome Mines	New York	17⅝	16½	17⅛	Apr. '21, Q	.25
Golden Cycle	Colo. Springs	*71	*70	*70	June '21, Q	.02
Goldfield Consol	N. Y. Curb	*8	*8	*8	Dec. '19,	.05
Hollinger Consol	Toronto	7.20	7.07	7.07	Feb. '21, M	.05
Homestake Mining	New York	55	55	55	June '21, M	.25
Kirkland Lake	Toronto	*40	38	*38	....	
Lake Shore	Toronto	1.20	1.17	1.18	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.90	1.86	1.86	Jan. '21, K	.05
Porcupine Crown	Toronto	*15	13	13	July '17,	.03
Portland	Colo. Springs	*50	*50	*50	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb		.	*4	May '19,	.05
Silver Pick	N. Y. Curb	*7	*6	*6	....	
Teck Hughes	Toronto	*11½	*11	11	....	
Tom Reed	Los Angeles	*70	*65	*67	Dec. '19,	.02
United Eastern	N. Y. Curb	3 3/16	2	2 3/16	Apr. '21, Q	.15
Vindicator Consol	Colo. Springs	*34	*33½	*33½	Jan. '20, Q	.01
West Dome Consol	Toronto	*6½	*6½	*6½	....	
White Caps Mining	N. Y. Curb	*7	*5	*5	....	
Yukon Gold	N. Y. Curb	1¼	1	1⅛	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*21	*18	*19	Apr. '20, M	.03
Batopilas Mining	New York	⅞	⅞	⅞	Dec. '07, I	.12½
Beaver Consol	Toronto	*30	*29½	*30	May '20, K	.03
Coniagas	Toronto	1.75	1.75	1.75	May '21, Q	.12½
Crown Reserve	Toronto	*9	*7½	*8	Jan. '17,	.05
Kerr Lake	Boston	2⅞	2⅞	2⅞	Apr. '21, Q	.12½
La Rose	Toronto	....	.	*20	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*16	*16	*16	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.05	1.05	1.05	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4⅞	4⅛	4⅛	Apr. '21, Q	.15
Ontario Silver	New York	4½	4	4	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	..	.	2	Jan. '12,	.10
Peterson Lake	Toronto	*4.	*4¾	4¾	Jan. '17,	.01½
Temiskaming	Toronto	.		*21	Jan. '20, K	.04
Trethewey	Toronto	*13	*12¼	*12½	Jan. '19,	.05
		GOLD AND SILVER				
Atlanta	N. Y. Curb	*1	*1	*1	....	
Barnes-King	Butte	‡	.	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*54	*49	*50	....	
Cashboy	N. Y. Curb		.	*5	....	
El Salvador	N. Y. Curb	*18	*8	*12	....	
Jim Butler	N. Y. Curb	*8	*8	*8	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*4	*4	*4	June '16,	.05
Louisiana Con.	N. Y. Curb	.	.	⅛	....	
MacNamara M.& M.	N. Y. Curb	*16	*16	*16	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 1/16	1	1	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	1⅛	*79	*80	....	
Tonopah-Extension	N. Y. Curb	1½	1 7/16	1 7/16	July '21, Q	.05
Tonopah Mining	N. Y. Curb	1 3/16	1 3/16	1 3/16	Apr. '21, SA	.05
West End Consol	N. Y. Curb	*85	*78	*78	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N. Y. Curb	....	....	*9½	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	‡ ..	....	1.10	Dec. '21,	.15
Chief Consol	Boston Curb	2¾	2¼	2½	May '21, Q	.05
Consol. M. & S.	Montreal	13½	13	13½	Oct. '20, Q	.62½
Daly Mining	Salt Lake	‡ .		1.50	July '20, Q	.10
Daly-West	Boston	....	.	2¾	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†2½	†2	2	Apr. '21, K	.05
Electric Point	Spokane	.		7	May '20, SA	.03
Federal M. & S.	New York	7	6½	7	Jan. '09,	1.50
Federal M. & S., pfd	New York	24	24	24	June '21, Q	1.00
Florence Silver	Spokane	....	....	*12½	Apr. '19,	.01½
Grand Central	Salt Lake	‡ ..	....	*07½	June '20, K	.03
Hecla Mining	N. Y. Curb	3 13/16	3 13/16	3 13/16	June '21, Q	.08
Iron Blossom	N. Y. Curb	*18	*16	*16	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	‡		3.00	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*5	*4	*5	June '21, I	.02
Prince Consol	N. Y. Curb	*27	*27	*27	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*4	*3½	*4	Feb. '19,	.01
Rex Consol	N. Y. Curb	*8	*7	*8	....	
South Hecla	Salt Lake	‡		3	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*15	*12	*15	Oct. '17,	.05
Tamarack-Custer	Spokane	1.80	1.80	1.80	Jan. '21, K	.04
Tintic Standard	Salt Lake	‡		2.40	June '20, Q	.10
Utah Apex	Boston			2	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	..		*3	Nov. '17,	.01
		QUICKSILVER				
New Idria	Boston	†*50		*50	Jan. '19,	.25
		VANADIUM				
Vanadium Corp.	New York	29¾	27	28¾	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	47	46	46	Apr. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	75	75	75	Apr. '21, Q	1.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	37½	35½	36½	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York			68¾	June '21, Q	1.75
Am. Sm. pf. A	New York	69	69	69	July '21, Q	1.50
U. S. Sm. R. & M.	New York	28	28	28	Jan. '21, Q	.50
U. S. Sm. R. & M. pf	Boston	40	38	39	Apr. '21, Q	.87½

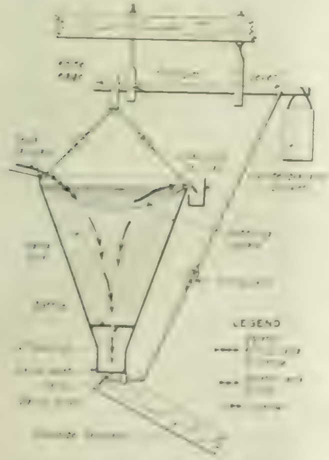
INDUSTRIAL NEWS

Boylan Classifier Used in the Joplin-Miami District

By P. R. Coldren

Written for Engineering and Mining Journal

Increasing popularity for the Boylan cone classifier is being recorded in the Joplin-Miami zinc and lead district, and an increasing number of mining companies are installing them. This classifier is used in place of trommels, overshot, impact and other mechanical screens, free- or hindered-setting classifiers, common hydraulic classifiers, dewatering boxes, and similar devices, and also instead of mechanical and hydraulic classifiers. It operates on the principle of the free-settling hydraulic classifier. The volume of replacement or the speed of flow in the machine is maintained almost constant by the automatic opening and closing of the oversize valve, governed by the amount of solids in the cone. The diagram should be self-explanatory.



SECTION OF THE BOYLAN CLASSIFIER

[illegible]

[illegible]

The original cost of the machine is [illegible] to $400. It uses no power or [illegible]. The sides of the cone are protected from wear by a lining of stationary or slowly moving sand, and the wear is confined to the plate valve seat, the conical valve, and the valve lever. The cost of maintenance on one cone through which 50,000 tons have been run was [illegible] for one conical valve. As against this it is pointed out that screen jackets cost approximately $50, and their life is little more than 10,000 tons.

The average efficiency of the cone on seven screen tests taken on different cones was 83.3 per cent. The average assay of the tailings after desliming was 0.93 per cent lower than before desliming.

Some of the companies that have installed these cones in this district are the Muncie, Anna Beaver, Premier, Standard, McBee, Chanute Spelter, and Farmington. The cone was patented on Jan. 6, 1920, by S. H. Boylan, the inventor, a mining engineer living at Joplin, and is sold by the Ore Reclamation Co., Joplin, Mo.

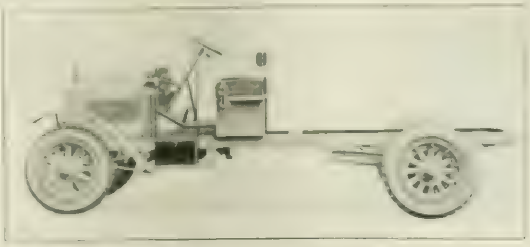
A New One-Ton Motor Truck

The O. Armleder Co., Cincinnati, Ohio, has placed on the market a new one-ton model which is capable of making speed, yet is so sturdy that it will stand heavy duty service.

Among the important features is the construction of the springs. There are no shackles or shackle bolts to the springs, which fact eliminates about forty-eight wearing parts. The springs are longer than those on other trucks; but owing to their construction they [illegible] under load, so that when the truck is empty the weight rests on the tips of the springs, making them as flexible as the springs of a touring car. Under load the [illegible] from the ends of the springs, which gives them the strength of the short springs used on other trucks.

Another feature which increases endurance is the special mounting of the power plant, shocks ordinarily transmitted between the motor and the frame being absorbed by the special spring mounting of the power plant on the frame.

The radius rods and the rear propeller shaft are the same length and are mounted parallel to each other. This eliminates all the end thrusts from the universal joints and prevents whipping of the propeller shafts at any of the speeds attainable.



F W D NEW ONE-TON TRUCK

Brown Convertible Locomotive Crane Fits Small Jobs

During the last few years many plants have found it economical to handle their coal, ore, stone and other bulk materials by a locomotive crane. Most of these cranes were large-capacity machines — too big to be economical for many small jobs.

With the idea of filling the need for a smaller capacity high-grade crane for this work, a new Brownhoist No. 2 locomotive crane has been announced by the Brown Hoisting Machinery Co., of Cleveland, Ohio. This machine can be changed in a few minutes' time to handle grab bucket, bottom block, or lifting magnet. With these attachments, practically all kinds of materials can be handled.

[illegible]

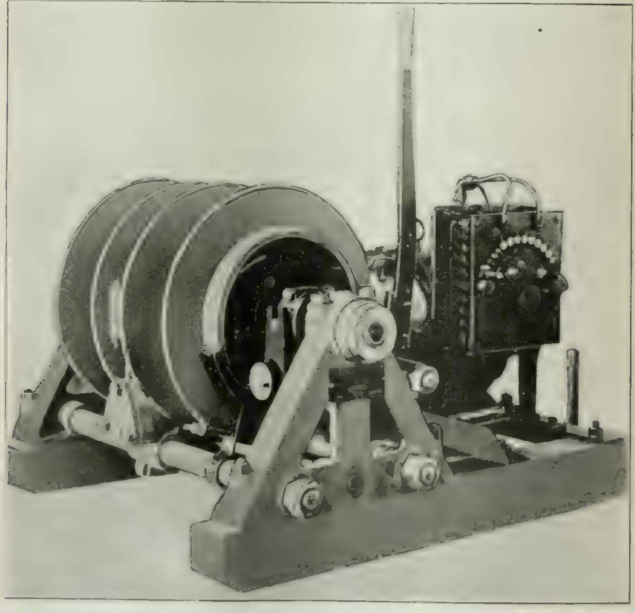
Experience with the larger type has proved the machine to be well fitted to handle all kinds of bulk materials by bucket. With hook and block, the various kinds of sling loads are handled, and [illegible] ings, bars, and the like are easily and quickly shifted. All models are self-propelling, and most cranes are used also for switching both empty and loaded cars. This new crane will do the same work within its capacity. It is built to handle a one-yard bucket, hook loads of five tons, or a 36-in. magnet.

To meet the different working conditions, these new Brown hoists are made to operate by steam, electricity, or gasoline engine. They are built for use on railroad trucks, traction wheels, or creeper trucks.

Motor-Driven Scraper Hoist

The modern system of underground loading by means of a power-driven scraper is bringing in its train the active development of the actuating hoist. Steam and electricity are of course the usual powers developed, but compressed air is also used, and the Lake Shore Engine Works, Marquette, Mich., have recently designed and built the latter type also.

The accompanying photograph shows, however, an electric motor-driven scraper hoist recently developed by the above mentioned company. Electric power usually permits of very compact, simple and handy installations. This is one of the striking characteristics of the model shown. The over-all dimensions are only 3 ft. 4½ in. wide, 4 ft. 2 in. long, and 2 ft. 4 in. high; the total weight is 1,400 lb.



ELECTRIC SCRAPER HOIST BUILT BY LAKE SHORE ENGINE WORKS

The International Nickel Co. announced recently that it had moved its general offices from 40 Exchange Place to 67 Wall St., New York.

Crossley Digging and Loading Machine

To meet a great demand for a small digging and loading machine which could be sold at a price that would make it possible to be used in a great many places where it is impossible to use a steam shovel, a new machine has been developed and patented by George C. Crossley, a mining engineer of Trenton, N. J. This machine is light in weight, simple in construction, easily moved about, and will save the labor of many men. It is driven by gasoline engine, electric motor, compressed air, or steam.

CROSSLEY RAPIDIGGER

It will dig and load practically any material, either from the natural deposit or from storage piles, excepting rocks and other solid materials, which could be loosened up first either with dynamite or plowed with the same machine.

The machine requires little head room or floor space, and can be shifted about under its own power. It is entirely self-contained and is strongly built to withstand the hardest work and abuse. All parts are interchangable and standard. There being few movable parts, the repair costs are small. Little power and only inexperienced labor are required to operate the device.

Portability is a feature, and the machine can be lowered in a cage to any level in the mine.

It is planned to have only one type and size, and the machine is being built by the Rapidigger Company, of Trenton, N. J.

Conveyor Companies Consolidated

The Link-Belt Co. of Chicago, Ill., has acquired all of the capital stock of the H. W. Caldwell & Son Co., and Frank C. Caldwell has been elected a director of the Link-Belt Co. Two experienced and successful companies in the conveyor world have thus joined forces, with the result that the Link-Belt Co. has added two new lines, Helicoid conveyors and power-transmission machinery, to its line of manufactures. The H. W. Caldwell & Son Co.'s plant will continue to operate under separate corporate existence and under its present name. The plant management will remain substantially the same.

TRADE CATALOGS

Tanks.—Turl Engineering Works, 39 Cortlandt St., New York, have issued a leaflet illustrating steel and cast-iron storage tanks, fabricated structural steel and miscellaneous iron work, steel plate and sheet metal construction, conveyors, storage bins, and chemical apparatus.

Shaft Sinking—In its bulletin No. 15 the E. J. Longyear Co., Minneapolis, Minn., has outlined several shaft-sinking operations which have been performed by the company. These contracts cover a number of mining districts and represent a diversity of work, which, judging from the comments made by officials of the companies in the different sections, has been carried out in a most efficient and satisfactory manner. The Longyear service is on a departmental basis as follows: Geological, engineering, contract drilling, mining, and mechanical.

Pump-governors—The Atlas Valve Co., 282 South St., Newark, N. J., is distributing a bulletin describing the Ideal pump governor, an article the company has acquired the sole rights to manufacture and sell.

Diesel Engines—Fulton Iron Works, St. Louis, Mo., has issued Bulletin No. 801 of the Fulton Diesel Oil Engine. The publication includes descriptions of the various types of Diesels.

Sheet Metal—"Armco in Pictures and in Fact" is the title of an attractive publication issued by the American Rolling Mill Co., Middletown, Ohio. The book is bound in imitation limp leather, well illustrated, and contains 247 pages. The first part covers a description of the various preparation processes of "Armco" products. The latter part contains a fund of reference and computing tables.

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and
Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
CLEVELAND ABBE, Jr.
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, July 16, 1921 *Number* 3

Employee Representation at Bisbee

ORGANIZING A PLANT with the Federal Government as a model, a scheme often associated with the name of John Leitch, has generally been successful in promoting efficiency and in decreasing labor troubles wherever tried. A notable example is that of the Goodyear Tire & Rubber Co. The secret, an open one, lies in employee representation without paternalism.

The plan is to be further tried at Bisbee, Ariz., where on June 28, as told in our news columns last week, the employees of the Phelps Dodge Corporation adopted the constitution of an "employees' representation plan," by a vote of 907 out of 923 who were eligible to vote. The Phelps Dodge Corporation is the first large mining company to take this important step.

Under their new constitution the employees will have a voice in the adoption of rules and regulations governing their work and conditions of employment through their own representatives. Certain broad powers are guaranteed to them, those not specified being reserved to the company. In particular it is stipulated that the company has the unquestionable right to increase or decrease production or the scale of its operations as it chooses. The executive power is vested in the president and the general manager in charge of the company's routine business.

It will be interesting to watch the results of the experiment at Bisbee, where, in spite of the general curtailment, the time is considered opportune to try out the plan. The relations of the Phelps Dodge Corporation with its employees have always been peculiarly happy. As a correspondent writes us, "If other large companies looked at their relations with their men in the same light as the Phelps Dodge does, there would be much less unrest and labor difficulties."

The Tariff on Minerals and Metals

THE TARIFF QUESTION is the affair of greatest interest in Congress at the present time. Business is depressed: and according to the accepted popular formula, it is the fault of the Government. A new Administration has come into office; and accepting the theory that the depression has been due to the last Administration, it proceeds first to prepare and administer the approved remedy of the party for business troubles —increased tariff duties, to be taken frequently in large doses until recovery, and to be taken thereafter as a preventive.

The present proposed tariff "protects" a lot of industries. Any American industry is open to "protection" under this theory, so long as it applies in due form. So among the metal industries we have duties on manganese, molybdenum, tungsten, aluminum, antimony, quicksilver, tin, lead, and zinc. These will protect various American industries. The tariff on aluminum will subsidize the Aluminum Company of America, which will be practically the sole beneficiary; the tariff on tin in bars will subsidize the few tin smelters hereabouts, which will be the sole beneficiaries; and so on. In the case of tin ore, of course, there could be no duty, for we have no tin mines, and the tin-smelting industry of the United States runs exclusively on imported ores.

Every man, woman, and child in the United States uses and pays for tin and aluminum; and it is a question we are not prepared to solve whether each should or should not be taxed for the protection of closely controlled or monopolistic industries. Personally, and on selfish grounds only, we object to this tax; but there are doubtless millions who are eager to pay it.

The import tax of five cents a pound on nickel is not of interest to the mining industry. We do not mine nickel in the United States. It is a tax to protect the nickel-smelting industry, which centers around New York, and which operates exclusively on imported ores; and the tax is designed to enable these to survive principally the competition of nickel shipped from Europe as well as a new Canadian refinery.

Mining men, running over the list of metals protected, are likely to think that something is being done to help the mining industries. This is so in some cases—manganese ore, molybdenum ore, tungsten ore, lead and zinc ores are subject to an import tariff. Of molybdenum ore we have a large quantity: the tariff will principally benefit one company, the American Metal Company, which is probably able to supply the country's needs from its properties at Climax. Manganese and tungsten fall into the group of which we have a limited supply: therefore, conservationists have argued against the exhaustion of these deposits being artificially stimulated. The reply to this argument is, "Nonsense; we have unlimited supplies of manganese and tungsten in this country."

Without debating this question at present, we should like to have seen a duty on tin ore and nickel ore, on this same theory, for these cases are to the point. If geologists and engineers are talking nonsense about manganese and tungsten, why are they not talking nonsense about nickel and tin? We shall not fail to find indignant subscribers who will object to our saying we have no nickel or tin in this country, so we should like to have seen it tried, because you cannot spoil a rotten egg; and under the stimulus of a high tariff we should like to watch the tin and nickel mining industries expand. But you can spoil a good egg—you can gut and wreck deposits of ores of which we have a limited supply; and the Geological Survey assures us this is the case with high grade manganese ores and with tungsten ores.

There was a time when Maryland was the world's greatest producer of chromite. Now the chromite is gone, and the mining period is scarcely a memory. As regards the tariff on chromium, we note that there is no tariff on chromium ore, but there is one on the ferro-alloy, ferrochromium. This means that the tariff will not benefit the American chrome-mining industry, but will make the Electrometallurgical Company the sole beneficiary. This company has a practical monopoly on the ferrochromium industry, is probably the largest manufacturer of ferrochromium in the world, and uses imported ores. We are not criticising this arrangement: we are merely elucidating the tariff. Chromite certainly belongs in that group, like tungsten and manganese—only perhaps more so—of which we have only a limited supply of our own. Among other raw material products protected are: Graphite, mica, talc, bauxite, fluorspar, asphalt, fuller's earth, clays, pumice, gypsum, limestone, and building stones. Refractory brick, including magnesite and chromite brick, are also covered by substantial tariffs.

Meeting Business Half Way

WE HAVE for some time given voice to our opinions regarding the situation in the mining industry. We have attempted to point out that the depression through which we have been passing is but the natural outcome of events and not a condition which gives any deep-seated reason for alarm. We have offered suggestions, from time to time, as to ways and means that might bring about a speedier rehabilitation in mining, in the meantime looking hopefully for those signs that would indicate that the curve had ceased to drop and was on the upward trend. Certain indications belie the fact that there is any decided change in the situation. Metal prices are still at a low figure, there seems to be little or no market, and reports of the resumption of operations at plants recently shut down are slow in coming in. On the other hand we hear of certain improvements in various sections of the country, and these must have their reflections on the mining industry. We refer particularly to a gradual picking up of the buying market for machinery which has undoubtedly been influenced by a decrease in price.

Considering the mining business from its mechanical side—that is, that part of the work which requires equipment—we can regard the items of new construction and replacement as essential to the successful continuation of any mining enterprise. New construction is, speaking generally, more typically characteristic of good times, of a period when industry is at its top notch, and when a demand for big production necessitates capacity output. Replacement necessarily exists at the same time as the "new construction" period; but, on the other hand, it remains during the slack time and is continuous, or should be. It serves as the auxiliary, as it were, to the other, regardless of whether business is good or dull.

The idea of putting off until tomorrow what one cannot do today has been the graveyard of many businesses as well as individuals. Business does not continuously play a waiting game, for the modern trend is toward large production and lower costs, and those who cannot compete on those conditions are out of the running.

Replacement, as we have used the term, does not mean simply keeping all the parts of the mine, mill, and smelter in good order, so that on the return of business operations may resume as before. It means also what we please to call "modernizing"—overhauling the plant if need be, experimenting, planning, finding the most efficient way of doing things.

The editorial pages and advertising sections of *Engineering and Mining Journal*, as well as all live literature in the mining field, have pointed out to the operator many ways to produce better and with more speed. But how far has the mine operator gone? Is he sitting still and waiting for "good times" to come to him, or has he realized, with Mahomet, the position of the mountain? The operator who stands still, even in these times of depression, loses step when the "pick-up" comes. There are few properties the operation of which even under capacity conditions cannot be improved and made more efficient.

Technical Societies and Journalistic Adventure

WE SET OUT, on our return from Washington, clearing up our desk at home. Various circular letters and publications lay in the accumulated pile. Among others was a wrapper which bore the name *Mining and Metallurgy*. Mechanically, almost, we slid it into the waste basket—kindly, respectfully, regretfully; yet expeditiously and without hesitation. And only some time after, when some semblance of order was restored to our desk, did we give thought to the subject. And our first thought was, "Why not write to the Institute and suggest that they discontinue sending this publication, which usually is slid into the waste basket unopened? The Institute needs economical management, and would be glad to save the money; and our waste basket would not need to be emptied so often." But then caution stepped in: "If you do that, it will be thought that you are going out of your way to disparage *Mining and Metallurgy;* and you know very well you do not want that to be thought. Better let that come in with all the other things which might well be spared the mails and for which you have no use."

Recently, *Engineering and Mining Journal*, at the instance of some of the Institute's officers, offered to give the Institute systematic publicity if they wished to spare themselves the trouble and expense of publishing a magazine. The offer was not accepted, and we are well content with the wisdom of the decision. One of our all too candid friends remarked that he was delighted with the prospect, because then he would receive only one paper instead of two; and, being all too candid, he queried further whether anybody read any of the mining journals anyhow. On that principle, of course, and to be sure, the fewer the better. But we can tell him one thing. Everybody who gets *Engineering and Mining Journal* puts up five dollars for it (students, four dollars), and that means the subscribers really want it. And that applies to him. But if he could only get *Mining and Metallurgy* by subscribing separately for it, would he put up five dollars for it, or three, or one?

That is a fair test. A society of mining engineers has gone into the magazine-publishing business. We suppose it must be legal, although they certainly were not incorporated for that purpose. But they are in the business—news, advertisements, editorials, and the whole paraphernalia. Only the subscribers are shanghaied and are not from the ranks of the freeborn. We who write are among the subscribers, and we are here trying to think our way in public out of this situation. So we suggest to the society that it charge a dollar and a half a year to those [illegible] who wish to receive the journal. For it is much more than a bulletin of the society. Such a monthly bulletin the society must have, and it should go to every member.

But at this juncture, in search of material, we rescue our copy from the waste basket and remark an editorial on Socialism and Bolshevism. There is some data on the World Production of Coal in 1920, reprinted from the U. S. Geological Survey. There is a report of a report on differential flotation reprinted from the Bureau of Mines. It has two pages of "Industrial News and Developments" which is maintained on account of the advertisers. It abstracts important papers in current periodicals, and so on. Yes, there is no doubt about it: it is not a monthly bulletin of the Institute, but a venture in the field of journalism, with something of the flavor of the *Mining Magazine* of London, but not so compact. It is a new business competitor.

We love our competitors: but, little brother, the field is very crowded; and if it were not for shanghaied subscribers, provided for you by your daddy the Institute, you would stand the same chance as the proverbial snowball in Hades. But as a remittance man, you doubtless can always get a square meal. You may have read our editorial on the National Geographic Society last week or the week before. It gave us a big idea. The Institute and the American Mining Congress are going into the business of aggressive journalism. Why should not the *Engineering and Mining Journal* go into the Mining Society business? There is always room at the top.

The Value of Gold

WITH INCREASING AMOUNTS of gold being concentrated in this country, the accumulation becomes properly viewed either as an asset or a disadvantage, according to developments. Our gain is the loss of other countries. Some of them, like Russia and Austria, are not only without gold, but are down and out; others, strange to say, without gold and with the flood of paper money which means national bankruptcy, are nevertheless increasing their industry and becoming more prosperous. Such is the case with Germany, whose depreciated currency only allows her to sell to greater advantage in foreign countries. How France and Italy are going to return to the gold standard, if ever, is a mystery. Poland is nearly as badly off as Russia in her fabulous flood of paper money.

It is a good thing for us to get the lion's share of the gold in the world, but what is going to happen, as we get so much that other great nations have none? It means that they will have to abandon the gold standard, and our gold will be of no importance to them. But as the case stands, we will take nothing but gold in our dealings with them. We want to sell them our goods, in order that we may do an active business and be prosperous; but they already are in debt to us to the limit. Having no gold, they can pay [illegible] in goods, which we could use very advantageously. But the Tariff Doctor steps in and forbids our taking this form of nourishment, and tells us we had better live on our own fat. So we have our gold and our goods, and our [illegible] commerce, and the foreign commerce of the world is taken over by those who are willing to trade for gold, goods, or credit. So that it looks as if the medicine which is being given us to cure our depression may keep us abed longer than necessary; and that when we get up we may find that Germany has won the war. Certainly, we are not going to compete in the markets of the world with goods—metallic or otherwise—raised under the expensive culture of a high protective tariff, with the high wages and other costs which go therewith.

It is not, therefore, so much that the possession of so great a stock of gold should make us proud, as that the lack of possession of gold by other powers worries us.

Germany Again to the Fore

AMERICAN metallurgists may as well begin to scrap their smelters, for a recent invention makes them no longer necessary or desirable features of otherwise barren landscapes. Some had about come to this conclusion anyway. In *Commerce Reports* for June is soberly described the latest German invention for the winning of metals. (Can we never stop those Germans?) It is a "simple, rapid and effective method of separating alloys into their metal components and extracting metals from mineral ores." How is it done? Well, that is apparently a dark secret, but the chief factor seems to be a "catalytic agent." "Big blocks" of alloy go into solution in less than thirty minutes. "Out of the solution thus obtained the various metals are dissected by the employment of simple methods of chemical reaction, which permit the retaining of the metals one by one." (A trained dissector evidently needed; also a civil engineer, possibly, to build a retaining wall.)

Concentrated ores can be treated in the same way but require one or two more operations. "The catalysator (page Mr. Webster) employed can be bought in the open market in any quantity required (an obvious advantage), the greater part of it being recuperated in the process and used again." (It probably needs to recuperate after the strenuous work it must have to do.)

Among the many advantages over present methods are the relatively small expense involved, and the simplicity of installation and appliances (the whole thing sounds simple to us); also the elimination of the melting process does away with the need for coal. "The process is effective with any number of metal components, every metal being recuperated separately, and in the case of concentrated mineral ore, every component metal part, be it silver, antimony, tin, lead, nickel or copper, being retained one by one in the purest form." (Further experiment, with the advice of a lawyer who has been paid a good retainer fee, will no doubt permit of the metals being retained two by two, thus permitting double efficiency.)

"The inventor of this process is Mr. Harry Pauling, of Berlin, who has attracted much attention for his work along these lines." (Very likely.) Herr Pauling has the wire mills [illegible] too, for he has also developed a method which enables one to produce copper wire directly out of the electrolytic bath, thereby eliminating the melting down of the [illegible] blocks obtained under the old process, the rolling of the blocks into plate, and drawing into wire." (Gosh!) No wonder we've been selling wire [illegible] to Germany.

We are glad to see that the foreign representatives of the Department of Commerce, with the [illegible] of leadership by a mining engineer, are not overlooking the latest in metallurgical improvement, and it is no fault of theirs [illegible] if our readers still cling to the old methods.

WHAT OTHERS THINK

Waste in Phosphate-Rock Production

My attention has been called to an error in my article in *Engineering and Mining Journal* of April 23, 1921, entitled "Waste in Phosphate-Rock Production." The error occurs in paragraph 2, column 2, page 710, the first line reading: "A recently conducted experimental plant," etc. This should read as follows: "An experimental plant operated at one time by the Balaklala Copper Co., conducted under the Cottrell process," etc.

It was not intended to convey the idea that this was used for the purpose of phosphoric acid precipitation. I had been keeping in touch with the department at Washington, D. C., and from the information I had received I did not feel justified in publishing in advance any such information. The remainder of my article will show that I was merely writing of smoke- and fume-control. Also, all hard-rock phosphate mined in this section is still being graded for the acid treatment, as we had not been advised of any perfected commercial installations for the purpose of phosphoric-acid precipitation by the Cottrell process. STRAUSS L. LLOYD.

Inverness, Fla.

Getting the Tariff Out of Politics

Referring to the article on "The Tariff on Minerals" in the issue of June 11 of *Engineering and Mining Journal*, by Marc Pawl, your caption calls it a "novel view." It appears to me a common-sense, practical viewpoint, as applied to those minerals of which the United States has an insufficiency, especially for war purposes—such as manganese, chromite, mercury, antimony, and tungsten. If it were possible for an individual, firm, or corporation to own the above minerals, in place of the many owners throughout the whole United States, would it not be good business to conserve the small known amounts of these minerals, by admitting them duty free; conserve for possible war emergency our known supplies?

Again, tungsten, as an example. Is it right or fair to tax 106,000,000 people (the consumer always, ultimately pays the bill) $10 per unit, the proposed tariff, for the benefit of less than 100,000 people who may be interested in its production? Why not let China, with her cheap labor, supply us at $3 to $4 per unit? Some two years ago, Frank L. Hess, in charge of the tungsten minerals department of the U. S. Geological Survey, published a bulletin, advocating that no tariff be placed upon tungsten ores, because of our known scarcity, and its importance, as an alloy for high-speed tool steel, in case of war, and its then being unobtainable elsewhere. Is this not plain common-sense business, such as any individual would exercise, if possible? Antimony is very essential, in the hardening of lead for shrapnel purposes, and there are small known supplies in the United States.

Something is wrong in the estimates of costs of the mercury producers. Except during the late war, the average price, as I recall, for many years, was around $40 to $45 per flask. One cannot believe that they would continue to produce for many years at such a loss. The tariff question is largely a selfish one. Consider that within an area of a radius of 100 miles from Boston there is more wealth than any like area in the United States, built up, made from a protective tariff of the various manufacturing industries. Can you name a single tariff-protected article, or industry, except the porcelain, during the last thirty or more years but what has become very wealthy? All the owners' heirs are millionaires. When one can see, in a foreign country, Mexico, as example, many of these tariff-protected articles sold at retail for one-half the price that the same are sold for in the United States, how can one help believe there is something wrong?

The American laborer gets a better wage, because he earns it. Our improved machinery permits him to produce more. The tariff is only an economic question. Take it out of politics. Place it in the hands of our best scientific economists. G. L. SHELDON.

Denver, Col.

Engineers à la Mode

Even a casual reading of current technical journals cannot fail to leave an impression of the present-day emphasis on certain managerial problems which may be grouped under the term "The Human Factor" and include among others Adjustment of Wages, Americanization, Compensation, Employment, Industrial Relations, Housing, Mental Factors in Industry, Civic Service, Prevention of Illness, Vocational Rehabilitation, and Welfare. When discussion of such subjects forms so great a part of the committee work of the A.I.M.E., it is small wonder that the framers of the model licensing law hesitated to define the word "engineer," or that we find Mr. Hoover speaking of "the drift of the profession from purely technical functions."

In the directory of the A.I.M.E. only about a fourth of the members are avowedly administrators, half are practicing engineers, and a remaining fourth are of other or unstated occupations. Admitting that many engineers graduate into the administrating class, and that many others wish to do so, it must also be admitted that a vast number of administrators were never engineers, have had no technical training, and rose from office or operating departments other than engineering. Perhaps the actual situation could be expressed by "the drift *into* the profession of purely *untechnical* functions."

Directors undoubtedly recognize that executives in certain lines should have a technical or engineering training, and it appears that many ambitious men have thought to take advantage of this preference by a short cut, and therefore style themselves "advertising engineers," "economic engineers," "efficiency engineers," "industrial engineers," "sales engineers," "welfare engineers." Yet one wonders how much there is of common interest between the really technically trained man and these social and psychological engineers.

There is an illusion that the mere name "engineer" will bring prominence to the person using it. Sometimes it may, but the misuse of the term by individuals certainly adds nothing to the prestige of technical men in general who have worked for the right to be called engineers. At the root the illusion consists in believing in the form rather than the substance.

Has not the propaganda by social writers aided in getting us away from first principles? Engineering is not a question of amusement, caprice, culture, emotion, morale, patriotism, sentiment, or subconscious mentality.

All these things may have their legitimate devotees, or at times they may be a pleasant conversational topic, or a camouflage to obscure one's [illegible] real work. We know where to discuss topics of engineering in mining and metallurgy, but why wish onto us everything else in the category of modern thought? Maybe there is a jealous Society of Executives, or American Institute of Ouija Board Operators. MYRON R. WALKER.

Pittsburgh, Pa.

Suggests Federal Universities

The suggestion of J. F. Inglis in *Engineering and Mining Journal* of June 4, to centralize engineering education in "two or three schools completely equipped and run by the Government, if you please," bears a decidedly constructive idea and is worthy of careful consideration. But let us not be limited to the mining or the engineering profession.

For more than a hundred years the Government has maintained two colleges, one at West Point and one at Annapolis, which have no superiors in the world in their specialties. But the recent war taught us that we need more than soldiers. Men of every profession, without exception, are in demand in such an emergency. We are prone, of course, to consider the engineer's phase of the situation, and it was certainly acute, perhaps more so than in the other professions. Witness the fact that two calls went out in less than three months for engineer officers. The age limit was raised to fifty years, and men who didn't know how to stand at attention were hustled into captain's uniforms, given three months in a training camp, and found themselves majors and lieutenant colonels soon after. And when they got to France they worked harder than any other branch of the service. Other units were relieved, but the engineers were on the go, and it is related that some of them were sent from St. Mihiel to the Argonne Forest without a day of rest between.

Not only does the Government use men of every profession in war but in civil life as well. It trains its soldiers, but civil employees must provide their own education, and yet they are paid no more than the soldiers for work involving the same degree of technical skill or responsibility. Prompted, perhaps, by an uneasy conscience, the Government gives a good collegiate education to its Indian wards, who, too often, fail to profit by it, but its white subject, who would eagerly make the most of such an opportunity, must find some means of providing such an education for himself.

Why not one or more national universities? Here men could be trained in the various professions and given such military instruction as necessary to qualify them for commissions in the reserve army. On graduation they would be commissioned and appointed to positions in the civil service, in which they would acquire an excellent practical experience such as would fit them for positions of responsibility in the industrial world. As compensation for their education they should serve in a civil position for a certain period, on salary of course. If a man desired to resign his position before the expiration of that period, he could do so by the payment of a sum based on the unexpired portion of his term of service.

Thus could be established a uniform and high standard of education and a means of providing the Government with useful men in its civil service, furnishing men of high qualifications for our industries, and creating a trained reserve immediately available in a national emergency. And let it by all means, as Mr. Inglis suggests, lay stress on the business value of an education.

Perhaps such a suggestion doesn't jibe with the present talk about disarmament, but when we see leading nations talking disarmament and taking a hitch in their belts at the same time, and when we remember that Creasey tells of the wise statesman who, several hundred years before Christ, predicted that there would never be another war, we may fittingly recall Cromwell's famous order and proceed to look after our powder, even if the practical realization of such a scheme of education would not be of vast benefit to the development of the country as a whole. LEROY A. PALMER.

San Francisco, Cal.

Judged From an Advertising Viewpoint

During the last few months I have noted with interest the current comments by Institute members on Institute affairs and publications. In reviewing the opinions already published, I have been somewhat surprised to note that one of the most important causes for complaint, from the standpoint of the technical magazine, has not been touched upon. If the subject has been avoided for reasons of delicacy on the part of the editorial department, no such reasons should deter an outsider from calling attention to the consideration, which I believe may be of importance to the engineer who depends on the leading mining publications for reliable, timely, and well-digested information, in order to keep himself abreast of the rapid developments in his profession.

The point I wish to make is that "Mining and Metallurgy" is increasing its advertising business at the expense of our old friends, the independent mining press, on which we depend for our real, honest-to-goodness, up-to-date, technical information. Anyone familiar with the cost of publishing a first-class technical magazine knows that the subscription price covers only a fraction of the cost of delivering the publication, and that the periodical must depend upon its income from the sale of advertising space. With these facts in view, it seems to me that it is up to the engineer to decide whether he is going to use his influence toward the support of his old friends and servants, who have been faithful to him for many years, and on whose ability and desire to serve him he can depend, or whether he intends to "dull his palm with entertainment of a new-hatched, unfledged comrade."

An expansion of the policy of engineering societies to issue magazines, and attempt to support them by securing advertisers, using their membership lists as selling arguments, will surely undermine the very foundations of the engineer's reliable sources of current technical information. He must realize that the general quality of the service rendered by his former faithful servants will be gradually but surely impaired, because they cannot afford to keep up their former and present high standards in the face of a movement to withdraw their financial support.

It is squarely up to the engineer, and the Institute member, to decide what kind of service he wants and whether he will stand by his old friends, or continue to experiment with a new acquaintance, with the sacrifice of quality and efficiency. HARRY J. WOLF

New York City.

HYDRAULIC OPERATIONS, TWO "GIANTS" IN FOREGROUND

Phosphate Mining in Florida

Open-Cut Work, Dredges, and Hydraulic Operations the General Practice—Product Is Washed in Log Washers and Converted Into a Fertilizer—Steam, Gas, and Electricity Used as Motive Power—Typical Installations Described

BY STRAUSS L. LLOYD

Written for *Engineering and Mining Journal*

FLORIDA PHOSPHATES are classified into hard-rock, soft, land-pebble, and river-pebble grades, and are found in the Eocene, Miocene, and more recent geological formations. Hard-rock phosphate occurs in massive and laminated forms, or as boulders piled together; also as pebbles when broken by weathering and water movements. It possesses a variable structure, from compact to fibrous, and although usually of a creamy color, is frequently found stained with iron oxide.

The soft phosphate occurs in deposits by itself or associated with hard-rock phosphate and may be clayey or sandy, filling spaces between boulders of hard-rock phosphate. It is evidently a secondary deposit formed by the disintegration of other phosphates of lime. It carries from 20 to 30 per cent less phosphate of lime than hard rock, which contains from 80 to 86 per cent.

Land-pebble phosphate is essentially an aggregate of hard whitish phosphate pebbles varying in size from grains to pieces one inch in diameter, averaging possibly a little over one-quarter inch, and having usually a matrix of phosphatic clay and sand. The percentage of phosphate of lime which the pebbles contain is from 75 to 80, but the average material as mined does not reach this standard. The mineral is mined either by open cuts, by dredging, or by hydraulicking, to be washed dried and shipped to fertilizer works, generally situated abroad.

River-pebble phosphates are found as bars in rivers of southern Florida, and with them the fossil remains of vertebrates. The river-pebble variety is blue or black, varying from one inch downward in size, and frequently occurring as the hardened casts of small molluscs. It is presumed that river-pebble phosphates are derived from land-pebble phosphate, and also from hard-rock phosphate. The percentage of phosphate of lime in the river-pebble type is between 58 and 68. At present river dredging for phosphate is not as active as land-pebble mining operations.

STEAM SHOVELS AND HYDRAULIC METHODS USED FOR REMOVING OVERBURDEN

Florida phosphate beds are covered with soil of varying depths, which is removed by steam shovels or hydraulic nozzles. If the deposit is below the water level, traction dredges working on land, or floating dredges, are used.

The overburden of land deposits is stripped by steam shovels, a cut being taken the full swing of the shovel boom, and the shovel moved forward a short rail length when the cut is finished. The capacity of the dipper or shovel varies from 1 cu.yd. to 2½ cu.yd., and the boom and dipper arm is made to conform to the depth of the alluvion. For example, a 35-ft. boom will raise material 18 to 20 ft. above the shovel track and make a cut 35 ft. wide. The cars to carry the overburden are standard-gage of 12 cu.yd. capacity and are usually dumped by hand, although some of the more recent cars have air-dumping equipment controlled from the engine cab. They are run out to the dump, care being taken not to waste the material where it will cover future work. Steam-shovel work is done by contract. The price was about 20c. before the Great War, and about 35c. before the present slump in the price of phosphate rock curtailed mining operations.

PUMPHOUSE AT LEFT, DITCH AT EXTREME RIGHT

Wherever conditions are favorable and space is available for the disposal of the material, the overburden is removed by hydraulic methods, and pumped into an abandoned excavation from which the phosphate has already been removed. The cost of stripping by hydraulic methods is from 10 to 15c. per cu.yd. The overburden in Florida phosphate fields is favorable for this kind of work, being clean, fine sand, with some pebbles, the majority of the foreign substance being sods, stumps, and palmetto roots. Occasionally the sand is cemented and grades into a soft but tough sandstone which must be blasted before hydraulicking. Owing to the overburden containing little clay, it can be stacked in large dumps that do not liquefy and run to the streams.

ARRANGEMENT OF PIPING, DITCHES, AND PUMP

In Florida where hydraulic stripping is practiced hydraulic mining may also be used and the material broken by playing one or more streams of water under a pressure of from 90 lb. to 140 lb. per sq.in. against the face of the deposit, an operation that causes the rock containing the phosphate to crumble and flow into a ditch cut in underlying marl. The flow is aided at times by additional water from a ¾-in. nozzle ditch-hose, the object being to drive the material into a sump about 8 ft. square, also cut in the marl. From the sump the material is lifted by an 8-in. or 10-in. centrifugal pump and discharged into log washers. As the rock material consists of firm sand and round phosphate pebbles, little of it being over 1½ in. in diameter, it is easily made to flow through the ditch into the sump, on a grade of two inches to the foot by the use of about ten times its weight in water.

The hydraulic nozzles are connected to the main water-supply pipe, usually 10 in. in diameter. When two nozzles are worked, each has from 200 to 500 ft. of 6-in. diameter, flanged, spiral-riveted, galvanized water-pipe. Asphalt roofing paper or tar board is used for flange gaskets. At one or two convenient places, in the 6-in. line, a ball-and-socket joint is applied to facilitate lateral movement of the nozzles.

When two nozzles are used they are pointed so as to wash the material to a central point, which is the ditch leading to the sump. If the ditch clogs, an auxiliary hose is coupled just back of the nozzles, and the flow of water from this is used to move the material to the sump. After the face of the rock is mined far away from the sump so that the material does not flow properly through the ditch, a new sump is blasted 50 to 75 ft. nearer the working face, and the pump moved to it. The pressure required for this hydraulic mining is not high, but the work demands a large volume of water in order to transfer the material through the ditch to the sump and so as not to choke the pump by an excess of solids.

The machinery for transferring the phosphate rock to the washer consists of a centrifugal pump of the volute-box type, with a chilled cast-iron facing, directly connected to a slip-ring motor. The tail-piece of the pump, which must be made flexible, is raised from the sump by means of a set of triple blocks suspended from a tripod. This arrangement is necessary, because whenever the mouth of the suction pipe becomes clogged with grass, roots, or other impediments it must be raised out of the water for cleaning.

If the distance is more than 800 or 900 ft. between the mine pump and the washer, a relay pump is usually installed. In such cases the mine pump discharges into a sump from which the relay pump draws its material, and forces it to the log-washer. A sump is used owing to the difficulties arising from back flow and water hammer when operating two centrifugal pumps in series. When the centrifugal pump discharges without much head, the end of the pipe line is elevated for a pipe length at an angle of 45 deg., to furnish sufficient pressure to work against, and prevent vibrations of the pump.

Most of the new phosphate plants are equipped with both steam and electricity for driving machinery. The 8-in., and 10-in. centrifugal pumps are driven by General Electric motors of the slip-ring induction type, 60-cycle, 75 hp., 2,000 v., and 21½ a., with street-car controller having three resistances, a Thompson ammeter, and an oil circuit breaker. Pump, motor, and other parts are mounted on skids, so as to be readily moved, and the motor is covered with a light frame house. Practically all the water pipes and pump pipes used in the Florida field are of steel, with peaned flanges and cardboard gaskets. The flanges, which come separately, are generally put on by men working on contract.

After the material reaches the washer it is delivered to a relay pump without going into a sump. This pump lifts the material to the top of the washer, where it is discharged into a launder that feeds a cylindrical screen, having 1½-in. holes. The screen makes two products: oversize consisting of mud balls and coarse rock sent directly to the tailing pond, and an undersize, discharged on an inclined stationary screen with 3/50-in. slot openings, where some of the sand is removed, the operation being assisted by sprays of water. The oversize from this screen passes to a 16-ft. double log washer, which discharges the material into another 16-ft. single log washer. These logs separate the particles of phosphate, sand, and pebble from the silica by reason of their grinding and mixing action. Wash water is also supplied, which assists the separation by forcing the silica sand backward over the tail-gate of the log box. The last set of logs discharge on a shaking screen, which further eliminates all but from 6 per cent to 8 per cent of the remaining silica and the greater part of the water. The dewatered material from this screen goes directly into a hopper-bottomed storage bin over railroad tracks.

TYPICAL INSTALLATIONS OF PHOSPHATE-ROCK WASHERS

The Prairie Pebble Co.'s washer is driven by a motor back-geared 5 to 1, the countershaft running at 103 r.p.m., with sprocket drive. This is a 60-cycle machine of about 30 hp., 220 v., 75 a. The company has suspended operations.

The Florida Mining Co.'s washer probably represents the best practice in the pebble-phosphate field. Its special feature, aside from its superiority in heavy structural work, is the method of passing mud balls and coarse phosphate pebbles to a roll crusher, to be disintegrated and discharged to the log washers in such condition that it can be cleaned readily. The log washers are double 20-ft. logs solidly constructed and well designed, paddles being large and heavy. The central spindle of the log is a heavy hollow shaft, to which the paddles are bolted with lock nuts, a feature superior to the four separate angle irons used in some other logs. The angle-iron logs, however, have one advantage in that there are no stuffing boxes at the tailing end, these being replaced by a chilled cast-iron gudgeon and bearing, supplied with fresh water to keep out the grit.

The hydraulic and steam-shovel methods of stripping the overburden and the hydraulic methods of removing the overburden as already described apply to hard-rock phosphate mining and soft-phosphate operations. In the pits in the hard-rock section, steam dipper dredges are used, which load the skips hauled up an incline railway, delivering the phosphate rock to the top of the washer. The phosphate thus carried from the pits is dumped upon a grizzly, where it is sized. That which passes through the bars of the grizzly is ready for sizing by the "separator" or trommel, but that which is too large to pass through the bars is broken by hand with a pick, axe or dynamite, and made ready to pass through the bars of the grizzly.

The phosphate rock passing into the "separator" is sized for the set of log washers where it receives its treatment for the removal of adhering clay. The phosphate too large to pass through the perforations of the revolving screen passes out of the lower end and falls into a jaw crusher and then through a chute into the first set of log washers, where it is washed with the phosphate which has already been sized by the revolving screen or trommel.

DREDGE LOADING A SKIP

One end of the log-washer revolves in a gudgeon; the other end works in journals. The log, driven by gear wheels, works the phosphate rock toward the head of the box and discharges into the second log washer, a single log. Water is introduced at the upper end of the box, and the phosphate rock fed at the lower end. The clean water thus meets the rock, and, becoming dirty, flows out of the lower end, carrying with it clay in suspension.

There is no general standard for these log washers, the box being about 4 ft. deep at one end and 2 ft. at the other, according to the length of the logs, which varies from 16 to 30 ft., and pitched at an angle sufficient to give rise of 1¼ in. to the foot. The dirty water from the washers generally flows away in sluices, but where the grade is insufficient a centrifugal pump is used to assist in its removal.

After the log washers have removed most of the clayey matter, the phosphate passes through a chute into a trommel having an internal spray, to eliminate the remaining clay and smaller portions of the sand.

These screens have jackets, and are commonly called "rinsers." The phosphate, after passing through the "rinser," falls through a chute on a slowly revolving "picking table," where boys and men pick out the "sand rock" and other foreign matter not removed by the log washers and screens. The phosphate, after hand-sorting, is automatically pushed through the center of the table by a large brush or scraper, into a chute leading to a car under the picking table, in which it is carried to the drying shed, to be either kiln dried or dried in a mechanical drier, reducing the moisture to a required 3 per cent.

The excess of moisture in the hard rock in this section of Florida during the early days of mining was removed entirely by kiln burning, a process still in use by many operators, in which the phosphate rock is placed on ricks of wood and the wood fired, the phosphate partly smothering the flames, permitting slow burning, and by the gradual spread of heat, becoming more or less uniformly dried. In addition to removing moisture, this step also eliminated a great deal of the adhering sand and carbonate of lime.

When hard-rock phosphate predominates, it has heretofore been regarded as the sole product of the mines, as the soft phosphate is all washed out after passing through the crushers and into the log washers, where about 90 per cent of the mine material is thrown out as waste matter, a condition regarded as a limiting factor in mining hard-rock phosphate.

It has not been considered profitable to operate a mine when less than 10 per cent of the material handled is recovered as crushed phosphate. During the Great War, while mines were standing idle, plans were perfected for mining of the soft phosphate, even where no hard rock exists, and this has led to the opening of additional mines from which an immense tonnage of "soft" phosphate will be added to the supply of material. In general, the plan is to mine the soft phosphate as near as possible in pure form by eliminating the adhering clay and sand, to haul it up the incline to mechanical driers, where it is practically freed from moisture, and then to pass it through mills, reducing it to a fine powder, after which it is to be shipped in bulk or in bags, as desired by the purchaser.

This method differs from the ordinary handling of hard-rock phosphate in that it does not require crushing, except to break up lumps, and that the soft rock will not stand washing, as it is not and never has been "rock," but a finely powdered material resembling gray chalk or potter's clay. When any attempt is made to wash it, the entire mass is dissolved and becomes suspended in the wash water, from which it can be liberated only by evaporation. When it is brought to the phosphate washers in mining hard-rock phosphate, and passed through crushers before it goes to the log washers, all of the soft phosphate is lost, being carried away in the wash water with the rest of the debris.

PHOSPHATE USED DIRECTLY AS FERTILIZER OR CHEMICALLY TREATED

Nearly all of the pebble phosphate mined in Florida is used in the manufacture of acid phosphate and is the principal source of material used for this purpose. It contains about 32 per cent of phosphoric acid and is mixed with equal weight of sulphuric acid, yielding acid phosphate containing about 16 per cent phosphoric acid. Hard phosphate rock contains about 37 per cent of phosphoric acid, and brings a better price for export than for domestic use. Little of it is used for making acid phosphate, or ground for use as raw rock phosphate. Many of the mines in the pebble district are now owned by fertilizer manufacturers who send all of the products of the mines to their own plants, where it is largely used in the manufacture of mixed fertilizers.

This leaves soft phosphate as the only material which the farmer can buy in unlimited quantities for use without other treatment after it leaves the mines, and as it is neither suitable for use in the manufacture of acid phosphate, high enough in grade, nor in the proper form for export, the only satisfactory use for it is to apply it direct to the fields.

A DRAG-LINE SCRAPER

Most of the mines supplying this material guarantee it to contain 26 per cent of phosphoric acid, as compared with 32 per cent pebble phosphate and 37 per cent hard-rock phosphate. It has been shipped and sold to a considerable extent for use on the farms of Georgia and the Carolinas during the past few years, many farmers testifying to the good results obtained. Unfortunately, practically no experimental data are available from the state experiment station as to its value, so every effort is being made to have it thoroughly tried out during the next year or so, and thus obtain reliable data as to how it will compare with other forms of phosphate as a fertilizer.

It is not claimed by those who mine and sell soft phosphate that it contains any more available phosphate or phosphoric acid than the pebble or hard-rock phosphate, but they emphasize the claim that when dissolved in soil water it assumes a finer state of division than it is possible to crush any form of rock phosphate. It appears on examination to be as fine as chalk or talcum powder, though no definite determination has so far been made as to the exact size of the particles.

It is claimed with good reason that, in the use of ground rock as a fertilizer, its value is in direct proportion to its fineness. It is customary in acid-phosphate plants to grind it to pass through a 60-mesh screen, and it was first used as raw rock phosphate in this form. Later, machinery was provided for grinding rock to pass through a 100-mesh screen, and it is possible that those who are interested in selling ground rock will perfect methods for economically grinding it so fine that it will pass through a 200- or 300-mesh screen. One soft rock phosphate miner ventured the opinion that soft phosphate would easily pass through a 300-mesh screen, but no experiments have been made to test this statement.

If the claims made by soft rock phosphate companies, that this material exists in such a finely divided state that it readily becomes available after a few days' action of soil water and mild organic acids derived from decaying vegetable matter, are substantiated, this material may thus be popularized as a fertilizer in states near enough to the mines to make its transportation feasible. Soft phosphate can be used alone in heavy or light applications, as it is not subject to leaching, or in combination with any other fertilizer material with which the user desires to mix it. Some of the soft-rock phosphate miners have already arranged to make up mixed goods using the soft grade in the fertilizer, and are selling it in competition with mixed fertilizers made with the acid phosphate.

The motive powers used in the phosphate mines of Florida are the reciprocating steam engine, electricity, the Diesel oil engine, and turbines of such makes as the Parsons 300-kw. type. The Charleston Mining Co. at Fort Meade, Fla., has a 1,000 kva. vertical Curtis turbine and is installing a 600-kva. horizontal turbine of the same kind. For a smaller unit of 3,000 kva. and less, the horizontal turbine is preferable, by reason of the absence of the forced-feed step-oiling system, such as is necessary in the vertical type. The chief advantage of the turbine over the reciprocating engine is its simplicity, low cost, ease of upkeep, and the possibility of using a lower-priced operator. It is also much more compact than the reciprocating engine.

Heaviness of construction is noticeable in all equipment in Florida phosphate fields. Much construction is reinforced concrete and steel, so that almost perfect rigidity is obtained, a feature essential for economical operation and successful working of shafting. When supports are not entirely rigid, ball-and-socket pillow blocks are used. Heavy stationary rigid pillow blocks are used in large sizes, placed on end-adjustable base plates.

Lubrication is principally by means of grease cups, on account of the excessive dust, which precludes the working of chain oil-bearings; however, in places where dust is not excessive the self-oiling pillow block is not only more economical in oil, but requires attention only once a month and uses a grade of oil giving a lower coefficient of friction. On account of the excessive amount of dust and grit about drives, sprockets and chains are almost universally adopted for transmission of power. Heavy chains are used. It is noticeable with all of these drives that none exceed the proper speed for chain, viz., 500 ft. per minute. Manganese chains are being adopted with excellent results.

Where belts can be used, chains should not be given preference, as a well-designed belt drive will last for years. The only reason that belts give so much trouble and wear out so quickly is that they are over-stretched, the designers failing to give sufficient attention to installations. A belt drive properly installed is from 6 to 8 per cent more efficient than chain drive. No rope drives are used in Florida, on account of the universal employment of electric power. Hard-rock phosphate miners use steel cable on their re-hauls and to haul skips up inclines to the log washers, the steel-cable drum house being at the top of the washer and near the log washers.

Wet-rock elevators are placed at 57-ft. centers. These elevators have a pitch of four 3.41 in. per ft.; elevator buckets, 8 in. x 18 in., have round bottoms. Manganese chains work on an 18-in. traction tail pulley and 30-in. traction head pulley traveling at the rate of 235 ft. per minute. Dry-rock elevators are similarly constructed, but their length is divided into two vertical lifts, to reduce the weight on each chain. These elevators have given perfect satisfaction, the use of manganese chains insuring long life and freedom from breakdowns, repairs, and frequent renewals. They are all single-strand elevators, which obviates any trouble with unequal wear on chains. However, unequal wear may be reduced by leaving one of the tail sprockets loose to permit ascending buckets to rise parallel.

The majority of mechanical driers are of the rotary type, set level, the material being fed at the cold end and worked to the hot end by spiral flights on the inside of the shell. All of the driers are oil or coal fired, which accounts for their large capacity and easy operation. The only objection to rotary driers is their use when the rock contains clay that clogs the spirals, which reduces the heating efficiency of the drier, taking longer to do the work. Rotary driers are about 50 ft. long and require about 5 hp. to drive them. Their capacity is about 100 tons of well-drained sand in ten hours, or 120 tons of phosphate rock. To dry this quantity of material requires from five to six tons of coal. One man can fire two driers with coal, provided the coal is placed in front of the furnace.

The most noteworthy part of the construction is the type of storage bins of all the plants. One plant has a reinforced bin 525 ft. long and 75 ft. wide by 30 ft. deep, not including the clearance over the tracks. It has three compartments, with four tracks overhead and three tracks underneath. The storage shed built by the Phosphate Mining Co. has, as a special feature, an overhanging side, giving a cantilever, which allows the bins to project over the railroad tracks. The mill building, or that part over the driers, has reinforced concrete columns, with slab floors having reinforced beams. For a considerable tonnage in the Florida field large storage bins are desirable. The storage bin of moderate capacity, say 20,000 tons, would cost about $80,000, representing a charge of 2⅜c. against 3,000,000 tons. The ordinary storage shed with an electric crane would represent a charge of only .003 mill per ton. Judging from these figures, the ground-level storage with an electric crane is cheaper for loading from storage pile into the cars.

Scale-Forming Matter in Blast Furnace Jacket Water

Corrosive or scale-forming matter in water often causes considerable trouble when the water is used for cooling in the jackets of blast furnaces. This is particularly true in operations where the water reaches the boiling point. At Broken Hill, in Northern Rhodesia, according to a short paper prepared for the Australasian Institute of Mining and Metallurgy, several jackets were burned through, and the difficulty was remedied by placing bundles of wattle bark in the hot well at the rate of one ton per month. This extracted the tannin and added from one-half to one part of that substance to 100,000 of the circulating water. During the last two years since the wattle bark has been in use, no jackets have been burnt, and stoppages have been reduced from sixteen to four hours per month. Any scale which forms is of such a porous nature that it can be easily removed.

In a wattle-less district, no doubt any other bark containing a fair proportion of tannin would answer equally well, or a predetermined amount of soda ash might prove effective.

Dredge Construction at Dayton, Nev.*

Erection of Steel Hull and Dredger Equipment — Camp Organization — Sequence of Construction — Labor Input and Cost — Design Made To Conform to Important Parts Obtained From Dismantled Dredges

BY GEORGE J. YOUNG
[illegible] and Mining Journal

DURING 1920, the Gold Canyon Dredging Co. completed and put in operation a 9-cu.ft. bucket dredge for the working of an alluvial gold deposit situated between Dayton and Silver City, Nev. As the dredge was constructed in part of dismantled material and machinery from two dredges owned by the Marysville Dredging Co. at Marigold, Cal., and in part of new material fabricated in San Francisco, and as much of the construction equipment and miscellaneous material required were drawn from a number of places in both Nevada and California, there were unusual problems in both design and construction. Good engineering was required in evolving the dredge plans about existing major parts and in marshalling the material in proper sequence at the dredge site in such a way as to provide continuous occupation for the erection gang and to secure a minimum construction cost. The work was under the supervision of Gerald H. Hutton, and despite unusual delays beyond the control of the company, the dredge was finished and put in operation within a relatively short time.

The ground to be dredged consists in part of streambed material and in part of a stream terrace lying west of the natural waterway and sloping down toward the Carson River. The estimated acreage is 115.3, not including probable extensions that might result from further prospecting. The highest point, about two miles from Dayton, was selected as a site for the construction of the dredge and for initial operations. Dayton was selected for a camp and headquarters as it is on a branch of the Southern Pacific R.R. extending from Churchhill to Mound House. The distance from San Francisco is 337 miles by rail and the operation is 264 miles from Marysville, both of these points being the beginning of rail transportation for the principal parts of the dredge. Machine-shop facilities are available at Carson City and Reno, both accessible by road and railroad. A spur track was put in jointly by the company and the Southern Pacific at Goldy, between Dayton and Mound House, and this was the railhead for the receipt of all material except that locally hauled from near-by points. Over 2,000,000 lb. of material and equipment were transported by rail and hauled over the one mile of road from the spur track to the dredge site.

COMFORT OF WORKERS MADE A PRIMARY CONSIDERATION

Dayton was selected for housing and headquarters on account of its convenience and relative accessibility. The plan of providing auto truck transportation for the workers during construction and operating was considered preferable to the erection of a camp in the near neighborhood of the dredge. Two houses were purchased to serve for boarding house, club room and office, and temporary arrangements were made at the start of operations for housing and boarding at a local hotel. Three residences were leased for married employees, and a garage was constructed for automobile and auto truck.

A water system, cesspools and accessories and provision for fire protection were made as speedily as possible. The company provided a club room, with furniture, heat, light, and shower baths, the men furnishing other accessories and taking care of the room. All this was done after consulting with local health authorities and under the general direction of Edwin Higgins. There was thus provided a small, well-organized community. As the operating period was estimated to be five years, and the construction period as it happened covered almost a year, the importance of these arrangements will be appreciated.

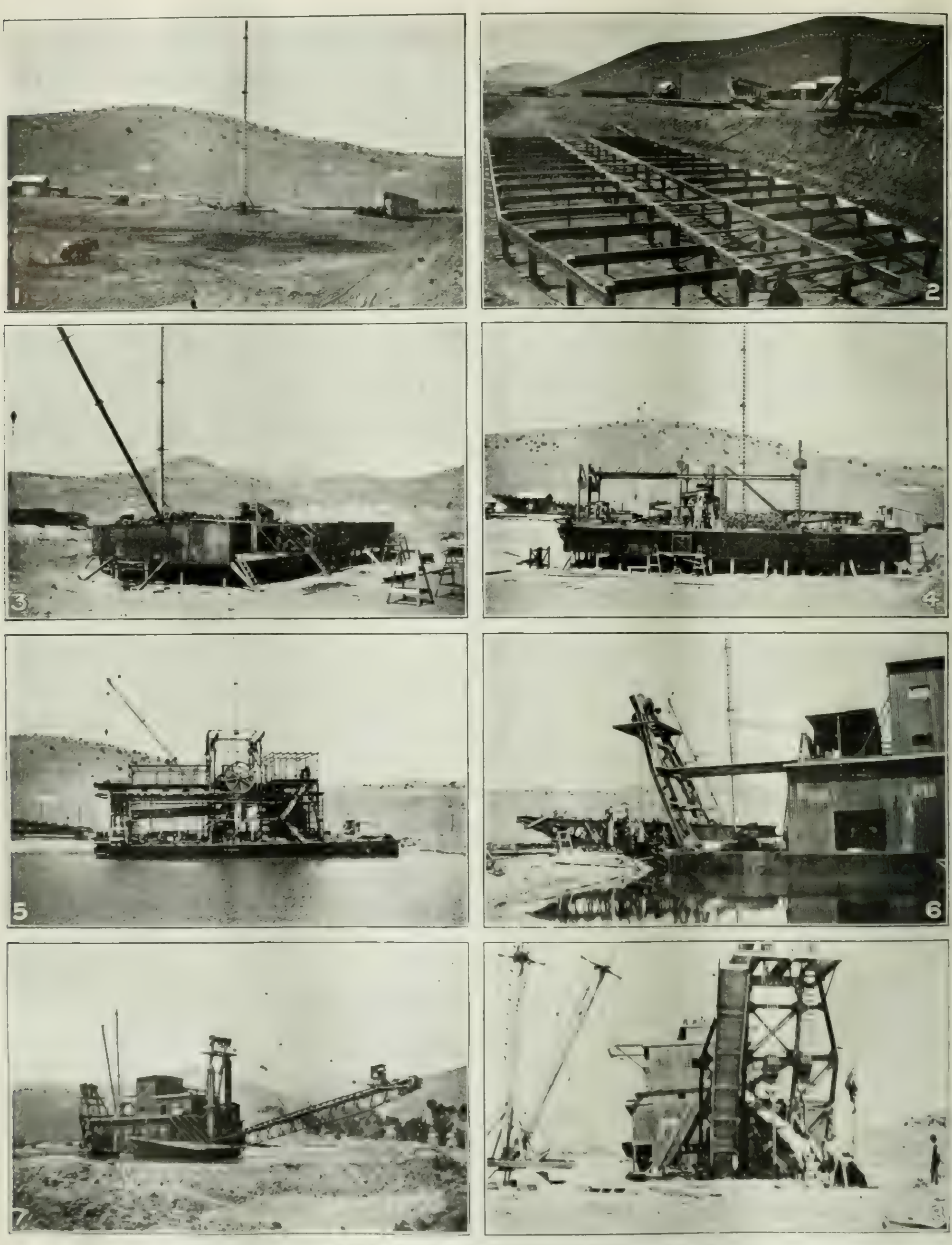
At the dredge site temporary buildings consisting of a storeroom, shop, compressor house, and derrick motor house were constructed. The construction equipment consisted of two compressors, one 10 x 10 and the other 8 x 8, and a derrick with hoist and accessories such as power line and transformers, as well as miscellaneous tools. The road between the railroad spur and the dredge pit was graded and graveled. The dredge pit was first excavated, and, as originally planned, was approximately 170 ft. square, but hard ground was encountered on one side and the pit was narrowed to 140 ft. The sequence of major operations was as follows: placing of hull foundations, erection of hull, installation of mechanical equipment and parts, placing of stacker and bucket line, installation of motors and miscellaneous equipment, housing of the dredge. Part of the erection was done after floating the dredge, which permitted maneuvering of the dredge in the pond. The time sequence and significant features are given in the chronology or log which follows:

TABLE I. CHRONOLOGY [illegible]

[illegible]

---

* [illegible]



PROGRESS IN DREDGE CONSTRUCTION AT DAYTON, NEV.

1—Excavation of pit. 2—Construction of hull foundations. 3—Construction of steel hull. 4—Erecting superstructure and placing of winches and pumps. 5—Hull floated, part of superstructure erected. 6—Bow gantry in place, and preparations for placing of ladder, deck housed in. 7—Ladder and stacker in place, gold sluices erected. 8—Finishing the bucket line of the dredge.

March 9—Pipe line and [illegible] for water supply to pit completed.
March 17—Two carloads [illegible] arrived at spur.
March 19—Two carloads structural [illegible] arrived at pit.
March 27—Fourth carload of hull material arrived at spur.
March 30—Fifth and sixth [illegible] carloads of hull material arrived at spur.
April 5—Work on 22,000- to 4,000-volt transformer substation started.
April 8—Electric welding of plates begun.
April 9—Strike of [illegible] switchmen [illegible] movements of freight.
April 14—Lumber [illegible] completed.
April 17—Boarding [illegible] company's property, completion of [illegible]. Hull material [illegible].
April 2[illegible]—Electric [illegible] equipment at Marigold.
May 1—Rivets driven [illegible]. Constant water ordered for June 1.
May [illegible]—Two carloads of structural steel, including bow and stern gantries, arrived at spur.
May 10—Electric welding completed.
May 12—Distributor and [illegible].
May 1[illegible]—Two carloads of [illegible] completing superstructure, arrived at spur.
May 17—Power line completed from [illegible] to the pit.
May 26—Carload of lumber [illegible] carload of [illegible] and electrical material from Marigold arrived at spur.
June 1—Transformer substation [illegible]. Water [illegible] into American Creek from water [illegible]. Rivets driven to date, 18,591.
June 3—Water turned into pit.
June 6—Installation of electric wiring on dredge begun.
June 8—Dredge floated. Upper [illegible]. Survey work begun on claims.
June 9—Erection of structural steel [illegible] completed.
June 16—Main drive installation [illegible] completed.
June 2[illegible]—Last car of essential dredge parts arrived at spur from Marigold.
June 29—Day lost on account of [illegible].
July [illegible]—Day lost on account of holiday.
July 6—Power on swing winch [illegible] transformers. Bow gantry hoisted into place.
July 2[illegible]—Screen installation completed.
July 27—Spuds hoisted in place.
Aug. 8—Power applied through main substation and dredge transformers.
Aug. 9—Digging motor running.
Aug. 12—Ladder and lower tumbler in place.
Aug. 16—Tail flumes installed.
Aug. 17—Stacker lifted in place.
Aug. 18—Power applied to pumps.
Aug. 19—Began installing bucket line.
Aug. 21—Bucket line installed.
Aug. 30—Trial run two hours.
Sept. 3—Trial run three hours.
Sept. 4—Lights on, trial run four hours.
Sept. 5—Public initiation of operations at 3:45 p.m. Shift reports started 11 p.m.
Sept. 17—Bedrock encountered.
Sept. 21—Compressor in operation.
Sept. 2[illegible]—First clean-up.
Oct. 1—Second clean-up.

WATER SUPPLY FROM EXISTING FLUME LINES

A constant water supply is essential in the operation of a dredge, and the establishment of this supply in the absence of a near-by natural source involves natural and often legal obstacles, especially where there are pre-existing water rights and rights of way to be secured. The elevated site of the dredge in this instance made it entirely probable that seepage losses would be a considerable factor and an assured water supply imperative. The water available from natural flow in Gold Canyon was not considered sufficient. A seepage factor was therefore established for the ground from data derived by filling several available shafts with water, and observing and timing subsequent draining. As a result, a contract for a constant flow of water was made with the Virginia & Gold Hill Water Co., which has a water system supplying Virginia City, Gold Hill, and Silver City. This water supply was considered preferable to pumping of water from the Carson River or from adjacent mines.

WOOD-STAVE PIPE DELIVERING WATER SUPPLY TO DREDGE POND

Some construction work, in the form of 4,500 ft. of 8-in. woodstave pipe and 3,800 ft. of ditches, was necessary for the delivery to the dredge pit of the clean water purchased, and to keep it separate from the natural flow of the creek, which is often polluted by mill tailings from above. Rights of way were acquired from property holders for these structures, and, in addition, a blanket water right for the creek flow and the water purchased was granted by the State Engineer, subject to the usual qualifications.

RIVETING THE HULL. THE WELDED JOINT IS SHOWN ABOVE THE MEN

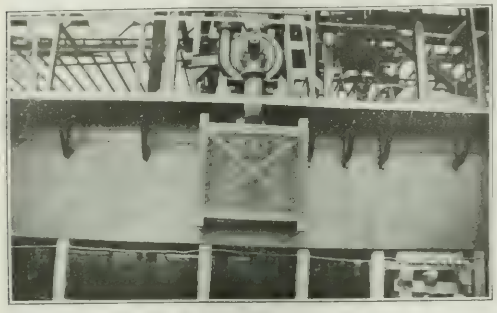
During June, the ground to be dredged was laid off in 300-ft. squares from a base line established in the center of Sec. 22 and running east and west. Stakes were set at every 300 ft. on this line, but only every 900 ft. on the N.-S. lines. The points thus derived, together with a few additional stakes set in prominent places, were intended to serve for spud locations. The stakes used were ¾-in. iron pipe projecting 9 to 12 in. above the ground and provided with a metal flag suitably marked.

POWER FROM HYDRO-ELECTRIC PLANT

The only power company in the field was the Truckee General Electric Co., with hydro-electric plants on the Truckee River and a power-line system serving the Virginia City district. A five-year power contract was entered into with this company under the available schedules, which are subject to the supervision of the Nevada Public Service Commission. The maximum demand meter system operated in such a way as to cause some apprehension that power costs during operation might be as excessive as the power costs during construction had been. In March, 1920, power cost was approximately $180. In comparison, the cost for the kw.-yr. service in California would have been about $60. In June, construction power costs reached [illegible] per kw.-hr. It was deduced that imposition of unusual loads such as lifting the upper tumbler or moving the dredge around the pit with the derrick caused a serious expense for power. An unusual load in June is estimated to have cost $65 for power alone. The maximum demand system, or Schedule K of the power company, was found to be especially severe for construction work, and an unsuccessful effort was made to have this class of worplaced under a schedule more consistent with the conditions peculiar to construction. An installation of a curve-drawing wattmeter was decided upon so that peak loads could be reduced to a minimum.

Re-used Material

Second-hand material available to the company was used wherever possible and was purchased wherever it was advantageous to do so. Corrugated iron, tools, canvas, lumber, furniture, safe, derrick and winch, air tools and equipment, winch motors, cables, and compressors were gathered from various places. From Marigold, Cal., the dismantling of No. 3 dredge of the Marysville Dredging Co. afforded the following parts: main drive pinions, main drive pulley, screen, screen drive, stacker, stacker belt, electrical equipment, winches, operating gear, lower tumbler, ladder suspension, deck sheaves, spud and keeper, buckets; from No. 4 dredge: bull wheels, herringbone gears, bow-line drums, screen bars and plates for spares, ladder, upper tumbler, bucket line, stacker motor, stacker suspension, and gantry caps. Necessary repairs were made in this material at the shops of the Marysville Dredging Co. before shipping.



SCREEN BOX FOR CENTRIFUGAL PUMP

Design and Weight of Parts

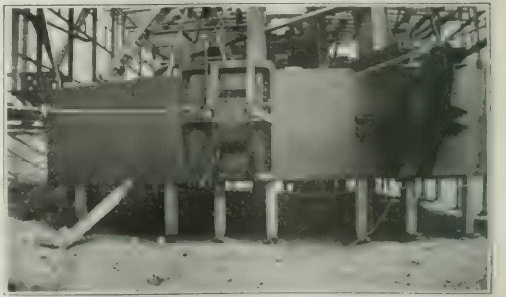
The dredge is of steel hull and steel superstructure design. The designs were worked out co-ordinating re-used parts with the new material in such a way as to result in a practically new dredge. Hull dimensions are 46 by 108 ft. 5 in. by 8 ft. deep, allowing a 20-in. freeboard under operating conditions. E. J. Watson prepared designs and plans for the dredge as a complete unit and supervised the work of repair at Marigold. Hull fabrication and construction in San Francisco were done by the Bethlehem Shipbuilding Corporation and Dyer Bros. Delivery of the hull material from the bottom up was provided for. Delay and difficulty ensued, owing to the fact that the work had to pass through the shops of two firms, but these difficulties were eventually overcome.

The estimated weight of the more important parts of the dredge are: hull, 323,825 lb.; superstructure, 201,634 lb.; house sheeting, 18,000 lb.; house roofing, 6,000 lb.; rivets, not included in foregoing, 5,000 lb.; total, 554,459 lb. As construction progressed, changes of various kinds suggested themselves, although no serious complications in conforming construction to design arose. Some of the changes in the hull were as follows:

Addition of a 6-in. angle iron under the bottom corners of the well hole for protection against interference of rocks when the ladder is being lifted; addition of 6-in. angle iron around corners of the bow and the curve for protection against rubbing of lines and swinging of dredge against side of pit; addition of plating on the bottom at the back of the well hole for protection if dredge is required to operate with insufficient flotation water; plating around the stern for protection against wearing of sand; setting the plates from the back of the well hole to the stern athwartships instead of longitudinally to provide for a break in the seam that would have extended from bow to stern; change from 8-ft. side plates (not to be had in reasonable time) to a built-up side plate, the joint being made by welding, and the seam slightly below the water line; longitudinal stiffening of the hull being provided for by two ½-in. plates, 8 ft. deep, running the length of the hull.

A novel feature in the construction of the hull was the use of arc welding for the deck seams and the upper side seams. All main construction joints were riveted as usual.

A number of minor changes in the designs were made, some on account of greater clearances and others for additional strengthening. Close attention was paid to the electrical installation, with a view to protecting motors and men against accident and for the purpose of gaining information to reduce as far as possible the power cost during operation. Trumbell externally operated switches in which contacts are covered by a steel casing were specified, and as the individual motor controls obtained from Marigold were not equipped with under- and over-voltage release attachments, it was decided to use an oil circuit breaker with under- and over-voltage relays on the main power circuit. A 4,500-volt oil circuit breaker was also mounted upon the the secondary side of the main substation for the protection of the 22,000-4,400-volt transformers. Arrangements were made to disconnect the dredge transformers by means of primary cut-outs. Instrument equipment included a curve drawing wattmeter to measure total load on motors, a portable voltmeter, and a switchboard ammeter to register the load on the variable speed motors.



SPUD KEEPERS

Labor Drawn From Outside Localities

Local labor was scarce, and skilled labor experienced in dredge construction had to be drawn from outside localities, chiefly from California. At the outset, the question of wages came up for decision. The scale of wages had to be high enough as compared with existing labor scales in contiguous localities to hold the working

TABLE III. AGGREGATE MONEY INPUT BY MONTHS

[illegible]

organization together and low enough to secure a reasonable cost of construction. Throughout the construction work it was necessary to keep the flow of construction material and equipment such that there would be a minimum of interruption in the employment of skilled labor and a maximum of accomplishment.

In the beginning there were serious delays in the preparation of material, caused by the strike of shipyard employees at San Francisco. During this period the construction crew was kept busy on odds and ends, such as completing the railroad spur; unloading and erecting derrick; constructing temporary buildings at pit; completion of pit; installing dredge foundation; erecting and housing of construction transformers; completion of telephone line and ditch from Gold Canyon creek to pit; clearing of dredging area, and camp work generally.

The preliminary schedule of wages was $4 for labor and $6 for mechanics. A careful investigation of wage scales in use by the Marysville Dredging Co., the Valdor Dredging Co., Natomas, and the shipyards was made, and a tentative wage scale for construction and operation prepared. With some changes the scales were in effect during construction. They were as follows:

TABLE II. CONSTRUCTION WAGE SCALE

	Per Day		Per Day
Acetylene torch operator	$5 00	[illegible]	$5 [illegible]
Blacksmiths	6 00	Laborers	4 00
Blacksmith's helper	4 50	[illegible]	6 40
Boilermakers	6 40	[illegible]	6 40
Carpenters	6 40	Oilers	4 25
[illegible]	5 00	[illegible]	4 50
[illegible]	5 50	[illegible]	4 00
Electricians	6 40	[illegible]	6 00
[illegible]	4 50	[illegible]	150 00
			[illegible]

The average of all wages for 7,812 shifts was $5.34 per shift.

Some friction developed as a reflex of the shipbuilders' strike in San Francisco, but it did not last long. In June, 1920, wages advanced in some of the dredging areas in California, and the company equalized its wage scales correspondingly when the dredge began to operate.

Labor input, together with segregation, is given in Table III. Table V gives the monthly force report, Table VI the machine service, and Table VII the power used and rivets driven. Costs are segregated into a number of separate accounts, and the aggregates of these accounts from month to month during the construction are given in the table together with details of labor and payroll. A summary of principal cost items is given in Table IV.

TABLE IV. SUMMARY OF PRINCIPAL COST ITEMS

[illegible]				[illegible]
Transportation				
Freight			$14,660 81	
[illegible]			[illegible]	
[illegible]			[illegible]	
				[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]				[illegible]
Total				[illegible]

On June 1 water was diverted from the flume of the water company and was turned into the pit June 7 at

8 a.m., rising sufficiently to float the dredge at 10:30 a.m. on June 8. On flotation, the draft at the bow was 25 in. and at the stern 37 in. Experiments had demonstrated that the pit softened on application of water, and the foundations were consequently increased in number to a degree unusual in other dredge-building operations. It is estimated that a load of 12 lb. per sq.in. was placed on the foundations of the eighty posts and five cribbings supporting the dredge. The performance of these supports was found entirely adequate, the dredge being supported in perfect alignment. After the dredge floated the blocking was dragged away by the truck and the water allowed to recede somewhat.

TABLE V. MONTHLY FORCE REPORT BY SHIFTS

	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Total
Foreman	31	30	31	30	31	31	30	31	30	275
Blacksmiths	31	22	31	30	29¾	29	6		.	178¾
Blacksmith's helpers	31	30	31	30	30	31	5¼		.	188¼
Boilermakers	92	110	114	86¼	66	61	31½	9		569¾
Carpenters	41	84	91	115¼	99¾	89	87¾	102½	94¼	804¼
Storeroom man	31	31	31	29½	30	31	13¼	.		196¾
Derrick man	25	30	31	30	30	26	.		.	172
Handy men	229	348	326	281¼	314¾	307¾	158¾	120¼	30	2,115¾
Watchman		.	.	28	31	31	4	.	. .	94
Laborers	144	190	224	226¼	267	201¾	31¾		38	1,322¾
Riggers	31	26	31	30	30	6	. .		.	154
Truck drivers	31	30	31	30	31	31	5		.	189
Electricians		15	55	56	61	62	35¼	11	22½	317¾
Electric welders	.	44	22	. . .	.	.	. .		. .	66
Office	.	30	31	. .			.		.	61
Totals	717	1,020	1,080	1,003¾	1,051¼	937¼	407¾	273¼	215.125	6,704.375

TABLE VI. MACHINE SERVICE

	March	April	May	June	July	Aug.	Sept	Total
Hours caulking hammer used	181½	193	390	43	. . .	. . . .	. .	807.5
Hours riveting hammers used	472½	659	459	262	96	22	.	1,970.5
Hours pneumatic drills used	124½	351	328	674	550	71	.	2,098.5
Hours welding machines used	. . .	159	. . . .	. .	. . . .	. . .	. .	159
Hours automobile used	33	54	66	82	76	106	92	509
Hours truck used	125½	90½	137½	92½	70	89½	62	667.5
Hours oxy-acetylene torch used	6	21	49	101	83	122	18	400
Hours 10x10 compressor used (35-hp.)	166½	238	244	230	236	117		1,231.5
Hours 8x8 compressor used (15-hp.)	12	184	101	38	. .	111	48	494
Hours derrick used (50-hp.)	91	69	129	121	131	87		628
Hours shop motor used (1-hp.)	38	50½	129½	136	139½	127	17	637.5

The dredge was practically completed during August, and was put into operation with appropriate ceremonies on Sept. 5, 1920. The theoretical capacity of the dredge was computed as follows:

TABLE VII. POWER USED—RIVETS DRIVEN

	Maximum Power Demand, Kw	Power Factor, Per Cent	Total Kw.-Hr. Used	Rivets Driven	Rivets per Day
March	64	70	2,825	12,341	588
April	72	74	8,275	26,323	877
May	74	74	6,825	9,727	314
June	100	76	5,300	3,277	164
July	76	66	3,775	1,015	
August	72	71	3,100	294	
September	57.4	84	850		
Totals	73.6	73.5	30,950	52,977	

$$\frac{20 \text{ buckets per m.} \times 9 \text{ cu. ft.} \times 60 \text{ min.} \times 24}{27} = 9{,}600 \text{ cu.yd.}$$

Estimating digging time at 80 per cent gives 7,860 cu.yd. as theoretical capacity. This theoretical capacity should be corrected for loss of operating time and the ease or difficulty of digging the ground.

In eight years of operation in the Yuba field, a dredge of the size described herein has handled from 5,800 to 6,600 cu.yd. per day. The capacity of the Gold Canyon dredge is expected to be much lower, on account of existing unfavorable conditions, such as the presence of boulders and the uneven contour of the bedrock surface. In 115.3 acres prospected, there are estimated to be 6,076,000 cu.yd. of gravel, which will require more than four years of operation.

South African Mineral Production

The mineral production of the Union of South Africa for 1919 and 1920, compiled from returns prepared by the Government Mining Engineer and subject to revision, are given in the following table:

Metal, Mineral, or Precious Stone	1919 Quantity, Fine Ounces	1919 Value, £	1920 Quantity, Fine Ounces	1920 Value, £
Gold	8,331,651	35,390,609	8,158,455	34,654,922
Silver	891,304	203,646	892,205	224,769
	Carats		Carats	
Diamonds	2,592,099	11,237,778	2,551,665	14,762,956
	Tons		Tons	
Coal	10,261,859	3,430,361	11,473,452	4,506,572
Copper	4,904	(a) 208,902	(b) 10,875	(b) 445,007
Tin	1,629	(a) 275,111	(c) 2,451	(c) 446,284
Antimony	32	556	. .	.
Arsenic	8	663	11	655
Asbestos	3,934	66,426	7,112	114,195
Bismuth ore		300	. . . . .	.
Corundum	179	1,486	261	1,446
Graphite	86	2,630	73	2,339
Iron ore	3,602	1,081	2,564	811
Iron pyrite	5,532	8,894	3,469	5,014
Lead ore	756	4,973	587	5,787
Magnesite	1,024	2,723	1,419	3,780
Manganese ore	155	776	67	277
Mica	3	369	1	500
Mineral paints (iron oxide, ochers, etc.)	240	572	536	1,049
Soda	52	753	.	. . . . . .
Talc	757	2,170	682	2,227
Tungsten	4	626	.	.
Zinc			(b) 2,349	(b) 15,614
Totals	. . . . . .	50,841,405	. . . .	55,194,204

(a) The value given is calculated on the percentage of pure metal content at London quotations. (b) Ore and concentrates. (c) Concentrates and metallic tin.

Among commodities of lesser importance, copper, tin, and asbestos reflect increased production and values, the expansion of the asbestos industry being especially noticeable.

Another Important Copper Producer

In the May 14 issue of *Engineering and Mining Journal*, on p. 848, we published a list of seventy-nine of the principal American copper-producing companies. Through inadvertence, we failed to include the name of the El Tiro Leasing Co., operating at Silverbell, Pima County, Ariz. This company, though now shut down through lack of smelting facilities and the low price of copper, produced about three million pounds of copper in 1920, and expects, when market conditions improve, to ship at least 600,000 lb. of copper per month from oxidized ores averaging 7 per cent copper. There is no mill. The ore is smelted by the American Smelting & Refining Co. at El Paso or Hayden, refined by the same company at Baltimore or Maurer, N. J., and sold by the A. S. & R. through its New York headquarters.

The Future of Small-Scale Mining and Smelting In Chile

Transportation Problem, High Costs and the Exhaustion of Deposits Responsible for Decline of Custom Smelters—Opportunity for Small Furnaces Situated Near Rail—Main Cordillera Almost Virgin Territory

BY WALTER STRACHE
Written for Engineering and Mining Journal

CHILE, which has been aptly termed the land of ten thousand mines, is feeling the effects of demoralized metal markets perhaps more keenly than other countries where developed industries or the extensive prosecution of public works absorb part of the unemployed. The situation is aggravated by the dull state of nitrates. Formerly, during temporary slumps in metal mining, labor migrated north, feeling fairly certain of employment in the *pampas*, where up to twelve or eighteen months ago there was generally a dearth of men. Today, however, with the demand for nitrates limited, owing to a low exchange in countries which were formerly great consumers, as well as to the manufacture of the synthetic salt in others, many of the plants are compelled to close down. The southern part of the country is largely agricultural, and the demand for labor is well supplied by the non-migratory type. The poor miner is therefore fallen on lean days. Fortunately, the government is alive to the situation and does much to prevent actual suffering. One railroad project is already under construction, namely, the 110-km. line from Iquique to Pintados, and the others under consideration will likewise help to alleviate the situation.

CHILE THIRD IN COPPER PRODUCTION

Copper mining and smelting and lixiviation enterprises form the principal metal industries, and in recent years Chile reached and held third place in the list of the world's great copper producers, being led by the United States and Japan. In 1920 exports of the metal totaled 98,200 tons. Of this tonnage, however, over 83 per cent is credited to Chuquicamata and Teniente (Braden) and the rest to bar and matte production from six smelters. It is significant that the production from small properties tributary to custom smelters is steadily decreasing except in some isolated instances. A glance at the diminishing number of smelters demonstrates this pointedly. In 1916, eighteen establishments were listed in the government statistics; in 1918, when copper sold for 24 or 25c. per lb., six had suspended operations, and in 1920 the list was shortened by six more. At the present time, which, however, is hardly a criterion, only the smelters at Naltagua and Chagres are working. Chuquicamata and Teniente are working only part time, and Potrerillos shut down altogether in December, 1920. The latter, though, had not yet reached the producing stage.

HIGH COSTS, EXHAUSTION OF DEPOSITS AND HIGH TRANSPORTATION COSTS CAUSE DECLINE

The causes of the decline in production of the custom smelters and the yearly decrease in the number of these are mainly the following:

1—The high costs in 1919 and 1920 of all food staples, steel, explosives and other supplies, without compensating increases in prices offered by the smelters when New York quotations were between 18 and 15c. per lb. This rendered impossible the operation of many of the innumerable small properties whose collective output furnished the bulk of the smelters' requirements.

2—Exhaustion of some of the formerly producing mines and the non-productive state of others due to neglect to control water or to adopt other precautions.

3—The transportation problem. Except in rare instances where the production is desirable, as in the case of high-grade copper-bearing fluxes, ores are bought f.o.b. smelter. The grades on which the producer can afford to pay pack-animal freight to the railroad, handling, and railroad charges to the smelter are in direct ratio to the distance from the mine to the smelter. Consequently, although there are several districts capable of furnishing considerable tonnages of 5 to 8 per cent ores, the prices offered for such grades do not warrant production.

These conditions do not necessarily mean that eventually custom smelting will be a memory in Chile and that production will be limited to Chuquicamata, Teniente, and later Potrerillos. It must be emphasized that many of the smelters that have shut down were built from ten to twenty or more years ago, and it is a logical conclusion that sooner or later some of the mining districts tributary to such smelters must have become totally or at least partly exhausted. With a high copper market, smelters on the coast augmented their ore receipts by marine shipments via Antofagasta from points as far north as Bolivia. But with a price to which copper quotations have now fallen the margin on smelting will not admit paying extraneous freights, with the possible exception of some of the silver-bearing Huanchaca ores.

Two ways are open to revive custom smelting and consequently stimulate production: (*a*) Small-scale smelting in districts where development is retarded by excessive transport costs; (*b*) systematic prospecting in the higher Cordillera.

FREIGHT PROBLEM GREATEST DETERRENT TO SMALL-SCALE OPERATIONS

Today the freight problem is, and it probably will always be, the most serious deterrent to the development of districts capable of furnishing 2,000 tons or more monthly of 5 to 8 per cent ores, generally with 2 or 3 oz. of silver, but too distantly located by trail or rail from the custom smelters. The richer ores were shipped in years past, and what remains on the dumps and in the mines, although often fair smelting material, can command no price because of the freights. A furnace situated in the center of such a district obviously would not pay on account of the same factor on coal and coke or matte.

A characteristic of Chile is its extreme length in proportion to its width. The Longitudinal Railroad, a line over 3,000 km. long, roughly parallels the coast at distances of from 60 to 70 km., and the mining districts, with the exception of Chuquicamata, Teniente, and Potrerillos, which own their own lines, and a few of the higher-grade properties, are generally situated within 25 to 40 km. of the rails. If, in addition to pack-animal freight, the operator is compelled to pay railroad charges for a 150 to 200-km. haul to the nearest smelter, he is naturally limited as to his shipping grades.

It would appear that furnaces of from 100- to 125-ton daily capacity situated at or near the rails and within easy distances of such districts would have no difficulty in obtaining ores up to 8 per cent and would be in a favored position to compete for the production of the higher grades. This would not cut heavily into whatever lots the larger smelters formerly acquired, but would probably effect the sales of 20 to 25 per cent export ores.

Enterprises of this kind must naturally assure themselves of a sustained production over a period of years, and must work with low overhead charges. With reverberatory furnaces using pulverized Chilean coal, a manager who can discharge the duties of ore buyer, a good smelterman, chemist, and bookkeeper it is probable that in a period of uninterrupted running a small smelter would show more profits than the larger ones with costly organizations and extremely high overhead.

CORDILLERA PROPER MAINLY VIRGIN TERRITORY

The zone within 40 to 50 km. of the coast has been gone over since the days of the Spanish invasion in the middle of the sixteenth century, when Almagro, Monroy, and Valdivia, coming from Peru, overran the country in quest of gold. Much later Chile entered the lists of great copper producers, and exports in the ten years from 1910 to 1920 showed a steady increase from 38,232 to 98,200 metric tons. Until recent years the greater part of this was produced in this zone, and here American and foreign engineers examined, during the last five or six years, practically every producing property, prospect, or *antigua* for coast smelters or private interests. Further inland or in the "near" Cordillera several deposits of 2 to 4 per cent disseminated ores with possible tonnages up to two million are known of generally by all local operators. As a rule, however, absence of indications warranting exploration for greater tonnages has retarded development.

The Cordillera proper, on the other hand, is in the main virgin territory. The hardships of desert travel with pack animals where water is often lacking for months have deterred the prospector from coming to this arid, wind-swept region. Little geological work has been done by the Chilean government in that part of the country near the international line, and the geological data extant are too scant or antiquated to be of value. It is noteworthy that the "big three," namely Chuquicamata, Teniente, and Potrerillos, are all in the higher altitudes. This in itself proves nothing; but it should certainly stimulate closer study of the more inaccessible regions than they have been accorded heretofore.

A well-organized party headed by an engineer with a balanced sense of business possibilities would not suffer unduly if properly financed. Food, fodder, and, where necessary, water depots can be established before the actual field work begins. The season's work of six months can be limited to a close geological mapping of a limited area. Such work, intelligently conducted, would not only cover the field of prospecting, but would gain for those interested an invaluable first-hand knowledge of the country, with its present or future possibilities. Incidentally, it would do much in running down some of the alluring stories of wonderful deposits which are so current in certain localities.

CHILEAN MINER COMPETENT AND HARD WORKING

As all mining enterprises are so interwoven with the labor question, a word may be said for the Chilean miner. During my travels in the hills in the course of examining hundreds of large and small properties and prospects I have invariably found him competent and hard working, generally with no regard for hours; and this at times under the most primitive of mining conditions underground and elemental living conditions above. In some districts meat is an almost unknown luxury, the menu consisting of an unvarying monotony of *porotos*, or beans, which, although of high nutritive value, would pall on the palate of the ordinary miner. In small mines, a few shacks form the camp, or the native miner makes his home for the time being in a windy adit. Yet withal, he is content, and what impresses the foreigner especially is his solicitude for the education of his children. Another characteristic is his unfailing courtesy, loyalty to his *patron*, and, above all, a true miner's faith in the ultimate richness of the vein. *"Hay que profundisar un poco mas"* (You only have to go a little deeper").

Platinum Production Decreased in 1920

Estimates of the production of crude placer platinum in the United States in 1920 give Alaska, 27 oz.; California, 656 oz.; Oregon, 23 oz.; and Washington, 8 oz., according to the U. S. Geological Survey.

Refiners reported a production of 41,544 troy ounces of new platinum metals in 1920, of which 36,015 oz. was platinum, 418 oz. iridium, 409 oz. osmiridium, 4,309 oz. palladium, and 393 oz. of the minor metals, including rhodium and osmium. This represents a decrease of 3,565 oz., as compared with the production in 1919.

There were also produced 57,710 oz. of secondary platinum metals in 1920, of which 51,255 oz. was platinum, 3,355 oz. iridium, and 3,100 oz. palladium. This represents a decrease of 3,806 oz., as compared with the production in 1919.

The platinum metals imported for consumption in 1920 included 80,955 oz. of crude platinum and unmanufactured ingots, bars, sheets, and other forms, of which approximately 58,009 oz. is believed to be refined metal; 4,718 oz. of iridium; 4,473 oz. of osmiridium; 6,944 oz. of palladium; 2,675 oz. of the minor metals; and 781 oz. of manufactured platinum ware. The imports of platinum for consumption in 1920 were 32,492 oz. greater than in 1919.

The consumption of platinum metals in the United States in 1920 was 141,041 oz., of which the jewelers took 57 per cent, the electrical industry 19 per cent, the dental industry 11 per cent, the chemical industry 10 per cent, and miscellaneous uses 3 per cent.

The stocks of platinum metals at the end of 1920 amounted to 67,508 oz., which is an increase of 55 per cent as compared with the stocks that were on hand at the end of 1919.

Geologists of Note

Frederick Leslie Ransome

FREDERICK LESLIE RANSOME was born in Greenwich, England, on Dec. 2, 1868. His father, in 1870, went to California, with the expectation of returning to England, but decided to remain, and was joined by his wife, son and a younger daughter. Six additional children were born in the United States, and the elder Ransome became an American citizen. F. L. Ransome attended the public schools of San Francisco and Oakland, studying under Le Conte and Lawson, and was graduated from the University of California in 1893. After graduation, Ransome gained a teaching fellowship, and in 1896 obtained a Ph.D., having published four papers on the geology of California, and assisted H. W. Turner in field work for the U. S. Geological Survey in the Sierra Nevada. In 1896, in San Francisco, Mr. Ransome took the first civil-service examination held for appointment to the scientific staff of the U. S. Geological Survey, and on the same date two men with whom he was later associated, George Otis Smith and Arthur C. Spencer, struggled with the same examination in Baltimore. The three stood at the head of the list of contestants. While awaiting an opening on the Survey, Mr. Ransome accepted an assistantship at Harvard University, where he taught mineralogy and petrography. In 1897 he succeeded C. W. Purington as assistant to Dr. George F. Becker, of the U. S. Geological Survey, and has ever since been identified with the Survey's geological work. His major official publications, familiar to mining engineers, include reports on the Mother Lode, Silverton, Ely, Cripple Creek (with Waldemar Lindgren), Breckenridge, Globe, Bisbee, Ray, Miami, Coeur d'Alene (with F. C. Calkins), and Goldfield and Bullfrog districts (the last with G. H. Garrey and W. H. Emmons). Since 1912 he has been chief of the section of Geology of Metalliferous Deposits of the Survey, succeeding Waldemar Lindgren in that position.

FREDERICK LESLIE RANSOME

When, at the suggestion of J. E. Spurr, the journal *Economic Geology* was founded in 1905, Mr. Ransome was active in its organization, and he has continued on its editorial board. He was on the first editorial board of the *Proceedings of the Washington Academy of Sciences*, is an associate editor of the *American Journal of Science*, one of three representatives of the National Research Council on the editorial board of the *Proceedings of the National Academy of Sciences*, and on the editorial board for the new series of scientific publications of the National Geographic Society. In 1914, in recognition of his services to science, Mr. Ransome was elected to membership in the National Academy of Sciences, and in 1918 was made treasurer of the academy and of the National Research Council. He is a member of the Washington Academy of Sciences and was its president in 1919; a fellow of the Geological Society of America and the American Association for the Advancement of Science; a member of the A. I. M. E., the Society of Economic Geologists, and the Geological Society of Washington (of which he was president in 1918). He was a charter member of the Mining and Metallurgical Society. In 1906 he attended as a delegate of the U. S. Government, the International Geological Congress held in Mexico, and in a similar capacity in 1913, the twelfth session of the same congress in Canada. In 1918 he served with the late Hennen Jennings, J. H. Mackenzie, Charles Janin, and H. D. McCaskey on a committee appointed by the late ex-Secretary Franklin K. Lane, to investigate the gold-mining situation in the United States. He married, in 1899, Ann Cordova Rose, of Washington, and they have three daughters and one son. As might be expected of a geologist, Mr. Ransome is a lover of out-door life. He and his family spend their summer vacations cruising on the lower Potomac in a power boat of his own building. In his geological work he seldom indulges in speculative flights of the imagination. Preferring to devote himself to the science of geology rather than to engineering or statistical studies, he has refused to acknowledge any real distinction between pure science and applied science, and has held that economic geology affords as many opportunities for thoroughly scientific investigation as do those branches of geology whose connection with industry is less apparent.

CONSULTATION

Manifold Uses of Quartz

"I am interested in the uses of quartz, but am unable to obtain any information which gives all the data I require in one particular reference. Will you kindly inform we what the principal uses of quartz are, and where I can get detailed information?"

Quartz occurs so widely distributed and in such a variety of forms—sand, gravel, sandstone, quartzite, novaculite, flint, chert, pegmatitic masses, quartz veins, and other varieties—that definite information concerning its occurrence and distribution would require an extended treatise. Besides these more massive and relatively pure forms, quartz is abundant in disseminated grains as a constituent of granite, gneiss, mica schist, and other less common rocks.

The uses and markets for this mineral are equally varied, if not more so. Much sandstone and quartzite are quarried and used as stone, either in massive block form, or crushed for concrete, railway ballast, road metal, and other purposes. At the opposite extreme is the clear, colorless quartz, perfectly transparent and free from flaws, used in the manufacture of lenses and other optical appliances, and, when cut in the form of brilliants, as a substitute for diamonds in cheap jewelry. This variety is known as rock crystal. The colored varieties used in jewelry (some of them furnishing gems of high value) include amethyst, smoky quartz (cairngorm), citrine (false topaz), aventurine, prase, cat's eye, tiger eye, rose quartz, and other less common varieties. If chalcedony be included with quartz, the ornamental varieties of agate, carnelian, sard, onyx, sardonyx, chrysoprase, plasma, and heliotrope or bloodstone are added to the list.

Natural quartz sand and crushed sandstone, quartzite, novaculite, pegmatitic quartz, and vein quartz are applicable to numerous uses, some of the most important being glass sand, molding sand, building sand, filter sand, sand for common brick and for sand-lime brick, sand-blast material, and sand paper. Finely pulverized, it enters into the body and the glaze of pottery, and is used as wood filler, paint pigment, polishing material, as an ingredient of scouring soaps and dentifrices, and as a filler in fertilizers. Grindstones for metals and for wood pulp (called pulpstones) are made of sandstone; and some millstones are made of conglomerate and of silicified limestone (burrstones).

Quartz in any of its natural forms is used as a flux in smelting basic ores, and purer varieties are employed in the electric furnace in the manufacture of ferrosilicon alloys and fused quartz glassware. There are also many minor uses for quartz, and the compilation of a complete catalog would be difficult to gather satisfactorily.

Obviously, the requirements as to purity, crystallization, transparency, size and form of grains or fragments and other characteristics vary greatly according to the purposes for which the material is to be used. Glass sand, for example, must possess a high degree of purity. Only minute amounts of iron, alumina, and titanium can be tolerated. Building sand, on the other hand, may be distinctly stained, but the shape of the grains is important. In both natural sand and the crushed materials the size of the grains and the degree to which they must be screened to uniform size varies according to the use to which the various grades of the material are to be put.

Statistics and information as to the occurrence, production, and uses of quartz are gathered and published annually by the U. S. Geological Survey, Washington, D. C., but these are incomplete, and, like most other Government publications, are generally several years behind time. The unsatisfactory nature of the information is due largely to the fact that there are great numbers of small producers, many of them operating irregularly, and to the unwillingness of many of them to furnish the data requested. They do not know, or have not been fully convinced, that such information is held in strict confidence, and that only the totals are given out. It is also not so generally known as it should be that such co-operation with the Survey, besides increasing the accuracy and value of the statistics, may be the means of direct assistance to the individual producer. In answer to numerous inquiries the Survey is often able to bring producer and consumer together, to their mutual benefit, a function which the Survey is glad to exercise.

The available information about quartz in the annual volume on *Mineral Resources*, published by the U. S. Geological Survey, is scattered through several chapters, each of which may be had in separate form, as follows: Gems and Precious Stones; Silica; Sand and Gravel; Sand-Lime Brick; Abrasive Materials; Stone. Among the available state reports may be mentioned "The Glass Sand Industry of New Jersey," (address, State Geologist, Trenton); "The Sand and Gravel Resources of Missouri," (State Geologist, Rolla); "Glass Sands of Kentucky," (State Geologist, Frankfort); "Sand and Gravel Deposits of Georgia," (State Geologist, Atlanta); "Glass Manufacture and the Glass Sand Industry of Pennsylvania," (State Geologist, Harrisburg). Many states have also published reports on building stones.

Two Most Important Sulphur Producers

"Will you kindly tell me what are the most important sulphur mines in the United States?"

The two largest producers of sulphur in the United States are the Union Sulphur Co., whose mine is at Sulphur, Calcasieu Parish, La., and the Freeport Sulphur Co., whose mine is near Freeport, Brazoria County, Tex. These two companies furnish about 99 per cent of the sulphur produced in the United States. It would be well for you to obtain a copy of a brochure called "Sulphur and Pyrites in 1918 and 1919," published by the U. S. Geological Survey, Washington, D. C., as it contains additional information. The pamphlet is mailed free upon application to interested persons.

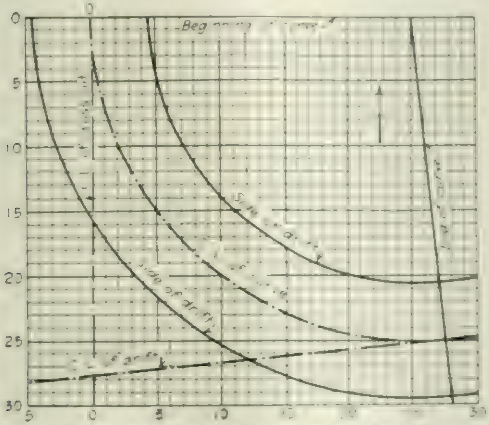
HANDY KNOWLEDGE

A Curve Chart for Drift Work

By B. G. Best

Written for Engineering and Mining Journal

The accompanying curve chart I have used with success in rock drifts where no timber is placed. Near the point at which the curve is to begin, the center line of the crosscut is established by two or more plugs in the back of the crosscut, after which the captain is given the distance to the point of curve, the curve chart, and an instruction sheet reading as follows:



A CURVE CHART FOR UNTIMBERED DRIFTS

The scale of this drawing is 5 ft. to 1 in., and the smaller squares represent 1 ft. Everything is laid out with reference to the center line of the crosscut, which is represented by the vertical line marked 0—0. The vertical lines to the right of this line marked 5, 10, 15 and so on, are 5, 10 and 15 ft. east of the center line of the crosscut. The horizontal lines represent distances south of the point where the curve began. For instance, to locate the center line of the curve 10 ft. south of the point of beginning, follow down the 0 line, or center line of the crosscut, until it is intersected by the horizontal line marked 10. Then follow east on this horizontal line until it intersects the line marked center line of curve. This point of intersection is two squares to the right of the 0 line, or 2 ft. east of the center line of the crosscut.

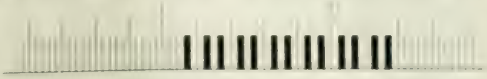
Metric Scale for Surveyors

By J. S. Carnahan

Written for Engineering and Mining Journal

A part of a metric scale for surveyors, divided in the usual manner, five divisions to the meter, each representing 20 cm., is illustrated in the accompanying sketch. On the 1:500, which is the scale most in use for mine mapping, the divisions are of shorter length than on any of the others. They are so fine as to produce eye-strain in a comparatively short time and become indistinguishable as one grows older. The inking in of the second and fourth divisions of each meter, as shown in the sketch, throws all five into brilliant relief, eliminates the eye strain and facilitates generally the use of this most important of metric scales.

Similar treatment of other scales will probably be worth while. A flat beveled scale blade, rather than a triangular prism, is recommended, because the ink shadings are less liable to erasure by contact with the map or other surface. A white enameled scale edge is preferable to the yellow. At the extremities of the meter divisions, the adjoining subdivisions are both white, but they are easily distinguished, one from the other, by the extra length of the line dividing them. This break in the alternation of black and white divisions facilitates, in reality, the use of the scale.



INKING SECOND AND FOURTH DIVISIONS OF METRIC SCALE AVERTS EYE STRAIN

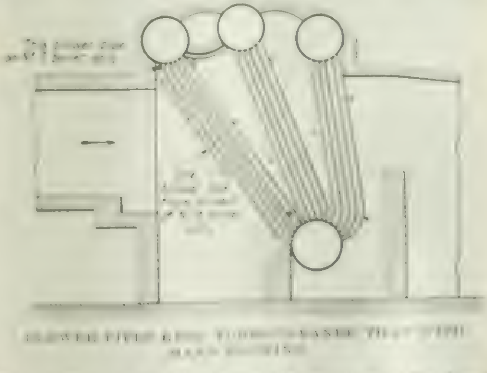
Soot Blowers on Waste-Heat Boiler

By N. L. Stewart

Written for Engineering and Mining Journal

During the last year experiments have been carried on with Diamond soot blowers on the two waste-heat boilers of one of the reverberatory furnaces at the Garfield smelter. These blowers could more properly be called dust or slag blowers, as the flue dust on the front row of tubes is quite often fused into a sticky mass. The blowers are operated with steam at about 150 lb. The two boilers are Stirling, Class S-17, set in battery.

The blowers on the first trial gave fairly good results on the back tubes, but failed to clean the front tubes. It was then decided to change the position of the front blowing units, but to try one arrangement on No. 7 boiler and a different arrangement on No. 8. On No. 7 boiler the front blower pipe was placed in a horizontal position almost directly under the center of the upper front drum. The steam jets therefore in this test were parallel to the boiler tubes. This arrangement gave good results.



[illegible]

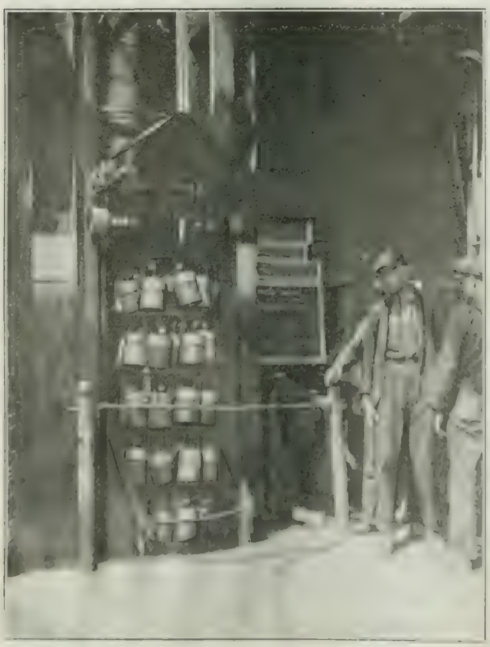
On No. 8 boiler two blower pipes were provided, placed parallel to the front boiler tubes and in recesses in the side walls of the brick setting. This arrangement gave poor results. The boiler tubes were not cleaned nearly as well as on No. 7 boiler. Furthermore, the steam jets blowing across the boiler tubes cut grooves in them, and several tubes had to be replaced. As the blower pipes could not be moved while the reverberatory was in service, the use of the front blowers on No. 8 boiler was discontinued for the remainder of the run. As the single horizontal blower gave such good results on No. 7 boiler it is probable that this arrangement will be adopted on any other boilers that may be equipped with soot blowers.

In general, if the soot blowers continue to operate satisfactorily, they will effect a saving by keeping the tubes cleaner than with hand blowing, and by admitting less cold air to the boiler. The soot blower has been operated so far about every six hours. The time the steam of any one blower pipe is actually on probably averages about thirty seconds. It is practically impossible to measure the quantity of steam used in blowing and to determine the exact saving. The placing of the soot blowers is shown in the accompanying sketch.

Handling Lunch Buckets

Written for *Engineering and Mining Journal*

At the Plymouth Consolidated Gold Mines, Ltd., at Plymouth, Cal., lunch buckets, instead of being piled into a skip or cage, are hung from a frame which is suspended by hooks in the timber skip. The buckets, each with its identification tag, are hung from hooks attached to rings, which are placed on the frame a sufficient distance apart to allow the bucket to swing clear. About eight buckets are suspended from each horizontal circle. The frame revolves readily about its suspension. The lunch bucket trip is stopped at each level, and the miners take off their buckets.

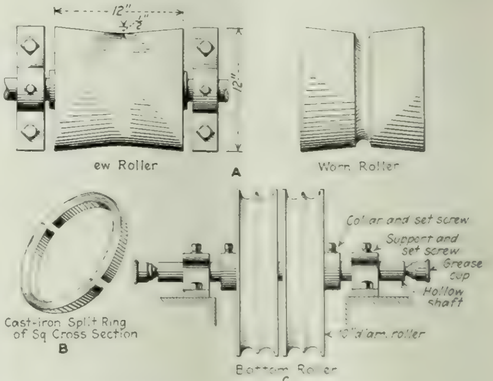


LOWERING A LOAD OF LUNCH BUCKETS AT PLYMOUTH MINE

Shaft Rollers

Written for *Engineering and Mining Journal*

In inclined shafts, the hoisting rope is carried upon rollers or idlers. Where a vertical shaft departs from the vertical and becomes an incline, top rollers, or rollers placed upon the hanging-wall side of the shaft compartment, are necessary to prevent the shaft timbers from being cut by the rope and to reduce the friction of the rope to a minimum. The main shaft of the Plymouth Consolidated Gold Mines, Ltd., Plymouth, Cal., is vertical to the 1,600 level. It then passes to a 55-deg. incline, the transition curve being of 250-ft. radius.



SHAFT ROLLERS USED AT PLYMOUTH MINE

Between the 2,100 and 2,300 levels the shaft steepens to 60 deg. and then to 65 deg. and finally in its lower portion flattens to 50 deg. The total vertical depth to the 3,235 level is 3,000 ft. With these changes of angle, rollers are necessary at several points and bottom rollers in the inclined section of the shaft. Top rollers are made of cast iron and turn upon a stationary shaft. The surface of the roller is made concave, the concavity being approximately ½ in. The roller is hollow and partly filled with crude oil through plugs which are screwed into its ends. A bushing is used and oil holes connect with the oil space within the roller. The shaft ends are supported by boxes bolted to the timbers.

The bottom roller consists of a pair of double-grooved wheels which turn upon a shaft. Two collars are set upon the shaft and are adjustable so as to allow of a small amount of end-play. Two boxes with setscrews support the shaft. Lubrication is provided by making the shaft hollow and putting grease cups in both ends, as shown at *C* in the figure.

The top rollers wear as shown at *A*. When badly worn the roller is replaced and the worn roller repaired by turning down a split cast-iron ring, shown at *B*, until it can be driven into the groove. The roller is turned down until the surface is smooth and is ready to be used again. Both types of rollers give excellent service and were devised and made at the mine shops. The maximum speed of hoisting is 1,000 ft. per minute.

THE PETROLEUM INDUSTRY

Draining Oil Reservoirs by Shafts and Tunnels

By Paul de Chambrier*

Written for Engineering and Mining Journal

THE MINING of shallow oil sands by shafts and tunnels at depths from 30 meters to 65 meters was applied in Alsace from 1735 to 1865. From that time on the mining works were deepened to 72 and 95 meters and then abandoned in 1888. During the first phase, the production consisted in raising bituminous sand to the surface and washing it with boiling water in order to draw 30 to 50 kg. of thick grease out of each ton of sand. The layers developed during the second phase from 1865 to 1888 were richer. A heavy crude oil of 0.985 specific gravity, 12 deg. Bé., containing neither gasoline nor kerosene, oozed naturally and was collected in a sump, from which it was taken out of the shaft.

By boring in oil sands situated at a depth from 150 to 450 meters flowing wells were struck which yielded light crude oil of a specific gravity of 0.870, 31 deg. Bé. The subterranean works were then abandoned. Mining works were only begun again during the war, in the year 1916, on quite a new principle. The question was now to drive tunnels in a layer saturated with gas, a very dangerous operation. This audacious test, tried in the Pechelbronn mines, was perfectly successful and established that this extracting method was fitted to recover quantities of oil two to five times greater than those already obtained from the same bed by the boring process.

Seth S. Langley, in the Dec. 4 issue of *Engineering and Mining Journal*, expounds a method for determining certain production estimates and the calculation of drainage area of oil sands. He presents an example of pay sands with 3 per cent oil extractable by borings and by drainage tunnels.

In Alsace the practical result has been more favorable. From one ton of oil sand, 20 kg., or 44 lb. of oil is extracted by wells and after this about 50 kg., or 110 lb., by draining tunnels. Calculations of the oil remaining in the sands already exhausted by borings and of the oil recoverable by drainage into tunnels is in practice more difficult than in a theoretical example.

In oil sands the recoverable oil flows toward the bottom of the layer only very slowly. The gas pressure is not sufficient to lift the oil in the pump tubing more than a few feet; but drainage galleries of great cross section will considerably facilitate the downward flow of the oil toward the floor of the tunnel. Hence it is not possible to establish a ratio between the draining area of the vertical channel of a boring well and the horizontal galleries driven in the lowest part of the layer.

Moreover, the bubbles of gas, [illegible] between the grains of sands and the oil droplets, prevent the oil from flowing freely under the effect of gravity toward the floor of the strata. But when a drainage gallery has been opened in these oil sands, both gas and oil will separate easily, and oil can then flow freely toward the lower part of the strata. There remain only in the sands the quantities of oil retained by adhesion, namely, 40 to 50 kg., or 88 to 110 lb.

In one of the three mining works at Pechelbronn, Alsace, 4,450 meters (14,600 ft.) of subterranean galleries had yielded until Sept. 1, 1920, a total amount of 55,000 cu.m. of oil (1,942,311 cu.ft.), consequently 1 meter (3.28 ft.) of gallery produces an average of 12.36 cu.m. (423.90 cu.ft.) of oil.

The subterranean working of petroleum requires certain special precautions which are necessary to avoid serious accidents or fires. Notwithstanding this fact, the new extracting method presents many advantages and will find its application in certain oil fields.

There exists a series of studies published in France on the working of petroleum by means of shafts and galleries. These are listed in the pamphlet of Paul de Chambrier "Exploitation du pétrole par puits et galeries," edited by Dunod; Paris, 1921; Price 5 fr. See also in the *Journal of Petroleum Technologists*, London, June, 1921, No. 27, "Working of Petroleum by Means of Shafts and Galleries," and "Notice sur l'Exploitation par puits et galeries des gisements pétrolifères," by Mr. Langrogne, engineer at the Service of Mines. *Annales des Mines*, XI Series, Tome XI, April, 1921, edited by Dunod, Paris, p. 323 to 353.

---

*Consulting engineer of the Pechelbronn Mines.

Oil Strike Reported in Arizona

Special Correspondence

There is belief that oil has been struck in Arizona after many years of futile prospecting. The strike has been made in the eastern Whetstone Mountains, a few miles east of Huachuca Siding, at the junction of Pima, Santa Cruz and Cochise counties. Old [illegible] fossil remains and several small seams of coal are to be found in the district. Mescal Springs, near the strike, has long been known to carry oily water. The strike is said to have been made in shale and sandy clay at the bottom of a well which was sunk for water to a depth of 220 ft. on the Wolferton ranch. The material burns readily and is reported to carry a material percentage of oil of a paraffin base. The well will be sunk deeper with all speed, in the hope that a gusher will be developed.

The country for miles around is being located by miners unfamiliar with the proper procedure, and many others are hurrying to Phoenix to secure leases on tracts of state lands that lie near by. The district is situated about ten miles northeast of Elgin, twenty miles from Patagonia and fifteen miles west of Fairbank, all on the Benson-Nogales branch of the Southern Pacific railroad system. Texans declare the sand similar to that first struck in the Ranger district.

Book Reviews

The Engineer. By John Hays Hammond. Cloth; 4½ x 6½; pp. 194. Charles Scribner's Sons, New York. 1921. Price, $1.25.

This little book is one of a "vocational series." Others are on "The Teacher," and (in preparation) "The Newspaperman," and "The Ministry."

The volume by Mr. Hammond is clear, thoughtful, precise, and astonishingly well written. Indeed, we should be inclined to give the author first prize among mining engineers for the translucent brevity of his style. A keen analytical insight is continually in evidence, and a comprehensive range of thought on every subject which is taken under consideration.

"The purpose of this book," the advertisement reads, "is to make clear to the young man who is interested in engineering the advantages and shortcomings of his profession and what determines his mental and temperamental fitness for it." First are taken up brief studies of the general profession of engineering, the qualities necessary in an engineer. "Nothing is more false than the more or less prevailing belief that imagination is only useful to the poet, artist, or philosopher, and should be suppressed by the practical man as dangerous. The engineer, practical as he is, must at the same time be as much of a dreamer as any of these, if his work is of any magnitude. He must have the power to see a thing before it exists."

The important natural qualities which the engineer must have, besides imagination, are "integrity of purpose, accuracy of thought, capacity for judgment, ingenuity, curiosity, the creative instinct, and an innate interest in the workings of material laws." An engineer, Mr. Hammond thinks, should be thoroughly educated. He does not even mention the "correspondence school" route. Moreover, he strongly advocates the pursuit of liberal studies before and during the technical studies, in order that the engineer may be broad and cultured. English is most important of all. "Surely, of all that makes up the background of any professional man's education English is by far the most important."

The study of engineering, the author believes, is an excellent training for any career, if the student eventually chooses not to become an engineer; and he is of the opinion that such a preparation for life is better than "a diversity of studies."

Mr. Hammond devotes a close-packed chapter each to the mechanical engineer, the civil engineer, the mining engineer, the electrical engineer, the chemical engineer, the marine engineer and the military engineer. Of the natural equipment of the mining engineer he says: "First, he must be physically robust, preferably athletic, with great endurance. Then he must have the restless temperament of the explorer, keen for new discovery, interested in unknown places, at home in wilderness, adaptable to strange and uncomfortable conditions. He must be a leader of men, human and humane, tactful, sympathetic, interested in man psychology, familiar with labor conditions and life on the bare 'living wage,' self-confident but never self-conscious, equal to sudden mob emergencies, and without prejudice of race, creed, color or nationality. He must have sure, instantaneous judgment, based partly on intuition, but largely on training and experience. He must have sudden courage, physical and moral, which means not only the fearlessness of the soldier but equally an indifference to criticism inspired by animus and to erroneous public opinion. He must have a constant sense of responsibility, knowing that the fortunes of thousands of men and women stand or fall according to the accuracy of his professional opinion. Most important of all he must be honorable and honest beyond all suspicion, meticulously scrupulous in the handling of public or private property trusted to his care."

J. E. S.

Claims Against Mexico. By R. E. Desvernine. Cloth; 5½ x 8; pp. 149. Privately printed, 24 Broad St., New York.

In view of the present interchange of notes between the United States and Mexican governments, the United States insisting on provisions for the adjudication of claims before recognition can be accorded the Mexican government, this book is timely. The author, a lawyer, well versed in international law, has made "A Brief Study of the International Law Applicable to Claims of Citizens of the United States and Other Countries for Losses Sustained in Mexico During the Revolutions of the Past Decade," to quote from the subtitle, and first sets forth the historical basis for the present complex legal situations. In Chapter III he deals with the presentation and adjudication of international claims. Chapter IV discusses land, petroleum, and minerals, and the effect of Article 27 of the Mexican Constitution, a section of particular interest to mining companies and engineers. Such subjects as obstacles and defenses to presentation of claims and the measure of damages are also treated. Lindley M. Garrison, former Secretary of War, in a foreword terms the book's "usefulness unlimited in its field" and a "unique and valuable contribution to the subject." To anyone wishing a survey of the status of American mining claims against Mexico the book is to be highly recommended.

F. E. W.

Michigan Minerals — The Michigan Geological and Biological Survey, Lansing, Mich., has issued Publication 29, Geological Series 24, a cloth-bound book of 214 pages devoted to the metallic and non-metallic mineral industries of the state for 1918 and prior years. An appendix contains a directory of all producers.

Technical Papers

Metal Statistics—"Statistische Zusammenstellungen über Blei, Kupfer, Zink, Zinn, Aluminium, Nickel, Quecksilber und Silber," published by Metallgesellschaft, Frankfurt am Main, Germany, was recently received for the first time since the war, and since then the first annual (1920) "Year Book of the American Bureau of Metal Statistics," 115 Broadway, New York, N. Y., has been published. The German pamphlet has heretofore been the most complete and helpful compilation of metal statistics of its kind which has reached this office. The current number carries production statistics for the metals enumerated, from 1909 to 1918 inclusive, with price averages through 1920. The American publication covers only copper, lead, zinc, gold, and silver, but the figures given in all cases include those for the year 1920, and their timeliness adds considerably to their value. In common with the German book, the statistics given include production, consumption, prices, imports, and exports for the various countries, with summaries for the world. The first published effort of the American Bureau in this field compares creditably with the older publication and is in many respects superior, particularly from the American standpoint. No doubt there will be a gradual extension of the metals covered, finally including, possibly, the non-metallic minerals. World-production statistics are particularly hard to secure, and it is probable that in collecting data on a number of other products, information could be secured with comparatively little more trouble.

Mineral Resources—Recent publications of the U. S. Geological Survey, Washington, D. C., in the Mineral Resources series include: "Gold, Silver, Copper, Lead, and Zinc in California and Oregon in 1919" (forty-five pages); "Talc and Soapstone in 1919" (four pages); "Coke in 1918" (eighty-nine pages); "Zinc in 1918" (forty-seven pages); "Gold, Silver, Copper and Lead in Alaska in 1919" (ten pages); Silver, Copper, Lead and Zinc in the Central States in 1919" (fifty pages), and "Antimony in 1919" (twenty-four pages).

Tucson and Amole Mountains—Bulletin No. 106, Geological Series No. 2 of the University of Arizona, includes a geological reconnaissance of the Tucson and Amole Mountains by Olaf P. Jenkins and Eldred D. Wilson, together with notes on the southern section of the Amole mining district by Milton A. Allen. The pamphlet is published by the Arizona Bureau of Mines; G. M. Butler, director; Tucson, Ariz.

Safety—"The Safety Organization of the Old Dominion Mine at Globe, Ariz.," is discussed in U. S. Bureau of Mines *Reports of Investigations* No. 2,260, obtainable on request to the Bureau.

ECHOES FROM THE FRATERNITY

Hoover Suggests Remedy for Rehabilitation of Industry and Commerce

The following is an abstract of a recent address delivered in Boston by Herbert Hoover, Secretary of Commerce:

Considerable conflict of opinion exists as to the future of our foreign trade. Some extreme groups insist that inasmuch as our exports comprise but 10 per cent of our total production, therefore our foreign trade bears only this ratio to our economic life, and that consequently our true course should be to devote ourselves to the healing of internal economic wounds. Other extreme groups consider that the only remedy for our internal situation is a restoration of export trade. In either case, we must not allow the present extreme industrial depression to obscure our view.

Exports are vital to the stabilization of our industries, of price levels, of wages, and of employment. While exports cover but a small per cent of total production, on the other hand they comprise a large percentage of the production of certain industries. For instance, we generally export 20 per cent of our wheat, 60 per cent of our cotton, and 75 per cent of our copper. Unless a market is found for surplus production of our great industries, we shall continue to keep some 25,000,000 of our people in reduced buying power.

It is most essential that our economic relations abroad are maintained. The recovery of our foreign trade can march only in company with the welfare and prosperity of our customers.

We have not alone shifted from a debtor to a creditor nation, but our capacity for surplus production in food and manufactures has grown enormously, until we have taken front rank of the world in foreign trade. The direction of our trade has also shifted. During the last year about one-half of our entire foreign trade was with Europe, but of our exports to them, 80 per cent were food-stuffs and raw material. Of our exports to states outside of Europe, about 75 per cent were manufactured goods. Europe in turn is our serious competitor in the marketing of manufactured goods to the rest of the world.

Any improvement in European production of manufactured goods will favorably affect our market for those raw materials such as cotton and copper, where we possess the final supplies. In considering the demands for such raw materials, we must remember that the manufacturing countries of western Europe have lost, for a long time to come, any great markets in Russia and Turkey, the population of Europe as a whole has not the consuming capacity for manufactured goods that it had before the war, and, therefore, we must expect a less than pre-war consumption in Europe for their remanufacture of our raw materials. On the other hand, they will find, after this deflation is past, that the markets of the rest of the world are larger than before the war. I am confident they will gradually return to a pre-war demand for our cotton, copper, and other products.

Our whole financial relation with the rest of the world has greatly shifted, and the war has reversed our position so that the world, principally Europe, owes us today from thirteen to fifteen billions of dollars. We have not only loaned money to the Allies, but have also increased the surplus of our exports. Unless we would cease a large part of our war increased productivity, with all the resulting unemployment, and losses of such a cessation, we must continue for some time to export in excess of our imports. If today we stop giving more credits and demand payment of interest on debts due our Government, our exports will further decline, and the decline will find its interpretation in more unemployment among our own people and more displacement of our industries.

On the production and marketing side of our commerce, we can say that our food exports should remain on a greatly enlarged scale; that the demand for our raw materials should slowly increase toward pre-war amounts; that in respect to our manufactures, we should be able to hold special fields of repetitive production and ingenuity; that we will need to make a fight to hold the markets for manufactured goods where we come more directly into competition with the European manufacturer, but that we can do it if we will work and apply our brains to it.

We are suffering greatly in this immediate world-wide industrial depression. This depression is partly due to the war, partly to our post-war boom, with its speculation, extravagance and slackening of efficiency. The Government can help the public by removing the obstruction to commerce and industry, but the real cure for all depressions is courage and applied intelligence, and the return to primary virtues of hard, conscientious toil and economy in living. While our recovery may be slower than some may expect, nothing can prevent the prosperity of a country where people have enlightenment, wish to work, wish to produce, and wish to do right by their neighbors.

Dredge Operators and A. I. M. E. Members Fraternize in Nevada

The joint field meet of the San Francisco Section of the A. I. M. E. and the Dredge Operators held in Virginia City, Nev., district, June 27, 28, was highly successful in interest and good fellowship. Forty-four members and guests from California and Nevada were on the trip. F. W. Bradley, Charles W. Gardner, Albert Burch, T. A. Rickard, L. D. [illegible], Frank H. Probert, Roy H. Elliott, Edwin Higgins, Gerald H. Hutton and others were present. Gerald H. Hutton arranged the details of the two-day trip.

On Monday morning the adit of the United Comstock Mines Co. was visited. The visitors were taken to the face in mine cars hauled by storage-battery locomotive and there witnessed a Hoar loading machine in operation. They were then taken underground at the Yellow Jacket shaft and shown the development work in the orebody which is to be mined by the company. An excellent luncheon was next served, and in the afternoon the Gold Canyon dredge was visited.

Two papers were presented, one by George J. Young on "Mining at Gold Hill, Nev.," and the other by Gerald H. Hutton on "Dredge Mining Practice." Mr. Young presented an historical sketch of Gold Hill operations and a brief summary of present developments. F. W. Bradley, Albert Burch, Roy H. Elliott, Governor E. D. Boyle, and others discussed the paper. T. A. Rickard then introduced a resolution, which was unanimously adopted, to the effect that the members wished success to the efforts of the United Comstock Mines Co.

On Tuesday morning the North End mines at Virginia City were visited. The members descended the C & C shaft and inspected workings on the East and Hardy veins, and following this they were taken up to the Sutro tunnel level and through the north lateral to the Sutro tunnel.

July Meeting of Columbia Section, A. I. M. E.

There were present at the regular monthly meeting of the members of Columbia Section, A. I. M. E., Director and former chairman of the section, Stanly A. Easton; former chairman James F. McCarthy, and about sixteen others.

A meeting of the Columbia Section of the A. I. M. E. was held in the Davenport Hotel, Spokane, Wash., on July 1. There has been arranged by the local sections of the A. S. C. E. and A. I. M. E., the Executive Committee of the Associated Engineers, and the Executive Committee of the Washington State Metal Mining Association, a meeting consecutively for the first, second, third and fourth Fridays in each month. This is for the purpose of [illegible] and cooperation, which, with the [illegible] Wednesday [illegible] meeting of the Associated Engineers, enables the local engineers to keep in close touch among themselves and to be advised upon all public as well as engineering questions.

The North Coast Branch of the Canadian Institute of Mining and Metallurgy recently met at Alice Arm, B. C., Major C. E. North of the Dolly Varden mine occupied the chair. Among the speakers were Bert [illegible], M. L. A., G. F. [illegible], G. C. Mackenzie, H. Fowler, M. Peterson, H. M. [illegible], and John [illegible].

MEN YOU SHOULD KNOW ABOUT

Henry C. Carlisle is in Montana inspecting mining properties.

Percy E. Barbour returned to his desk at the A. I. M. E. offices last week.

L. H. Goodwin is in the Black Hills of South Dakota for two months.

Daniel Guggenheim sailed for Europe on July 5, on the "Aquitania."

L. E. Foster, of Gila, N. M., is visiting Kansas City, Kan., and Chicago, Ill.

Robert Linton, of New York City, has returned from a professional trip to Mexico.

Holland S. Reavis has moved from 120 Broadway to 115 Broadway, New York City.

James P. Porteus, of the Bonney mine, Lordsburg, N. M., is in Chicago, Ill., on mining business.

M. C. Lucky, who has been abroad for some time past, returned last week from Maracaibo, Venezuela.

C. A. Bennett, of Rochester, Nev., has just returned from an inspection of mines at Candelaria, Nev.

F. G. Janney, general superintendent of mills for Utah Copper Co., at Garfield, Utah, is leaving for New York.

Roy M. Wolvin, president of British Empire Steel Corporation, has returned to Montreal from his trip to England.

Eugene Dawson, mining engineer, left New York on July 9 to examine and develop placer mining properties in Equador.

J. R. Finlay, of New York City, is making an examination of the Chapin mine at Iron Mountain, Mich. for the Chapin Estate.

G. E. Hyde, associate of the school of mines at Okago, New Zealand, is now volcanologist to the Mexican Geological Survey.

Kirby Thomas, of New York City, is making an examination of the Northcliff mine, on the northeastern arm of Gowganda Lake, Ontario.

Alfred James (past president and formerly honorable secretary) has resigned from the Council of the Institution of Mining and Metallurgy.

George H. Garrey, mining engineer, of Philadelphia, Pa., who has been making examinations in New Mexico, recently moved up to Tonopah, Nev.

M. Chipart, director of the national school of mines at Saint-Etienne, France, recently was elected president of La Société de l'Industrie Minéral.

S. C. Lind, of the Reno Station of the U. S. Bureau of Mines, and **F. C. Lincoln**, director of the Mackay School of Mines, were in San Francisco, Cal., recently.

Robert M. Raymond, of the Columbia School of Mines, who recently spent several weeks in Mexico, was in Jerome, Ariz., over the Fourth. He has now returned to Mexico.

Alan M. Bateman of New Haven, Conn., has gone to Alaska to go over the exploration and development of the properties of the Kennecott Copper Corporation and will return in September.

John Briar, of Des Moines, Iowa, has been made secretary to the War Minerals Relief Commission. For many years Mr. Briar has been clerk to the Committee on Interstate Commerce of the Senate.

Ernest Bamberger, general manager for the Ontario Silver Mining Co., has returned to Salt Lake City, Utah, from the conference in Washington of representatives of the lead mining and smelting industries.

C. P. Ross, of the U. S. Geological Survey, has been ordered to report to the Oregon Bureau of Mines and Geology to co-operate in the work of mapping the regional geology of the Wallowa Mountains.

Thomas M. Buley, of the State Consolidated Oil Co. of California, which controls a large area of oil properties in the Western States, has completed a tour of inspection of the Alberta and Peace River oil fields.

Irving A. Chapman, of Brooklyn, N. Y., has joined the staff of Smith, Brodie & Lunsford, accountants, as specialist in engineering and cost work. His office is in the Woolworth Building, Broadway, at Park Place, New York City.

F. F. Sharpless, secretary of the A. I. M. E., expects to visit Wilkes-Barre, Pa., at an early date when he will confer with the officers of the local section on the final arrangements for the Wilkes-Barre Meeting of the Institute.

Frederick T. Rubidge, mining engineer, and manager of mines, with Ladenburg, Thalmann & Co. since 1910, is now giving part of his time to consulting work and management for outside interests. His office is at 41 Broad St., New York City.

G. L. Hurst, until recently manager of the gold dredge department of the Bethlehem Shipbuilding Corporation, has opened an office in the Flatiron Building, San Francisco, Cal., and will engage in mechanical engineering, specializing in gold dredge work.

F. A. Wildes, superintendent of mines for the state of Minnesota, is to be transferred from his present headquarters at Hibbing, Minn., to St. Paul, to facilitate the handling of business pertaining to his office and to take charge of the land department for the state.

T. Skewes Saunders, for several years general manager for the Dos Estrellas Mining Co., El Oro, Mexico, has severed his connection with that company and has opened an office at room 525, Edificio "La Mutua," Mexico City, where he will engage in mine examination and consulting engineering practice.

Ambrose Swasey, of Cleveland, Ohio, sponsor of the Engineering Foundation and past president of the American Society of Mechanical Engineers, has been elected to honorary membership in the British Institution of Mechanical Engineers, in the British Institution of Mining and Metallurgy, and in the British Institution of Mining Engineers.

Prof. C. Schlumberger, ingénieur en chef des mines, professor in L'Ecole Nationale Supérieure des Mines, for personal reasons and at his own request has been placed on the retired list. Our readers will recall his treatise on electrical prospecting, a translation of which appeared in *Engineering and Mining Journal* in the May 7 and 14 issues.

Annie H. Martin of Reno and Carson City, Nev., was nominated on July 8 to be assayer in charge of the U. S. Branch Mint at Carson City, Nev. Miss Martin is a native of Empire City, Nev., and has devoted her life to the study of political and economic subjects. She is a graduate of the University of Nevada and of Leland Stanford, Jr., and has studied at a number of other well-known schools. She has also traveled and studied in Europe and the Orient. In 1918 she was an independent candidate for federal senator from her state, to which she had brought woman suffrage in 1914.

Sidney Paige, of the U. S. Geological Survey, is making a tour of inspection of the geological field parties that are now engaged in field work.

The principal field parties of the U. S. Geological Survey that will do work in Alaska this summer are on the ground and have their work well under way. **F. H. Moffit** and his party reached Snug Harbor on July 2 and began work in the Inniskin Bay oil field. **S. H. Capps** and his party reached Portage Bay on July 2 and began work in the Cold Bay oil fields. **G. C. Martin** reached Fort Gibson on July 8 and commenced field work along the Yukon River.

Mining engineers and metallurgists recently in New York City included: **H. Lloyd Moris** of Steadman Moneta, Canada; **Gustaf M. Lundberg** of Madison, Wis.; **James M. Little** of Patagonia, Ariz.; **Warren D. Thompson**, now of Stonington, Me.; **Joseph Daniels**, of the College of Mines, Seattle, Wash.; **Louis S. Cates**, and **Lester A. Blackner**, also now of Salt Lake City, Utah.

OBITUARY

Alexander Faulds, Vancouver, B. C., mining engineer, who investigated the Fernie explosion in 1905 for the Dominion government, was drowned recently in Stanley Park Reservoir. Mr. Faulds was seventy years old.

THE MINING NEWS

LEADING EVENTS

WEEKLY RÉSUMÉ

In Washington little progress is [illegible] reported on the [illegible] tariff bill on the House [illegible] the past week [illegible] on the bill to liberalize the War Minerals Relief Act is still delayed. A change in the design of the silver dollar now being minted from Pittman Act silver has been recommended.

Stagnant conditions continue unchanged in most mining districts. In Grass Valley, Cal., three companies, the Empire, North Star and Idaho-Maryland have shut down, following the refusal of the men to accept a reduction in wages. The Quincy Mining Co., in the Michigan copper country, made a further cut in wages of about 6 per cent on July 1. The asbestos industry in Quebec, [illegible], has slackened; wages have been cut, and the companies are working but four days per week. Iron ore shipments from Lake Superior district mines for June were less than half of those in the same month last year. In Utah, on the other hand, the Tintic district is very busy and is said to have produced more in the first half of 1921 than from Jan. 1 to [illegible]. From Australia it is reported that the Mount Morgan [illegible] soon through some arrangement with the state government.

In the Michigan iron country, R. S. Archibald, of Negaunee, is suing the [illegible] said to have refused to aid in building a light railway through various [illegible] per mile.

New Potash Plant To Be Built

The Bonneville Development Co., in Utah, having secured under the mineral leasing law a large acreage of [illegible] and brines, has announced that it will erect a [illegible] potash plant in the fall. This will be situated east of Wendover. The process to be used is said to be the same as that employed by the Salduro plant at [illegible], Utah. The officers of the new company are: J. L. Silsbee, president; J. A. Kahn, vice-president; J. L. [illegible], secretary, and M. H. Sowles, treasurer.

Operations have been temporarily suspended by the Salduro Chemical Co. It is said that the supply of potash dust secured by evaporation has been inadequate to keep the plant supplied. The cooler weather is held to be responsible for the lessened evaporation. It is thought work will be resumed in the fall.

The Boswell Mine, in Southwestern Oregon

New Bonanza Gives Promise of Continuance at Depth — Discovered in 1914, It Has Interesting History — Causes Revival of Interest in Gold Quartz Mining and Prospecting

BY HENRY M. PARKS

Written for Engineering and Mining Journal

THE DREAM of pioneer miners in southern Oregon, that rich orebodies would be encountered at depth, seems about to come true in the Boswell mine, in Josephine County. From the days when the pioneer of '49 found wealth in the bars of the Rogue and the Illinois rivers, and pushed over into the trackless reaches of the Applegate district, quartz miners have anticipated that ultimately some of the rich mines of the continent would be developed in that region. There have been surface pockets of fabulous wealth that were sensations of their day, and high grade ore has come from many prospect shafts and tunnels, but for various reasons in this, as in other sections of Oregon, there has been no deep mining, speaking in a comparative sense. The deepest mine in the State of Oregon has attained a depth of only about 700 ft. and in Josephine and Jackson counties there has been no deep mining development in recent years.

It was in February, 1914, that R. Boswell & Son found a trace of pay dirt on the land which had been purchased from the State of Oregon in 1913. This discovery was made when they were running out the lines of their land preparatory to prospecting the purchase. The history of the mine in its early development was not unlike that of many promising prospects in the mining districts of the west. After the initial work had revealed the possibility of rich returns, the property was tied up for nearly three years as a result of a legal action instituted against the owners of the property, delaying work until the early summer of 1917. The title and rights of the Boswells were fully sustained by the courts.

The development work that has been done reveals what appears to be a fissure vein, and it seems that the hope of the present owners that it will be [illegible] is justified. Their belief in the possibility of rich orebodies [illegible] by the character of the formation and the present conditions warrant the expectation that production will provide funds sufficient for extensive underground development.

The Boswell mine is located near [illegible] Creek in the [illegible] mining district in the southern part of Josephine County, Oregon, about [illegible] miles southwest of Grants Pass. It comprises the southwest quarter of Section 36, Township 39 South, Range 7 West, Willamette Meridian. It was in February, 1914, that George S. Barton, who had recently come from Tonopah, Nev., to southern Oregon, was invited by the Boswells to inspect their showings. At that time a small surface cut and some prospect holes, where work had been undertaken to sink to bed rock, constituted the prospecting that had been done. A sample of the dirt was taken at the point where the small cut had been made, and this was tested by panning.

"I will show you something when I pan this" was the remark made by Mr. Barton. Results proved that truth was spoken in jest. Small pieces of a brownish oxidized material about the size of a pea were shown. The material crumbled easily and was found to be full of fine and coarse gold. The showing was better than that from previous panning of surface dirt, and examination revealed that it came from the formation in the small cut. Work the next day brought down $3.25 in gold dust from the pannings. What appeared to be a well defined vein had been revealed and opened up in four inches of high grade, and which, with a little further work, widened to [illegible] inches.

In May, 1917, the Boswells installed a [illegible] Huntington mill with a Challenge ore feeder, and a 6-hp. gas engine. A muller was retained that had been used for some time before the mill was installed. With this plant, they recovered [illegible] in bullion by the end of the summer of 1917. At that juncture the operation and development of the property by the Boswells was interrupted by the world war. Young Boswell was called to the colors, and it was his request to his father that the development of the mine should await his return. [illegible] the father agreed and the promise was fulfilled, so that the mine was not again operated by Mr. Boswell. The boy died in France and the father had no desire to resume mining operations.

Public attention was directed to the Boswell property in the summer of 1917, when father and son were held up and robbed by masked highwaymen who [illegible] in gold bullion and dust. Both of these bandits were [illegible]

LEFT—HUNTINGTON MILL BUILDING, BOSWELL MINE, SOUTHWESTERN OREGON. RIGHT—12-TON CYANIDE PLANT

in the Oregon State Penitentiary at Salem. The other was convicted of bank robbery in California, and is serving a term in San Quentin prison.

In December, 1920, George S. Barton and M. Norden, of Seattle, Wash., with whom were associated Tacoma and California people, negotiated the purchase of the property from Mr. Boswell. In January, 1921, the Boswell Mining Co. was incorporated under the laws of the State of Oregon. The purchase price was $150,000, of which one-third had to be paid in cash before a pick could be stuck into the vein. The new owners installed a 7 x 9-in. Blake-type crusher, a Huntington mill, and a small cyanide plant. A tramway was built from the tunnel entrance to the mill, a distance of about 800 ft. The operation of the mill began about April 1, since when about 2,500 oz. of gold bullion has been shipped, all of which was extracted from ore taken above the 30-ft. level. At present the vein is open to a depth of 76 ft. and shows a width of approximately four feet. The tailings pond contains material that runs from $75 to $228 per ton and contains approximately $30,000 in gold. The recovery from the tailings has been about 95 per cent. The average recovery with the mill, by amalgamation, has approximated $800.

The vein in the Boswell mine strikes approximately east and west and dips about 75 to 80 deg. north. It is from two to four feet in width and has well defined walls, the rock on both sides being greenstone—probably an altered andesite. The vein is largely quartz and silicified greenstone, the most conspicuous feature of which is a peculiarly colored band of gouge material, which carries a large amount of gold.

Samples are obtained occasionally in the vein of a steel gray material, mingled with the quartz, and upon analysis is found to be approximately an arsenide of iron, probably lollingite. The sample analyzed by the State Bureau of Mines and Geology also carried 36.2 oz. of gold. This lollingite will probably be the important mineral carrying values when the operation has progressed beyond the oxidized zone.

On account of the limited equipment on the property at present there has been no attempt to mill any portion of the vein other than the oxidized gouge material. The company plans more extended prospecting work to determine the possibility of contiguous veins. As previously stated, the development so far indicates the possibility of values at depth, and the formation is also of a character in which the occurrence of large orebodies may be reasonably anticipated.

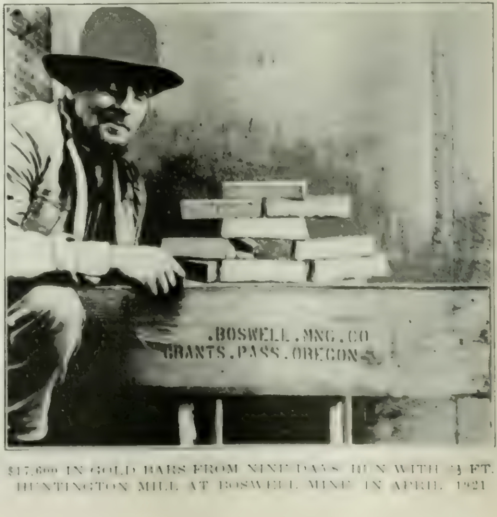
The region in which the Boswell mine is located has been constantly producing gold for seventy years. The Waldo Corporation, George M. Esterly, manager, is operating the Logan hydraulic placer mine at Waldo, Ore., which is about 12 miles from the Boswell mine. The Esterly property is one of the well known placer mines of southern Oregon. During the last year, a tunnel, 1,650 ft. long was completed, that obviates the necessity of using hydraulic elevators to remove gravel from the workings. The gravel is now flumed through the tunnel, and the water formerly used in the elevator is utilized in washing the gravel, thereby greatly increasing the output and efficiency of this extensive plant. The old Channel mine, another placer, is again a producer.

Grass Valley Mines Shut Down

The Empire, North Star, and Idaho-Maryland mining companies, operating in the Grass Valley district, California, stopped all work except that of pumping on July 1, as a result of the refusal of the men to accept the $1 reduction in wages announced on June 2. The decrease proposed would make miner's wages $4.62½ and those for shovelers $4.25 per day. On June 19 the local Mine Workers' Protective League proposed that the wage reduction be made 50c. per day. The operators refused to compromise.

To Finance Export of Copper To Italy

To assist in financing the exportation of 500 tons of copper to Italy, the War Finance Corporation has agreed to make an advance of $145,000 to an American banking concern.



$17,600 IN GOLD BARS FROM NINE DAYS' RUN WITH 3½ FT. HUNTINGTON MILL AT BOSWELL MINE IN APRIL, 1921

Principals in Ford Iron Land Deal Sued

R. S. Archibald, of Negaunee, Mich., Asks $75,000 for Services from Osborn, Case, Hudson, and Davidson

Ralph S. Archibald, mining engineer of Negaunee, Mich., through his attorneys, has entered suit in the Circuit Court of Chippewa County, Mich., against Chase S. Osborn, Fred Case, and Robert Hudson, of Sault Ste. Marie, Mich., and Otto C. Davidson, of Iron Mountain, Mich., for the payment of $75,000 for services which Mr. Archibald claims that he rendered the defendants prior to the time that they turned over the holdings of the Michigan Iron & Land Co. in Michigan and Wisconsin to Henry Ford. The defendants, in 1919, secured an option on most of the stock of the Michigan Iron & Land Co., and Mr. Archibald maintains that he was consulted and gave information regarding the mineral value of the 400,000 acres, receiving no compensation for his work. Mr. Archibald was familiar with the holdings, as he did work for the company at various times, and he believes that the information which he gave to the four men was used to good advantage when Henry Ford sought mineral and timber lands in the northern peninsula of Michigan. Mr. Archibald maintains that the holdings of the Michigan Iron & Land Co. were purchased for approximately $1,000,000 and turned over to Ford for $3,000,000, a profit of almost $2,000,000 for those who figured in the deal. It is likely that the case will be called for trial in September at Sault Ste. Marie, Mich.

Chase S. Osborn is a former governor of Michigan and has played a prominent part in Michigan mining affairs; Otto C. Davidson is superintendent of the mines on the Menominee and Gogebic ranges for the Oliver Iron Mining Co. Mr. Archibald is engaged ir consulting work and looks after the interests of fee owners on several of the iron ranges. The case will be bitterly contested and will probably find its way into the higher courts.

June Iron Ore Shipments Light

Iron ore shipments from the Lake Superior district for June were light. The movement up to July 1 was 40 per cent of that for the same period in 1920. The tonnage sent forward in June was 3,600,989, in comparison with 9,233,666 tons last year, or a decrease of 5,632,677 tons. The total tonnage handled by the docks this season to July 1 was 6,371,227 tons, a decrease of 10,069,278 tons, as 16,440,505 tons was shipped in 1920 up to July 1. It is likely that more ore will be handled during July, but orders are coming in very slowly.

Montana Power Co.'s Electricians Quit Work

The Montana Power Co.'s electricans in Montana and for that matter all the electricians of the state, have quit work, rather than accept a reduction in wages of $1 a day. The Associated Industries threatens to create an open shop unless the electricians return, and the latter are ignoring the threat.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Little Progress in Discussing New Tariff Bill

Opposition Thus Far Centers Against Dye Schedule and American Valuation—Hoover Defends Latter

Discussion of the tariff in the House of Representatives did not get far beyond general statements during the week ended July 9. So much of the opposition is confined to the dye schedule and to American valuation that little attention has been given any of the 10,000 individual items which make up the bill. Nevertheless, it is evident that the proposed duty on petroleum and the proposed duty on several important mineral raw materials will be hard-fought items.

Representative Goldsborough, of Maryland, in the course of remarks before the House on July 9, touched on the petroleum duty as follows:

Under this bill, providing a tariff on crude petroleum of 35c a barrel and on fuel oil at 25c a barrel, everyone who runs an automobile or tractor, every householder who lights a coal oil lamp or stove, will have to pay the tax which is passed on to the consumer. Every railroad which burns oil and every steamer which burns American oil will pass on the charge to the American consumer in freight rates.

The independent oil companies, or at least some of them, charge that the opposition to the duty on oil is mainly from the large corporations, because of their interest in Mexican petroleum. It is claimed that the duty is in the interest of 16,000 independent producers and refiners who are in danger of absorption by the more powerful companies. The large companies formerly controlled 80 per cent of the domestic production, it is declared by the independent companies, but this has been cut to 50 per cent in recent years, with the consuming public receiving the benefits of real competition. It is said that imports of Mexican oil have permitted the building up of a surplus of approximately 25 per cent, which is pointed to as the cause of the demoralization of the industry. Representative Goldsborough declared that the cheaper foreign oil is being imported and delivered at a fraction of the cost of production in the United States.

One of the principal arguments being used for the American valuation system is a statement made to the Ways and Means Committee by Secretary Hoover, who declared that there is no other alternative with unstable currency and exchange. On the other hand, it may be said that the majority of expert opinion seems to be against this change of policy, and it is predicted that American valuation will not be a part of the bill when it is enacted into law.

Representative Fordney, the chairman of the Committee on Ways and Means, made an extended defense of the proposal. He admitted that it has some disadvantages, but said that they are not comparable with the advantages which will flow from American valuation. Among other points he mentioned the ease with which actual dependable values may be secured under this system. Instead of having to deal with foreign manufacturers and agents, whose interest is to mislead and to deceive, the American manufacturer and dealer in whose interest the Government desires the information would be the principal source of this data. Moreover, it would be possible to compel the attendance of all interested parties at a hearing for the establishment of true market values. The plan would equalize the amount of duties paid on similar goods, regardless of the country from which imported. Foreign valuations discriminate against the high-cost countries in favor of the low-cost countries. The most potent argument, however, in favor of the system is admitted to be the fact that it does away with the troublesome matter of exchange and the difficulties of establishing foreign valuations at this time.

The Democrats are placing much stress on the fact that now, of all times, the tariff should not be changed. "At a time when this country has a vast surplus of gold," said one of the leaders of that party, "at a time when Europe, badly in need of our products, can pay for them only in goods, we are building up a tariff wall."

Representative Frear, of Wisconsin, one of the Republican members of the Committee on Ways and Means, issued a formal report as a member of the committee opposing [illegible] features of the bill, particularly the dye schedule. He had some biting criticism also for [illegible] of a duty on crude aluminum and on asphalt, and he described as prohibitive the rates prescribed for tungsten, manganese, and magnesite. He ventured the assertion that the steel industry is about able to walk alone, that it "has ever been protected" and "shows little need of tariff protection" at this time. The duty prescribed for potash will cost the American farmer $6,000,000 during the next two years, Mr. Frear declares, an amount "over 80 per cent of the total estimated increase in duties received from the entire chemical schedule in the 1921 rates over those of the Underwood Act."

Baruch Defended as to Copper Purchases

In view of the criticisms of Bernard M. Baruch, Senator Overman, of North Carolina, has had printed in the *Congressional Record* a statement of fact from the disbursing officer of the Council of National Defence, of which the following is an extract:

> There has been considerable criticism of Mr. Baruch in reference to Government contracts for the purchase of copper. An investigation of the conditions under which the much-talked-of "fixing" of the price of copper was made will show that the basis upon which the price was fixed was the figures furnished by the Federal Trade Commission on the cost of production; also, that Mr. Baruch was not the chairman of the committee which fixed the price, and that the price as fixed was approved by the President of the United States.
>
> From the time the appropriation for the War Industries Board ceased to be available until the records were finally turned over to the Council of National Defence by Executive order, Mr. Baruch personally paid the salaries of several employees necessary to finish the liquidation of the War Industries Board's accounts and to care for the records until they were finally turned over to the council.
>
> He paid for all the stenographic, clerical, and other assistance necessary for the preparation of the final report of the War Industries Board, the only cost to the Government being that of printing at the Government Printing Office.
>
> I can say that I know personally of upward of $100,000 which Mr. Baruch has paid on account of expenses which would have been proper charges against the Government had he cared to ask for reimbursement.

Arentz To Introduce Draft of New Mining Code

Committee Not to Press Bill at Present—Thought Advisable That Text Be Widely Distributed

The draft of a new mining code as prepared by the Ingalls committee is to be formally introduced in the House by Samuel S. Arentz, of Nevada. Mr. Arentz was designated to introduce the bill by the chairman of the House Committee on Mines and Mining. This step is taken so that copies of the law, with the proposed changes, may be available for distribution. It is not the intention of the committee to press this bill for early consideration, as it is believed wise to circulate as many copies of the law as possible, so that suggestions as to the effect of the changes may be received from those who would be affected.

May Change Design of Silver Dollar

As more than twenty-five years have elapsed since there has been a change in the design on the silver dollar, the House Committee on Coinage, Weights, and Measures has recommended the passage of legislation providing a new design which will be commemorative of the ending of the war with Germany.

Under the Pittman Act, 270,232,000 silver dollars were melted down. The replacing of these dollars has already begun, and more than 10,000,000 have been coined after the familiar design. The bill provides that there is to be no change in the weight or fineness of the silver dollar.

Action on War Minerals Relief Still Delayed

No action was taken during the week ended July 9 on War Minerals Relief legislation. Representative Rhodes, chairman of the House Committee on Mines and Mining, conferred at length concerning the situation with the Secretary of the Interior and the War Minerals Relief Commissioner. No conclusions were reached, and Mr. Rhodes stated after the conference that he could not comment on the matter until something more definite had been worked out. The committee is expected to take action soon.

Purchases of silver under the Pittman Act during the week ended July 9 were 441,119 fine ounces. This brings the total purchases under that act to 61,416,816 fine ounces.

NEWS BY MINING DISTRICTS

London Letter

Shamva's Gold Last Year Cost £3 5s. 9d. Per Oz.—East Rand's Cost £6 0s. 10d. Recently—Russo-Asiatic's Holdings Valuable

BY W. A. DOMAN

London, June 29—Possibly owing to the increased operating expenses, and the parlous condition in which many of the South African mines now find themselves—were it not for the "premium" they would be compelled to close down—the cost of production of an ounce of gold is assuming increasing importance. For years the ton milled has been taken as the basis, despite acknowledgment of the fact that this is not altogether a safe criterion. Tonnage can be made at any time by increasing the quantity of waste or low-grade rock, and so keeping down the cost as reckoned per ton.

It is beginning to be recognized that the product should show the cost, as it affords a better indication of profitability. Last year the Shamva mines averaged £3/5/9 per oz., as compared with £2/6/5 in 1915. The Shamva is the lowest-grade property being worked in Rhodesia. The estimate of ore reserves at Dec. 31 last was 1,981,250 tons, valued at 4.1 dwt. The actual extraction in 1920 was 88.32 per cent, as against a theoretical of 90.54, so that with gold at the normal rate of 4/2 per dwt., there is only a moderate surplus after working expenses of 125/18 per ton are met.

The mine is exceptionally well managed. Originally, when the company was floated, the expenses were estimated at from 90d. or 96d. per ton. The war upset all calculations, and costs have risen in this fashion—1915, 99/8; 1916, 103/3; 1917, 109/9; 1918, 118/1; 1919, 114/6, and last year, 125/18. Some of the increase is due to harder rock being encountered, but much is attributable to the fact that everyone wanted a finger in the premium pie. Three of the levels, known as Prospect, No. 1 and No. 2, have pierced the hill from north to south. Last year 609,509 tons was milled, and 608,759 tons brought in, of which 319,100 tons represented "excess" ore averaging about 2.7 dwt. The total recovery was 96,718 oz. of gold, realizing, with premium, £538,887, of which £223,526 was retained as profit. Quarterly dividends of 7½ per cent were paid, requiring £180,000. The future of the property and the prolongation of its life depend mainly upon the ability to remove and treat the large tonnage of low-grade overburden profitably.

At the annual meeting of the East Rand Proprietary mines, Sir Harry Skinner went exhaustively into the position, and showed that at one period recently the cost of winning an ounce of gold was £6/0/10. Here even the premium failed to give salvation. The trouble is that although the claim area is large, a considerable percentage of it contains unprofitable ore, and the working faces are so widely separated that costs are abnormally high. Costs have risen from 19/4 per ton in 1914 to 27/7 per ton last year, and averaged 28/- per ton for the first four months of the current period. The government has been consulted as to the position, and a commission of engineers has examined the mine. Despite the several suggestions put forward, no definite or satisfactory plan of working [illegible] been evolved. The company [illegible] a fair amount of cash, and should [illegible] the present year out under even [illegible] conditions. The debenture holders are safe; but, making allowance for the assets, the ordinary shareholders are not likely to get a substantial [illegible]. A cessation of operations would be disastrous to the local community.

In one sense the report of the Russo-Asiatic Corporation is disappointing, as shareholders must await the annual meeting before learning the result of the negotiations between the directors and the Soviet government in regard to the return and working of the properties. That the areas have a tremendous potential value is clear from the fact that when they were confiscated the board put in a claim through the British Foreign Office for £56,000,000, based on the stocks of metals, materials, machinery and plant on hand, the profit value of the proved ore reserves and the cost of plant, machinery, and general equipment. A good idea of the nature of the assets can be obtained from the fact that they comprise, *inter alia*, concessions in the Urals and western Siberia covering 2,500,000 acres; twelve developed metal mines with 7,260,000 tons of proved ore reserves, unlimited coal reserves being developed for a yearly output of 2,000,000 tons; two copper-smelting plants, with an electrolytic copper refinery having a present yearly capacity of 14,000 tons; a lead plant, a zinc plant, iron mines, railways, and other equipment. The capital of the corporation is £12,000,000 in £1 shares, of which 8,461,[illegible] shares are in issue, together with £614,117 of debentures.

AUSTRALIA

Queensland

Mount Morgan May Be Reopened Soon

Brisbane, June 4—Mount Morgan still remains closed down. The last suggestion for a settlement, which was made by the Minister for Mines, was for the Commonwealth government, either by itself or conjointly with the state government, to make advances to the Mount Morgan company to the extent of 90 per cent of the present value of the ore produced, and for the product to be held until it will realize a price that will pay for the cost of production at the rate of wages that the men demand. The acting Prime Minister, [illegible] that this would mean finding over [illegible] a year for Mount Morgan alone, and [illegible] large sums to be [illegible] to many other big concerns in similar straits that would have claims to like consideration, was not "having any", and the officials of the Mount Morgan company said they were not looking for [illegible] charity in the conduct of their business. Within the last day or two, however, the State Premier has stated that he has met the managers of the company, and that as a result there is a probability of the mine being reopened soon, although on what terms is not divulged.

CANADA

British Columbia

Conditions in Kootenays Continue Stagnant—Phoenix Without Rail Connection

Nelson—A summary of mining operations throughout East and West Kootenay for the first half of 1921 shows a continuation of the stagnation noted at the first of the year, but with prospects of a gradual improvement in sight. Nugget operations at Salmo continue the only mining activity of note in the Nelson division. Consolidated M. & S. Co. of Canada, Ltd., maintains limited operations in Rossland, with the Sullivan mine, at East Kootenay, as the main tonnage producer.

Smelter operations at Trail continue on a reduced scale, with no definite information of the lifting of what practically amounts to an embargo on custom silver-lead ores. The Slocan silver-lead district shows signs of a little more activity, especially around Sandon. Silversmith continues to be the only property in the district showing ore reserves of any consequence. The Ottawa, near Slocan City, a Consolidated property under lease, gives promise of early production on a small scale. There is some other leasing along Slocan Lake, near Kaslo and at Ainsworth.

South Fork of Kaslo Creek is generally inactive, with exception of Silver Bell and Silver Bear, the former being the only one in that section to maintain operations throughout the winter. Operations throughout the Boundary district are at a low ebb, with the Providence mine, near Greenwood, leading in number of employees and in production. There is much optimism in East Kootenay with no great amount of work going on at any point except at the Consolidated's big Sullivan property.

Coal production in the Crow's Nest Pass region has been cut more than 50 per cent. There is likelihood of resumption at an early date of operations at the Nickel Plate mine at Hedley, which normally figures prominently in the list of British Columbia dividend payers.

Sandon—The general annual meeting of shareholders of Silversmith Mines, Ltd., has been set for Aug. 4, to be held at the registered office of the company here. The balance sheet to end of fiscal year, May 31, 1921, has just been issued and indicates a net gain for the year of [illegible]. Income amounted to [illegible], derived from sales of [illegible] tons of ore and concentrates. The directors' report indicates that [illegible] tons of ore was mined, of which [illegible] went to the mill. Mill feed averaged [illegible], 10.5 per cent lead, and 10.1 per cent zinc, and the mill product amounted to [illegible] tons of silver-lead concentrates. The accumulation of zinc concentrates now on hand approximates [illegible] tons. The period of mill operation was about six months, averaging [illegible] tons of feed per day.

Ore reserves were maintained to the same extent as a year ago, current development placing in sight an amount equal to that removed. It is indicated that when metal prices are sufficiently high to warrant it, the company will again resume production operations.

Marysville—Some development is under way on a graphite discovery on Matthew Creek.

Grand Forks—Removal of rails on the Phoenix branch of the Canadian Pacific Ry. has been started, thus leaving Phoenix, for many years the scene of extensive operations of the Granby company, entirely without rail transportation, the Great Northern Ry. having already taken up the steel on its branch to that point. It is indicated that the entire branch will be abandoned, owing to the Consolidated M. & S. Co.'s decision to remove all equipment from the Emma mine, at Coltern, which had continued as a tonnage producer for some time after Granby operations ceased.

The Horn Silver mining company at Similkameen, has been acquired by Herbert Powell. Shipments have been made this year to the Trail smelter. It is probable that Mr. Powell will endeavor to interest capital with a view to the installation of a small reduction plant.

Trail—The Trail Board of Trade is again urging action on the part of the Dominion government with a view to securing an adequate protective tariff on wire rods and other manufactured products produced by the Consolidated Mining & Smelting Co. of Canada, Ltd. At a recent meeting of the organization J. J. Warren, president of the Consolidated company, described the efforts made by himself and others to secure a reasonable tariff on certain metals. He pointed out that definite promises had been made but that the Dominion government had since shown continued indifference to the matter.

Ore shipments received at the Consolidated company's smelter during the week ended July 2 are given in the following table:

Mine	Location	Tons
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Krao,	Ainsworth	2
Providence	Greenwood	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		[illegible]
[illegible] Mines		[illegible]

Ontario

Government Refuses To Aid Northern Ontario Light Railways Project

Porcupine—A contract has been let for several thousand feet of diamond drilling on the [illegible] at [illegible] Lake, near Porcupine. This was the first discovery of gold in the Porcupine district and was found a number of years before the Hollinger and [illegible] were discovered.

Diamond drilling is being carried on on the [illegible] group of claims in Porcupine, and it is anticipated that a total of [illegible] ft. will be drilled.

A contract will soon be let for sinking the shaft of the Moneta mine an additional 600 ft., from which depth the property will be thoroughly explored.

Kirkland Lake—Interests connected with the control of the Wright-Hargraves mine, at Kirkland Lake, have taken an option on the Clevinger Prophet property, in Gowganda. Work is to be started soon.

It is understood that as part of the exploration program for the Tough Oakes diamond drilling will be carried on from underground.

A gang of men has started to work on the Lebel Lode property in Kirkland Lake, and a considerable amount of surface trenching will be done.

Cobalt—It is now definitely announced that the Government has refused the application of the Northern Ontario Light Railways for assistance. This project has been promoted with the idea of building light-gage railways, such as were used in France, to serve a number of the mining camps and outlying districts, which are now without transportation facilities. The proposal met the heartiest approval all through northern Ontario, and it was confidentially expected that the Ontario government would assist in guaranteeing the scheme to the extent of $3,500 a mile, which was all that was asked. It is understood, however, that the refusal of the government to give assistance will not prevent the promoters from going ahead with the work.

During the last two weeks a wave of exceptionally warm weather, with no rain, has given rise to a number of forest fires all through northern Ontario. Fortunately there was no wind, or there is no doubt that the worst disasters in the history of this section would have been repeated. Practically none of the mining companies were affected, except the Associated Gold Fields of Larder Lake, which lost several miles of its power line. During the last few days cooler weather and rains have lessened the danger of another serious conflagration.

Cobalt—Ore shipments over the T. & N. O. Ry. for May totaled 257 tons, Coniagas shipping 81, La Rose 42 and O'Brien 134 tons. Of this the Deloro S. & R. Co. received 134 tons, the Coniagas 79 and the A. S. & R. Co, at Perth Amboy, 44 tons.

Quebec

Asbestos Industry Slackens; Wages Cut and Most Operators Working Four Days Per Week

Thetford Mines—Industrial conditions in the asbestos district have been considerably depressed for several months. The period of intensive operation which was carried on for the last four years showed a marked relaxation during the early spring and at present not more than half of the former number of men are being employed. A small wage cut was effected and in addition most of the mines have curtailed operations to four days per week. Asbestos shipments are slow and further readjustments of production and prices will probably be required to bring back normal conditions. A number of the mining companies have discontinued operations for the present. Among these are the Johnsons Co., at Thetford Mines and Black Lake; Bennett-Martin Asbestos Co., at Thetford Mines and Coleraine; Black Lake Asbestos & Chrome Co., at Black Lake, and the Penningtons Asbestos Co., at Robertsonville. New plants that have joined the producers are the Harris Syndicate and the Paré-Thèbierge Syndicate, Coleraine, and the Maple Leaf Asbestos Co., Thetford Mines.

H. L. Parish, engineer for the Black Lake Asbestos & Chrome Co., has been appointed resident manager of the General Asbestos Co., East Broughton. Edward Ansen, of Montreal, has been named manager for the Black Lake Asbestos & Chrome Co. at Black Lake.

The Belanger Chrome Mines of the Black Lake-Caribou, which was closed down following the slump, has been reorganized with local capital and is again producing up to normal capacity.

CALIFORNIA

Pumps Pulled at Allison Ranch—Kennedy Mine Unwatered

San Francisco — Natomas No. 9 dredge, a 15-cu.ft. wooden-hull gold dredge operated by the Natomas Co. of California at Natoma, was sunk on June 16. The accident was caused by the wearing of a hole in the side of the hull. Natomas dredge No. 6 was shut down after about thirteen years' operation.

Jackson—The Kennedy mine has been practically unwatered, this work having been started Sept. 11. Considerable repair work must now be done.

A 7-cu.ft. wooden-hull gold dredge together with steam power plant has been purchased and assembled preparatory for shipment to the Placers de Oro de Bacubirito, Sinaloa, Mexican. The dredge was Oroville Ltd. No. 3 and was thoroughly conditioned by the Bethlehem Shipbuilding Corporation. The power plant consists of boilers, compound condensing engine and generator. Wood is the fuel to be used. The dredge will handle ground to a depth of 40 ft.

Grass Valley—The pumps have been pulled at the Allison Ranch and the mine allowed to flood.

Melones—The Carson Hill Gold Mining Co. treated over 15,000 tons of ore during May in its 30-stamp mill. This is at the rate of 18.5 tons per stamp per day, a record far in excess of customary Mother Lode practice. A large tonnage is being rapidly blocked out in the mine. Rapid progress is being made in sinking the Melones winze below the 3,500 level.

Carrville—A contract for a 1,200-ft. adit has been let by the Golden Jubilee mine on Coffee Creek.

NEVADA

Ore Shipments from Pioche Drop to Low Point

Pioche — Ore shipments from the Pioche district for the fortnight preceding July 7 were still negligible. The Bristol Silver Mines Co. continues the principal shipper, forwarding over 500 tons of $46 ore to the Midvale smelter.

The Nevada Silver Horn Mining Co., operating in the new Silverhorn district, has started to haul a carload of siliceous silver ore from development work into Pioche for testing purposes.

During June the new shaft of the Bristol Silver Mines was sunk 138 ft. The formation encountered was extremely hard, necessitating at times as many as thirty holes to the round.

Development work is progressing at the Prince Consolidated. The water pumped has decreased from 300 to 250 gal. per minute. Both crosscuts have now been advanced 10 ft. from the shaft, and the ground has been found well mineralized. Sinking will be continued until a large sump is provided, and the crosscuts will be pushed toward the ore bed and laterals run through the orebody in anticipation of early shipments to the Salt Lake smelters. Important geological data is being obtained from this work.

W. E. Brodie, a contractor, reports that the development tunnel on the Nevada Silver Klondike is now advanced 130 ft. from the portal, and is expected to run through the porphyry into the iron vein any day. Col. Maurice J. Fink, associated with Speath McKnight, has financed this company and John Carter Anderson is consulting engineer.

Leadville—The Leadville mine at Leadville, in northern Washoe County, owned and operated by A. A. Codd, of Reno, Nev., and associates, is being operated steadily. The mill recently built is successfully treating 35 tons of ore daily producing 6 to 7 tons of silver-lead concentrates which are hauled 40 miles to the Western Pacific. Two auto trucks of 3 and 4 tons respective capacity are operated six days a week, each truck making a round trip per day. It is estimated that the haul costs $10 per ton of concentrates. The ore is crushed to 80 mesh and 94 per cent of the lead and 91-92 per cent of the silver is said to be recovered.

COLORADO

Modoc Consolidated Elects Directors

Cripple Creek—Development work on the 1,650 level of the Granite mine has opened a new vein of payable ore for a distance of 100 ft.

The Hardwood property of the United Gold Mines Co. is responding favorably to development, and new electrical hoisting equipment has been installed.

The Modoc Consolidated Mines Co. is producing about 110 tons of ore daily, of an average value of about $15 a ton. At the recent stockholders' meeting the following directors were elected: E. D. Avery, president, Mark A. Skinner, Thomas F. Daily. A. H. Frankenberg, A. S. Rundall, and Chas. W. Higley.

MONTANA

Senator Clark and Con. Kelley Predict Better Times for Copper—Gem Mining Co. Reports

Butte—The Anaconda Copper Mining Co. is continuing its program of [illegible] work, both at its mines in the Butte district and at the Washoe Reduction Works, at Anaconda, where a large force of carpenters is engaged. The company will also start cleaning its long flume furnishing the smelting and concentrating plants with water. Senator W. A. Clark, in a published interview in his newspaper, the *Butte Miner*, expressed the opinion that within six months there would be had a fair return to normal in the copper-mining industry. President Con F. Kelley of the Anaconda company, though conservative as to predictions in connection with the copper metal situation, expressed the opinion that the coming months would see an improvement and a continuance of constructive forces working in behalf of a betterment in the metal trade.

The North Butte Mining Co. has from 5 to 6 ft. of ore on the 3,400 level of the Edith May vein, carrying a copper content of about 9 per cent, and the showing is improving in the face of the drift on the 3,600, encouraging the belief that the body of ore in evidence on the upper level will be picked up in the lower workings. Crosscutting north from the Granite shaft for the Jessie, the North and South Berlin veins and for the North and South Croesus veins is planned as the next development program of consequence. Raising in the Speculator shaft from the 3,200 level to the 3,000 will be undertaken soon.

Butte & Superior is pushing its workings on the 2,200 level of the Black Rock mine to reach the copper vein disclosed on the 2,050 level.

East Butte Mining Co. reports an increased tonnage put into reserve as the principal feature of development work thus far this year. The East Butte smelter continues to work practically at capacity on its own and custom ore.

Elkhorn—Boston & Montana is increasing its labor forces with the idea of rushing the installation of its milling equipment, which now is arriving in quantity.

Granite County—The Gem Mining Co., operating in the Granite County district, produced during the year ended May 31 sapphires valued at $132,2[illegible]. The total production of sapphires was [illegible] ozs. These figures were made known when the company filed its report on net proceeds for the year. The deductions allowed under the law amount to $88,408.66, making the net proceeds of the company for the year $43,823.90. The tax collected under the law amounts to 1½ per cent of the net proceeds. The deductions allowed are for the cost of extracting and marketing the gems. The report came as a surprise to those who closely follow the mining market, as it was not known that the Gem company was producing and disposing of sapphires of anything approximating the value stated in the report.

MICHIGAN

The Copper Country

Copper Range Group Gets Coal at Low Freight Rate—Quincy Cuts Wages—Seneca Continues Development

Houghton—Copper Range costs should show a considerable reduction. Wages are down to a pre-war level, and the company is now operating with a new supply of coal which cost approximately half the price of coal shipped in last summer. Coal is still 100 per cent higher than in the pre-war normal years, but the saving effected will be large nevertheless. Copper Range was fortunate in being able to take advantage of the reduced lake freight rate on [illegible] per ton less before the former rate was ordered restored July 6 by the Interstate Commerce Commission. Before the higher rate went back into effect Copper Range had a little better than half of its year's supply ordered.

There was a slight gain in refined copper production by Baltic and Trimountain of the Copper Range group of mines in June, and Champion showed a slight loss. Champion failed to hold its men as well as the other two mines last month, finishing the month with a small net loss in man power. The fact that the drifts and stopes in Baltic and Trimountain gave a somewhat better yield in June also contributed to the gain at those properties. Copper Range has been taking on a few men of late from the iron mines, a number of experienced miners thrown out of work by the closing of some of the iron properties drifting to this district in search of employment. Copper Range, however, does not expect to increase its force much until fall, when many of its former employees who left the mines to take up farming for the summer will be back. In spite of this there are many idle men in the district. The three mines are producing, on their curtailed basis, about 2,500,000 lb. of copper per month.

Sinking is under way in Champion No. 1 shaft, in Trimountain Nos. 2 and 4, and in Baltic No. 2. Sinking in No. 3 Baltic is about to start. Drifting is in progress in all shafts. Copper Range is [illegible] ahead. No construction work of any extensive character is under way, and no changes are being made in the milling plants.

Beginning July 1, the Quincy Mining Co. adjusted wages about 6 per cent downward, making miners' wages $[illegible] per day and trammers' $[illegible]. The new scale is about equal to that paid by Copper Range and the other operating mines of the district. There is no change in operating conditions at Quincy. The mine is working four and a half days per week with a minimum force. Production is understood to be about [illegible] lb. per month.

A total of [illegible] lb. of copper was shipped out of the Lake Superior district by boat in June. It is estimated that [illegible] lb. more in the form of ingots, bars and wire went out by rail. Production for the month, including Copper Range, Mohawk, Wolverine, Quincy, and the Calumet & Hecla refinery output, was 5,500,000 lb.

Although metal sales fell off sharply the last ten days of June, the shipment figures indicate fairly good sales for the month as a whole. Of the water shipments, Calumet & Hecla sent 1,500,000 lb. to Germany and Copper Range, 700,000. The remainder was for domestic consumers. The shipments by boat showed a considerable increase over those of May and those of June a year ago. In May the total was [illegible] lb. and in June of last year, 5,190,000.

The Seneca management reports "fair to good" ground in all openings. Drifting is proceeding in all levels, and in the 6th or bottom level the drift going northward continues to penetrate territory of an encouraging character. June figures are not yet available, but Seneca in May produced, during the course of development work, 37,566 lb. of copper, stamping a total of 1,787 tons of rock. The yield was 21.03 lb. to the ton. This does not indicate close selection. Rather the rock was sent to the mill just as it was taken out, no stockpile being accumulated. No attempt at production is being made. The principal efforts of the management are centered in opening work, and occasional shipments are sent to the mill. The rock is still being shipped to the Baltic mill. The two heads acquired by Seneca in the Centennial-Allouez milling plant will not, of course, be used until that mill is reopened, which will not be until Centennial and Allouez are again producing. By that time, it is expected, Seneca will have its new hoists installed at both the Seneca and Gratiot shafts. There will be no resumption of sinking until these new drums are in position.

Surface water in the Osceola amygdaloid branch of the Calumet & Hecla is now being handled by an electric pump recently installed on the first level of No. 16 shaft. The flow of water is not heavy, but it has been flowing over into the conglomerate workings and must be pumped. Calumet & Hecla is rapidly replacing all steam pumps with electric pumps, and a big saving will be the result.

Gogebic Range

Newport Company's Shafthouse Burned—Tilden and Ashland Mines Alone Working Full Time

Ironwood—The Woodbury shafthouse of the Newport mine was struck by lightning the night of July 1 and the [illegible] set on fire [illegible]. The shafthouse, the largest in the district, is built of steel and from the collar to a point above the stockpile landing was enclosed with [illegible] on a wooden frame. It was the frame that burned. There was also a [illegible] used for a [illegible] for [illegible] locomotives and a drill [illegible] to the shaft, and these were completely destroyed. Trouble was experienced in getting water, otherwise the damage might have been small. The lightning storm was very severe, lasting twelve hours and causing several other fires and damage to electrical transmission lines.

Owing to the shortage of power since the burning out of their big generating unit at Ashland the local power company has been unable to supply the Puritan mine with power for its air compressor during the day and the mine has been working nights instead. The Oliver Iron Mining Co. is furnishing current to the power company from the Pabst mine power house where there are two 4,000-kw. generators.

The Tilden and Ashland mines are the only ones in the district working full time. The former has a high minimum royalty to pay, and is hoisting about 17,000 tons per month. The Ashland is shipping at the rate of 10,000 tons a month.

MINNESOTA

Mesabi Range

Ore Loading at Hill-Annex Pit Resumed

Marble—The Interstate Iron Co. has resumed loading ore at its Hill-Annex open pit. This is to be done on day shift only.

Virginia—The dewatering of the Lincoln shaft, operated by the Interstate Iron Co. is progressing satisfactorily. The water in the shaft has been lowered to within 12 ft. of the bottom level. The pumps are handling about 19,000 gal. per minute, which reduces the water about 6 in. per twenty-four hours.

Hibbing—The Rogers Brown Iron Mining Co. has stopped sinking its new shaft, which work was in preparation for new underground development.

Cuyuna Range

Armour No. 2 and Hillcrest Only Shippers in June—Pumps Pulled at Cuyuna-Mille Lacs

Ironton—The Armour No. 2 mine (Inland Steel Co.) and the Hillcrest mine (Coates & Tweed) were the only two Cuyuna Range properties that shipped ore in June. The former is working one shift with reduced force and shipping from pockets about 350 tons per day; the latter, an open pit mine, is shipping an average of 1,000 tons per day of iron ore and manganiferous iron ore. The Hillcrest will ship 100,000 tons for the season. No other properties are producing ore.

Pumps have been pulled at the Cuyuna-Mille Lacs mine, a manganiferous iron ore property formerly operated by the Cuyuna-Mille Lacs Iron Co., a subsidiary of the American Manganese Manufacturing Co. The mine has been idle since spring, 1919, but pumping was continued in anticipation of an upward trend in manganese ore market. Mine pumps handled 1,600 gallons per minute, making heavy pumping cost. The mine was recently examined by O. W. Wheelwright William Kelly and G. A. Jahn representing Eastern steel interests.

The Pennington mine has recently shipped one of its steam shovels to the Mesabi Range for Todd-Stambaugh Co. The Pennington has done no mining so far this season.

Riverton—John A. Savage & Co. is erecting a modern engine-repair shops of concrete and steel at its Sagamore mine. This company has waived shipments on a 100,000-ton contract this season, but is continuing to strip further ore reserves with hydraulic equipment. In the course of this stripping fifteen complete skeletons of buffalo buried at a depth of 8 to 12 ft. have been found in the muskeg overburden.

Crosby—Changes in the personnel of the Rogers-Brown Ore company have recently been announced. C. A. Stillman, formerly president of the company, goes to the Goodyear Tire & Rubber Co., Akron, as secretary; while H. J. Schlesinger, of the Steel & Tube Co. of America, will succeed Mr. Stillman. A. D. Chisholm, superintendent of the Newport mine at Ironwood, Mich., has been elected a vice-president of the Rogers Brown Ore Co., and will have general supervision over the Cuyuna Range operations. The Steel & Tube Co. owns 51 per cent of the stock of the Rogers Brown Ore Co., which operates two mines here, the Meacham and the Kennedy. The Meacham is carrying on only development work this season. The Kennedy continues to operate four shifts per week, has 90 000 tons of ore in stockpile but has made no shipments.

Trommald—The Marquette Ore Co., operators of the Maroco mine, report the sale of a large tonnage of Maroco ore. Orders have been received for pushing the work at the mine to the utmost and the property is expected to ship to capacity during the last three months of the season. The pit approach, started with hydraulic and sand sucker, is being completed to grade by a steam shovel, which will then make a clean-up of overburden averaging 10 ft. deep. Operators will materially increase labor forces Aug. 1, at which time they expect to be ready to dig ore. Stripping is being continued by hydraulic method eastward from the present pit, cutting ground formerly occupied by the main line of the Northern Pacific. A large portion of this orebody is of wash ore type, but it is planned to make this year's shipments, so far as possible, from direct shipping ore, leaving the initial run of ore through the washing plant until the 1922 season.

Riverton — The Sagamore mine is stripping by hydraulic methods an average of 50,000 cu.yd. per month. Ore uncovered during the last three months on the north bank of the pit is now being checked by Keystone churn drilling for next season's operations. Stripping is being continued along the south bank. Ore pit is being kept drained by a Glendora triple-plunger type pump, motor-driven, handling 900 gal. per minute from the drainage shaft.

A call for 200,000 tons of Kennedy mine ore is reported during the last week. This order comes at a time when closing of the mine was being seriously considered. The Kennedy, operated by Rogers-Brown Ore Co., has been working four days a week with alternating crews during the present season, and now has approximately 100,000 tons of ore in stock.

NORTH CAROLINA

Operations Resumed at Alred Gold Mine—Working at Ormond Property

Randolph County—The Alred mine is again being operated after having been down some time for alterations in the mill. Twenty of the thirty stamps are dropping one shift. Pulp from ten stamps is passed over amalgamation plates and then blanketed. That from the other ten stamps is passed over plates followed by a Plat-o table lately installed and giving satisfactory result, with a fairly high-grade concentrate. Two more Plat-o tables are to be installed. The orebody is 50 ft. wide here and is being developed by an open cut which supplies the mill. The ore is mineralized schist and in depth will be pyritic. The present oxidized ore exhibits numerous cubes of limonite, altered from pyrite. These contain gold and the centers are partly unaltered pyrite that furnish the concentrate. Another narrower orebody parallel to the large one has also been developed, which contains more free gold.

Montgomery County—D. C. Stainbach is doing some work at the Ormond property. The prospect is not a typical southern one, and its development is being watched with interest. The country rock is either rhyolite or metamorphosed sandstone, containing some gold, but the real ore is a high-grade soft streak lying along a well defined fissure.

WEST VIRGINIA

Bluefield—R. B. Miller, of Bluefield, states that in examining a manganese property some months ago on the Southern R.R. between Lynchburg, Va., and Durham, N. C., he discovered cobalt and nickel ore. Erythrite was found in the outcrop. Six feet from surface samples were taken running 48 per cent cobalt oxide with traces of iron. Two other samples showed 34 per cent Co and 18 per cent Ni also 16 per cent Ni and 28 per cent Co.

WISCONSIN

Platteville—The 200-ton mill moved from the Climax by Kistler & Stephens is being assembled on the Goke lease which has been proved by drill and shaft. It is a quarter-mile east of the company's Blockhouse mine.

WYOMING

Centennial—The Colowyo Gold Mining Co., of Centennial, Wyo., has applied to the Federal Power Commission for a preliminary permit to construct a power house on the Middle Fork of the Laramie River in Albany County, Wyo., to develop 100 hp. to be used for mining purposes.

THE MARKET REPORT

Daily Prices of Metals

July	Copper N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
7	12.375–12.50	28.00	[illegible]	[illegible]	[illegible]	[illegible]
8	12.375–12.50	28.00	[illegible]	[illegible]	[illegible]	[illegible]
9	12.375–12.50	27.50	[illegible]	[illegible]	[illegible] 4.35	[illegible]
11	12.375–12.50	27.50	28.25	[illegible]	[illegible]	4.30
12	12.375–12.50	27.375	28.25	[illegible]	[illegible]	4.30
13	12.375–12.50	27.375	[illegible]	[illegible]	[illegible]	4.25@4.30

*These prices correspond to the following quotations for copper "delivered": [illegible] for the week.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

July	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9									
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	72	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

July	Sterling Exchange	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	July	Sterling Exchange	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Metal Markets

New York, July 13, 1921

Lead, zinc, and copper, in the order named, have been in better demand during the last week, and producers have a somewhat more optimistic feeling. It is generally believed, however, that any general revival of business is a long time in the future, and that no large demand for metals is likely during the next few months. Transatlantic freight rates are now $11 to England, [illegible] to Germany, and [illegible] to France. [illegible] rates to Hongkong and Kobe, [illegible]

Copper

A few domestic inquiries were in evidence on Thursday and Friday, but no business of importance developed. The large buyers continue to show no interest in the market except to assure themselves that no sudden advance [illegible]. For July and August [illegible] delivered, could be done in almost any quarter, and some of the more anxious sellers among the small producers [illegible] small orders at 12.625c. for prompt delivery. [illegible] for the last quarter, and although most producers will not commit [illegible] later than September, [illegible] copper available for any [illegible] in the year for not more than 13c.

The Copper Export Association has done a fair business with Japan and Germany. Outside interests in the export market have quoted prices as low as 13.375@13.50c. f.a.s. New York, to compete with the association on European business. English dealers are also offering sharp competition. On Monday, the largest cable manufacturer in England bought in that country for £77, equivalent to 12.45c. c.i.f. at the then current rate of exchange. The increased premium on the American dollar has, of course, aided English dealers in business of this kind.

Lead

The official contract price of the American Smelting & Refining Co. continues at 4.40c.

Demand for lead has been very satisfactory indeed during the last week and almost all producers have made sales. Sellers seemed willing to supply all consumers without advancing their price levels to any extent. We have been unable to verify reports of lead sold on a higher basis than 4.50c., New York, and at least one producer quoted at this figure or less on every inquiry received. There is some disposition to quote slight premiums on forward business, but practically the entire demand is for July or August at the latest. Most of the business has been in the East, storage battery, cable, and cartridge manufacturers being the best customers. The demand for cartridges for [illegible] this summer. Lead continues to be in the strongest position of all of the metals, and demand is exceedingly satisfactory in the face of the general industrial depression.

Zinc

Although some of the larger producers have withdrawn from the market, sales were heavier than for many weeks. Supplies of zinc were plentiful [illegible] at the lowest ebb known, according to some operators, who also characterize the present situation as being due [illegible] year and [illegible]

[illegible]

Tin

Demand continues almost non-existent, with decreasing prices owing to the drop in sterling exchange. As in other metals, the price has little to do with sales, consumers being willing to take chances on getting their raw materials at a reasonable figure when the market for manufactured products opens up. There was quite a flurry in tin on Monday, but it was confined almost entirely to irresponsible trading interests. Futures continue to be quoted at the same prices which obtain for spot.

Arrivals of tin, in long tons: July 2, Singapore, 15; 5th, Rotterdam, 75; Liverpool, 25; 6th, London, 25; 7th, London, 75.

Gold

Gold in London: July 7th, 110s. 9d.; 8th, 110s. 10d.; 11th, 112s. 10d.; 12th, 113s. 4d.; 13th, 112s. 9d. The flood of gold to the United States continues unabated.

Foreign Exchange

Saturday and Monday, sterling experienced a severe decline, and the tendency in all of the important exchanges is decidedly uncertain. Variations in values are likely to be quick and wide. On Tuesday, July 12, francs were 7.86c.; lire, 4.61c.; and marks, 1.3575c. New York funds in Montreal, 14⅜ per cent premium.

Silver

During the last week the London market has fluctuated widely, with a low of 36¼d. on July 7, and a high of 37⅜d. on July 13. Buying by the Indian bazaars and China has caused the advances in price, and sales of Continental silver caused the reactions. The New York market also has been erratic, due to the changes in the London quotation and the weakness of sterling exchange. On the strength of China buying, local rates, however, have ruled somewhat higher than the London parity.

Mexican Dollars, July 7th, 45⅝; 8th, 46⅛; 9th, 46⅞; 11th, 45⅜; 12th, 45⅝; 13th, 46⅛.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 28@28.5c. are nominal. Outside market, 21@23c. per lb.; 22½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 4¾c.; market dull. W.C.C. brand, 5¾@5⅞c. per lb. Cookson's "C" grade, spot, 9@9½c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500-lb. lots.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb; black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $165@$185 per oz.

[1]Molybdenum Metal—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$60@$65 per oz.

Platinum—$72@$75 per oz.

Quicksilver—Nominally, $45@$47 per 75-lb. flask. San Francisco wires $47.

[1]Rhodium—$150 per troy oz.

[1]Selenium—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]Thallium Metal—Ingot, 99 per cent pure, $20 per lb.

[1]Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal. Market very dull.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55. Prices have been reduced $1 per ton for the 1921 season.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore — 25c. per unit, seaport; chemical ore (MnO_2) $55@$60 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]Titanium Ores—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports. Nominal.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]Zircon—Washed, iron free, 3c. per lb.

[1]Zirkite—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., July 9—Zinc blende, per ton, high, $24.40; basis 60 per cent zinc, premium, $22; Prime Western, $21; fines, $20; slimes, no sale; average settling price, all grades of zinc, $22.50.

Lead, high, $52.70; basis 80 per cent lead, $45; average settling price, all grades of lead, $42.96 per ton.

Shipments for the week: Blende, 3,874; lead, 667 tons. Value, all ores the week, $113,680.

Two smelters that have been out of the market again bought ore this week, but sellers still withheld ore from the market, and the purchase aggregated only 2,720 tons. Production continues above 5,000 tons per week, and with this week's shipment only 3,874 tons, an increasing tonnage of reserve stock is indicated.

Platteville, Wis., July 9—No market for zinc or lead ores. Shipments for the week, none. Shipments for the year: Blende, 11,461; lead, 978 tons. Shipped during the week to separating plants, 160 tons.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,700@$2,000; No. 2, $1,200@$1,500; spinning fibers, $400@$800; magnesia and compressed sheet fibres, $275@$400; shingle stock, $95@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga. Prices largely nominal.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $7@$9; washed, $9@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $20@$25, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

---

[1] Furnished by Foote Mineral Co., Philadelphia Pa

Feldspar—Crude, $7@$8 per gross ton, f.o.b. Maryland and North Carolina points; $7.50@$8.50, f.o.b. Maine; ground, $27@$30, car lots, f.o.b. Baltimore; ground, $17@$21, f.o.b. North Carolina points; $17@$21 per ton, No. 1 ground, f.o.b. New York State; $21@$23 per ton, ground, f.o.b. Maine. No. 1 Canadian, $26@$28, f.o.b. cars. Market quiet; prices largely nominal.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $18 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $13.50, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7@8c. per lb.; chip, 5½@6c.; dust, 3@4½c. No. 1 flake, 6½@7c.; amorphous crude, ¾@2½c. Market quiet.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.; No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports. 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $6.75; 68 per cent, $6.25; 68@66 per cent, $6.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12@14c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $8@$12 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic — White arsenic, 6½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $16@$18 per ton, f.o.b. Western mines, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.50@$1.75 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 14c. per lb. of chromium contained; 4 to 6 per cent carbon, 15c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $75@$80, f.o.b. furnace; resale, $90, delivered; English, $75@$80, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $28@$32, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works. Imported material, [illegible]

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $40@$42; [illegible]

Ferrotungsten—Domestic, 70 to 80 per cent W., [illegible] per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U., $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—[illegible] per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 21¾c. per lb.; wire, 15@15½c.

Lead Sheets—Full lead sheets, 8.25c.; cut lead sheets, 8½c. in quantity, mill lots.

Nickel Silver — 31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets 16¾c.; sheathing, 16½c.; rods, ⅜ to 3 in., 13¾c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $60@$65 per net ton, shipping point; arches, keys, wedges, $66; splits, soaps, $84.

Fire Brick—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $70@$75 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, July 12, 1921

Another downward revision in steel prices has occurred in the last few days, with the general announcement of a new schedule. In most commodities the reduced prices had already been quoted, though not by all producers, and particularly not by the Steel Corporation. In plates the new asking price of 2c. is higher than the price in many if not most sales in the open market for two or three weeks. In standard steel pipe, on the other hand, the price as now reduced had been altogether exceptional, if made at all, and in nails the shading had hardly been equal to the reduction now made.

The reductions are $4 a ton in bars, shapes, plates, billets, slabs and sheet bars from the so-called "April prices" and $5 a ton in sheets and wire products from quotations as reduced some weeks ago by $5 a ton from the April prices, so that these commodities record a $10 reduction. The new prices on finished steel products average about [illegible] a net ton below the Industrial Board prices and about [illegible] below the war-control prices, though they are about [illegible] above the average prices in 1913.

Pig iron—Bessemer is quotable at [illegible], Valley, or $1 decline, basic and foundry remaining at [illegible] and [illegible] respectively, with demand extremely light.

Coke

Connellsville—Furnace, [illegible]; foundry, [illegible].

---

[1] Foote Mineral Co., Philadelphia, Pa.

Germany's Important Support to the Copper Market

Export Trade Is the Chief Factor in the Prosperity of Copper Producers—Germany in Pre-War Role of Heaviest Foreign Copper Purchaser—Production Now Practically at Its Ebb

EDITORIAL MARKET STUDY

QUIETNESS AND ACTIVITY in the copper market are co-existent. Domestic business is nothing to shout about, and were it not for the fact that export demand has borne up surprisingly well, the American copper producer would indeed find small satisfaction in the behavior of copper during the first half of 1921. Export trade has been the bright spot in the copper market, and it has been so nourished and stimulated by low quotations, credits, and financial aids that the copper movement to Europe has assumed, at times, favorable proportions. Occasionally the volume of copper exports has been so heavy that a producer could neglect the domestic market, his share of copper exports under the provision of the Copper Export Association plans being sufficient to make up for the deficiency in domestic business.

The table of copper movements shown below indicates that monthly copper exports for the first five months of 1921 were from 55 to 92 per cent of the pre-war rate. The three most important purchasing countries were England, France, and Germany. Exports to each of these nations are given monthly, and bring out the highly significant fact that Germany has lately been the chief support to copper export trade. This statement is all the more remarkable when it is recalled that Germany pays cash for copper purchased in the United States, whereas France, England, and other countries have been and are able to take advantage of the liberal credit terms advanced by the Copper Export Association.

The omission of Germany from the list of those countries with which credit arrangements can be consummated has not had much effect on the ability of Germany to purchase all the copper she wishes. It may be, now peace has been officially declared, that negotiations will be entered into, looking to the extension of credit to Germany as to other countries. Whether such a step would increase sales to Central Europe is problematical. At the same time that Germany is purchasing copper from United States producers, she is also supporting the London copper market. The source of the credit for all these purchases is not definitely known, and the extraordinary ability of a nation defeated in war, burdened with an enormous indemnity, yet ready to pay cash for its raw-material purchases, is testimony to the fact that she still has friends willing to aid her financially.

The copper furnished Germany will not enter a war chest, as was the charge prior to the war, but will undoubtedly be cheaply manufactured into electrical machinery to be exported to all parts of the world. Copper, cotton, wool, and other raw commodities are urgently required by Germany to furnish the basis of her exportable manufactures, which in turn are her hope of discharging the reparation obligations.

The market outlook in the United States, although by no means rosy, no longer has the bleak appearance of the latter part of 1920. Those two most important steps, the financing of 100,000,000 lb. of surplus copper, and the sharp curtailment of production, have placed producers in a position from which they can view the future with confidence. Regardless of how small present world's consumption may be, United States production has fallen to a level smaller than monthly exports. The relation of present smelter production to pre-war, war, and post-war production is shown in the following table:

SMELTER PRODUCTION OF UNITED STATES COPPER

Year	Average Monthly Output in Pounds
1910 1913	96,700,000
1916 (Peak)	162,000,000
1919	100,800,000
1920	114,300,000
Jan., 1921	90,600,000
Feb., 1921	86,600,000
March, 1921	91,000,000
April, 1921	47,000,000
May, 1921	25,300,000

Since March, smelter production has declined rapidly, and for May it is about one-quarter of the pre-war rate of production. Copper output is now about as low as it will get, unless the industry receives further blows. The most important companies producing copper at present can be counted on one's fingers—Miami, Kennecott, American Smelting & Refining Co. (custom business), Copper Range, Quincy, Tennessee Copper, New Cornelia, and East Butte. Of course some American copper companies operating in foreign countries have not shut down, i.e. Cerro de Pasco, Chile, and Granby, and their production swells copper imports into the United States. Even with the addition of such importations, export trade alone, should it continue at the rate indicated in the first five months of the year, will be more than sufficient to take care of domestic production plus imports.

An echo of the serious condition of the copper industry of the United States is reflected in reports reaching this country of conditions in Australia, a great metal-producing continent, where copper production has been drastically cut and where the cost of copper production is prohibitive of further operation. The gravity of the Australian situation is, in large measure, due to difficulties with labor and the unwillingness of labor to accept a reduction in wages. Mount Morgan and Mount Lyell, two of the largest base-metal-smelting concerns, have announced their inability to continue operating under present conditions. Other properties have already closed down or are on the verge of doing so.

Comments from the London press frequently allude to the activity of the Copper Export Association and have intimated that the organization is threatened with disruption. If such a fate really hangs over that body, it is news to the American copper industry, as the association has been functioning entirely satisfactorily and is, from all reports, in a splendid financial condition.

Recovery in the copper market, long awaited by producers, is not expected during the summer and depends upon so many factors closely linked with general industrial prosperity that it is idle to hazard any guess as to when resumption of operations will occur.

COPPER MOVEMENTS TO AND FROM THE UNITED STATES

In Pounds

	Average Monthly 1913	Average Monthly 1920	Jan., 1921	Feb., 1921	March, 1921	April, 1921	May, 1921
EXPORTS							
United Kingdom	[illegible]	8,290,000	8,668,000	18,970,100	7,407,000	[illegible]	6,765,000
France	[illegible]	9,874,000	15,012,000	10,243,000	2,926,000	[illegible]	4,455,000
Germany	[illegible]	7,432,000	18,802,000	20,725,000	19,021,000	[illegible]	7,074,000
Total (all countries)	[illegible]	[illegible]	54,855,399	62,480,000	38,720,000	[illegible]	35,378,000
IMPORTS							
Total (all countries)	28,350,000	30,770,000	31,136,000	30,056,000	12,808,000	29,569,000	12,689,000

COMPANY REPORTS

Braden Copper Income $756,764

A report of operations of the Braden Copper Mines Co. for 1920 states that [illegible] tons of copper was produced, compared with 21,020 in 1919. Income account follows:

Operating income:		
[illegible]		[illegible]
[illegible]		[illegible]
		[illegible] 07
Operating cost:		
Plant cost	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
Ocean freight	[illegible]	
Insurance	[illegible]	
Refining	[illegible]	
Delivery and selling expenses	[illegible]	[illegible]
Operating profit		[illegible]
Other income:		
[illegible]	[illegible]	
Miscellaneous income	[illegible]	[illegible]
Total income		[illegible]
Charges against income:		
Taxes and interest		[illegible] 740 44
Balance of income carried to surplus		[illegible]
Surplus account:		
Net surplus, Dec. 31, 1919, as adjusted		[illegible]
Income for year, as above		[illegible]
		[illegible] 414 25
Charges against surplus:		
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
Amortization of discount on bonds	128,461 56	
	$3,087,079 18	
Less: [illegible]	[illegible]	[illegible] 48
Balance Dec. 31, 1920		[illegible]
[illegible]		[illegible]
[illegible] surplus, Dec. 31, 1920		[illegible] 43

The company is a subsidiary of Kennecott Copper Corporation. Capitalization, $12,953,530; bonds issued, fifteen year, 6 per cent sinking-fund gold bonds, $15,000,000.

Chile Copper's Deficit Increases

A statement of operations of the Chile Exploration Co. for the first quarter of the year 1921 states that 581,644 tons of ore was treated, averaging [illegible] per cent copper. In the preceding quarter, 1,066,[illegible] tons, averaging [illegible] per cent copper, was treated. [illegible]

The financial statement of the Chile Copper Co. and Chile Exploration Co. combined (earnings being based on copper actually delivered), as compared with the preceding quarter, is as follows:

	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Of the apparent loss of $1,[illegible] [illegible]

Lucky Tiger-Combination Gold Mining Co.

Gold, Silver, Sonora, Mexico

A report of operations of the Lucky Tiger-Combination Gold Mining Co. for 1920 states that 6,746 tons of concentrate, assaying [illegible] oz. gold, [illegible] oz. silver, [illegible] per cent copper and 14.05 per cent lead, was produced in the period covered by the report, yielding a revenue of $3,405,489.96. Operating statement follows:

[illegible]	[illegible]
Total costs and losses [illegible]	[illegible]
Leaving an operating profit of	[illegible]
Deducting provisions [illegible] depreciation and depletion, amounting to	743,276 90
Leaves a net profit of	[illegible]

The above costs were distributed as follows:

[illegible]	[illegible]
Mining	341,267 69
Milling	[illegible]
General	[illegible]
Marketing	[illegible]
[illegible] tax	[illegible]
	[illegible]
[illegible]	[illegible]
Total costs and losses	[illegible]

Dividends paid during the year totaled $1,323,373.45, or $1.85 per share. Capitalization, $7,153,370.

Le Roi No. 2, Ltd., Losses, £12,181

Copper; British Columbia

A report of operations of Le Roi No. 2, Ltd., (British) for the fifteen months ending Dec. 31, 1920, states that 16,422 tons of ore was shipped, valued at $271,743, or $16.55 per ton, and composed as follows: 0.6203 oz. gold, 0.712 oz. silver, 17.5627 lb. copper. Smelting charges were $7.4367 per ton. Profit and loss account follows:

[illegible]				£	s.	d.
[illegible]				[illegible]	[illegible]	[illegible]
[illegible]						
[illegible]				[illegible]	[illegible]	[illegible]
Interest				100	12	4
[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]				[illegible]	[illegible]	[illegible]
Audit fees, London				10	7	6
Total				[illegible]	[illegible]	[illegible]
				£	s.	d.
[illegible]						
[illegible]				[illegible]	[illegible]	[illegible]
[illegible]				[illegible]	[illegible]	[illegible]
[illegible]				[illegible]	[illegible]	[illegible]
[illegible]				12,181	[illegible]	[illegible]
Total				[illegible]	[illegible]	[illegible]

Profit and loss account balance, Sept. 30, 1919, was [illegible] [illegible] and fully paid.

Buena Tierra Mining Co., Ltd.

A report of operations of the Buena Tierra Mining Co., Ltd., for 1920 [illegible]

MINING STOCKS

Week Ended July 9, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Ahmeek	Boston	50	47½	50	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*42	*38	*40		
Allouez	Boston	....	....	20	Mar. '19	1.00
Anaconda	New York	39	37½	38⅞	Nov. '20, Q	1.00
Arcadian Consol	Boston	2 1/16	2 1/16	2 1/16		
Ariz. Com'l	Boston	8¼	8	8¼	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*20	*13	*19		
Bingham Mines	Boston	9	9	9	Sept. '19, Q	.25
Calumet & Arizona	Boston	49	46	46	June '21, Q	.50
Calumet & Hecla	Boston	227	222	225	June '20, Q	5.00
Canada Copper	N. Y. Curb	*31	*25	*26		
Centennial	Boston	8½	7⅞	8½	Dec. '18, SA	1.00
Cerro de Pasco	New York	27	25½	26	Mar. '21, Q	.50
Chile Copper	New York	10⅞	10⅜	10⅝		
Chino	New York	24¾	22¼	24	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	....	....	*26		
Con. Arizona	N. Y. Curb	*3	*3	*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1⅜	1⅛	1 3/16		
Copper Range	Boston	33½	32	33	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*35	*32	*35		
Davis-Daly	Boston	6	5¾	6	Mar. '20, Q	.25
East Butte	Boston	8	7¾	8	Dec. '19, A	.50
First National	Boston Curb	*52	*52	*52	Feb. '19, SA	.15
Franklin	Boston	2¼	1⅞	1⅞		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol	New York	....	....	20	May '19, Q	1.25
Greene-Cananea	New York	21¾	20½	21⅝	Nov. '20, Q	.50
Hancock	Boston	....	....	3⅛		
Howe Sound	N. Y. Curb	2¼	2	2¼	Jan. '21, Q	.05
Inspiration Consol.	New York	34	32¾	34	Oct. '20, Q	1.00
Iron Cap	Boston Curb	....	....	5	Sept. '20, K	.25
Isle Royale	Boston	20½	19	20½	Sept. '19, SA	.50
Kennecott	New York	20½	18⅞	20	Dec. '20, Q	.50
Keweenaw	Boston	....	....	1¼		
Lake Copper	Boston	....	....	2⅜		
La Salle	Boston	1½	1½	1½		
Magma Chief	N. Y. Curb	....	....	*21		
Magma Copper	N. Y. Curb	18¼	18	18¼	Jan. '19, Q	.50
Majestic	Boston Curb	9	9	9		
Mason Valley	Boston	1½	1½	1½		
Mass Consolidated	Boston	1⅝	1⅜	1⅜	Nov. '17, Q	1.00
Mayflower-Old Col.	Boston	4	3⅞	3⅞		
Miami Copper	New York	22¼	21	21½	May '21, Q	.50
Michigan	Boston	....	....	2		
Mohawk	Boston	49	47½	48¾	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	5⅝	5½	5½		
Nevada Consol.	New York	11⅛	11	11	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	14½	14½	14½	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5		
North Butte	Boston	9¾	9	9½	Oct. '18, Q	.25
North Lake	Boston	....	....			
Ohio Copper	N. Y. Curb	8	6			
Old Dominion	Boston	25	21½	23⅞	Dec. '18, Q	1.00
Osceola	Boston	27	26½	26½	June '20, Q	.50
Phelps Dodge	Open Mar.	†150	†145	...	July '21, Q	1.00
Quincy	Boston	37	37	37	Mar. '20, Q	1.00
Ray Consolidated	New York	13⅝	12½	12¾	Dec. '20, Q	.25
Ray Hercules	Boston Curb	....	....	*24		
St. Mary's Min. Ld.	Boston	33½	33½	33½	June '20, K	2.00
Seneca Copper	Boston	....	....	14		
Shannon	Boston	....	....	*80	Nov. '17, Q	.25
Shattuck Arizona	New York	6¼	6¼	6½	Jan. '20, Q	.25
South Lake	Boston	....	....	1		
Superior Copper	Boston	3¼	3⅛	3¼	Apr. '17,	1.00
Superior & Boston	Boston	1⅝	1⅛	1⅛		
Tenn. C. & C. cfs.	New York	8	7⅞	7⅞	May '18, I	1.00
Toulumne	Boston	*60	*55	*55	May '13,	.10
United Verde Ex.	Boston Curb	25	24	24½	May '21, Q	.25
Utah Consol	Boston	4	3⅞	3⅞	Sept. '18,	.25
Utah Copper	New York	51½	48¾	50	June '21, Q	.50
Utah Metal & T.	Boston	1½	1⅛	1½	Dec. '17,	.30
Victoria	Boston	....	..	1⅜		
Winona	Boston	*50	*50	*50		
Wolverine	Boston	10	8½	10		
		NICKEL-COPPER				
Internat. Nickel	New York	14⅝	13⅞	13⅞	Mar. '19,	.50
Internat. Nickel, pf.	New York	....	....	82½	May '21, Q	1.50
		LEAD				
National Lead	New York	76	74⅞	76	June '21, Q	1.50
National Lead, pfd.	New York	..		100	June '21, Q	1.75
St. Joseph Lead	New York	.		12	June '21, Q	.25
		QUICKSILVER				
New Idria	Boston	†*50	....	*50		
		ZINC				
Am. Z. L. & S.	New York	8⅞	8¼	8⅞	May '20,	1.00
Am. Z. L. & S. pfd.	New York	..		24	Nov. '20, Q	1.50
Butte C. & Z.	New York	4⅝	4⅝	4⅝	June '18,	.50
Butte & Superior	New York	14⅝	12⅞	13	Sept. '20,	1.25
Callahan Zn-Ld	New York	4½	4½	4½	Dec. '20, Q	.50
New Jersey Zn	N. Y. Curb	111	111	111	May '21, Q	2.00
Success	N. Y. Curb			*2½	July '16,	.03
Yellow Pine	Los Angeles	..		*55	Sept. '20, Q	.03
		GOLD				
Alaska Gold	New York	⅝	½	½		
Alaska Juneau	New York	1¾	1⅝	1¾		
Carson Hill	N. Y. Curb	....	....	13½		
Cresson Consol. G.	N. Y. Curb	1 13/16	..	1¾	June '20, Q	$0.10
Dome Extension	Toronto	....	....	*75		
Dome Mines	New York	17¾	17	17¾	Apr. '21, Q	.25
Florence Goldfield	N.Y. Curb	*27	*27	*27		
Golden Cycle	Colo. Springs	..	...	*70	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*7	*6	*6	Dec. '19,	.05
Hollinger Consol.	Toronto	7.12	7.10	7.12	June '21, M	.05
Homestake Mining	New York	55	55	55	June '21, M	.25
Kirkland Lake	Toronto	..	..	*38		
Lake Shore	Toronto	1.18	1.16	1.16	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.88	1.86	1.88	May '21, K	.05
Porcupine Crown	Toronto	*13½	*13	*13	July '17,	.03
Portland	Colo. Springs	*52	*52	*52	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	...	....	*4	May '19,	.05
Silver Pick	N. Y. Curb	*20	*20	*20		
Teck Hughes	Toronto	*11½	*11½	*11½		
Tom Reed	Los Angeles	*71	*65	*71	Dec. '19,	.02
United Eastern	N. Y. Curb	2½	2 3/16	2 3/16	Apr. '21, Q	.15
Vindicator Consol.	Colo. Springs	...	.	*33½	Jan. '20, Q	.01
West Dome Consol.	Toronto	*6	*5¾	*5¾		
White Caps Mining	N. Y. Curb	*8	*6	*6		
Yukon Gold	N. Y. Curb	*98	*90	*97	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*23	*19	*20	Apr. '20, M	.03
Batopilas Mining	New York	⅜	⅜	⅜	Dec. '07, I	.12½
Beaver Consol.	Toronto	*29	*29	*29	May '20, K	.03
Coniagas	Toronto	....	...	1.75	May '21, Q	.12½
Crown Reserve	Toronto	*8	*7½	*7½	Jan. '17,	.05
Kerr Lake	Boston	3	2¾	3	Apr. '21, Q	.12½
La Rose	Toronto	....	.	*20	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*18	*18	*18	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.05	1.05	1.05	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4⅛	4	4	Apr. '21, Q	.15
Ontario Silver	New York	....	....	4	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	*17	*16	*16	Jan. '12,	.10
Peterson Lake	Toronto	*4½	*4½	*4½	Jan. '17,	.01¼
Temiskaming	Toronto	*20½	*20	*20	Jan. '20, K	.04
Trethewey	Toronto	*12½	*12	*12	Jan. '19,	.05
		GOLD AND SILVER				
Barnes-King	Butte	....	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*54	*45	*52		
Cash Boy	N. Y. Curb	*5	*4	*5		
Consol. Virginia	N. Y. Curb	*25	*25	*25		
Dolores Esperanza	N. Y. Curb	2⅜	2⅜	2⅜		
El Salvador	N. Y. Curb	*15	*12	*14		
Jim Butler	N. Y. Curb	*7	*7	*7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	....	....	*4	June '16,	.05
Louisiana Con.	N. Y. Curb	...	...	¼		
MacNamara M. & M.	N. Y. Curb	*17	*13	*14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	†10½	†9	....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 1/16	*98	1 1/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*85	*72	*82		
Tonopah-Extension	N. Y. Curb	1 1/16	1⅛	1 1/16	July '21, Q	.05
Tonopah Mining	N. Y. Curb	1½	1 7/16	1½	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	*84	*78	*81	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N. Y. Curb	*10	*9	*9	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	....	...	1.07½	Dec. '21,	.15
Chief Consol.	Boston Curb	2½	2½	2½	May '21, Q	.05
Consol. M. & S.	Montreal	14	14	14	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†2½	...	...	July '20, Q	.10
Daly-West	Boston	3	3	3	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†2½	†2	2	Apr. '21, K	.05
Electric Point	Spokane	.	.	*7	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*32	*29	*32		
Federal M. & S.	New York	...	...	7	Jan. '09,	1.50
Federal M. & S., pfd.	New York	24	24	24	June '21, Q	1.00
Florence Silver	Spokane	.	....	*12½	Apr. '19,	.01¼
Grand Central	Salt Lake	†*40	....	....	June '20, K	.03
Hecla Mining	N. Y. Curb	3⅜	3⅜	3⅜	June '21, Q	.08
Iron Blossom	N. Y. Curb	*18	*18	*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†2.95	.	....	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*5	*5	*5	June '21, I	.02
Prince Consol	N. Y. Curb	*26	*26	*26	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*4½	*4	*4	Feb. '19,	.01
Rex Consol	N. Y. Curb	*8	*7	*8		
South Hecla	Salt Lake	*35	*34½	*35	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*15	*12	*13	Oct. '17,	.05
Stewart Mining	Boston Curb			*6	Dec. '15	.05
Tamarack-Custer	Spokane	1.80	1.75	1.75	Jan. '21, K	.04
Tintic Standard	Salt Lake	..	....	2.27½	July '21, Q	.05
Utah Apex	Boston	2	2	2	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	....	....	*3	Nov. '17,	.01
		VANADIUM				
Vanadium Corp.	New York	31⅞	28	29½	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	....	....	46	Apr. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	....	....	75	Apr. '21, Q	1.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	39	36½	37½	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf.	New York			68½	June '21, Q	1.75
Am. Sm. pf. A	New York	67½	67½	67½	July '21, Q	1.50
U. S. Sm. R. & M.	New York	30½	30½	30½	Jan. '21, Q	.50
U. S. Sm. R. & M. pf.	Boston	39½	39½	39½	Apr. '21, Q	.87½

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
CLEVELAND ABBE, Jr.
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, July 23, 1921 Number 4

Confusion Over Assessment Work

WHEN the law granting six months' grace for the performance of 1920 assessment work on mining claims was signed on Dec. 31 last by President Wilson, its meaning seemed perfectly clear. Yet twice within the last week we have been informed by our correspondents at Wallace, Idaho, and at Pioche, Nevada, that much confusion has arisen in their districts over conflicting relocations since June 30. The law reads:

> That the period within which work was to be performed or improvements made for the year 1920 upon mining claims as required under Section 2,324 of the Revised Statutes of the United States is hereby extended to and including the first day of July, 1921, so that work done or improvements made upon any mining claim in the United States or Alaska on or before July 1, 1921, shall have the same effect as if the same had been performed within the calendar year of 1920. Provided that this act shall not in any way change or modify the requirements of existing laws as to the work to be done or improvements made upon mining claims for the year 1921.

This extension of time and all the discussions in Congress pertaining to it were given the widest publicity in the press throughout the country. Yet many apparently made relocations as soon as 12 o'clock midnight on June 30 had struck, apparently taking it for granted that the claims were open to such relocation beginning July 1. Under the law quoted above, however, the old locations were valid up to *and including* July 1, so that relocations made before July 2 on claims benefiting by the period of grace were invalid. Hence the conflict and the confusion arising when many claims, illegally relocated on July 1, were again relocated with perfect legality on the following day by different locators. The iaw is clear on this point, however, and apparently there is no chance at litigation for those who were first to relocate.

Besides such cases there are those where claims were relocated on July 2, where the original locator was doing his assessment work when the time limit expired, but was unable to finish it. The question here is whether the claim holder may remain in possession, under Section 2,324 of the Revised Statutes, provided he continues his work without interruption until completed. As to this our Wallace correspondent says:

> The impression seems to be quite general that the law extending the time carries this provision also, and it is believed that many claim owners have gone on that assumption and were engaged in doing assessment work when the extended time expired. It will perhaps require a court decision to determine the intent of the law, but the wording of the act indicates that it was the intent of Congress to require all assessment work to be completed on or before July 1. Following the provision quoted above, the law says, 'so that work done or improvements made upon any mining claim in the United States or Alaska on or before July 1, 1921, shall have the same effect as if the same had been performed within the calendar year of 1920.' There is nothing there to indicate that Congress contemplated the doing of assessment work after the expiration of the period of extension."

Economy in Washington

IN WASHINGTON, plans are on hand to effect economy in the administration of the executive departments in a more businesslike way than ever before attempted. Some time ago we editorially stated that the executive departments were a complicated business, without any business head, and that the President should appoint an assistant who should have the business administration of the executive departments under his charge, and should handle this end of it while the President fulfilled his own special task of guiding the Ship of State. Substantially, this seems to have been accomplished in the appointment of the Director of the Budget, who apparently is going to carry out much of the function outlined. He evidently has authority in matters of business administration, not only over bureau chiefs, but over department heads—members of the Cabinet. It is commented in Washington that it is not so much the executive departments that he will have to combat, but Congress, which makes appropriations for political and patronage purposes to a large extent, and derives much of its influence therefrom. In other words, it will be the efficiency engineer against the pork barrel—and what chance will the efficiency expert have?

Our Government is ruinously extravagant; but its extravagance is mainly in one direction—war. Past wars and their result; present maintenance for war; preparations for future wars, with army and navy, pensions, war risk, and the whole train, is what burdens the taxpayer of America, and is bowing the back of the world. What is spent in the really constructive departments at Washington is a trifle, not to be considered by comparison. Your business manager, your efficiency expert, is very necessary, but the man who can show how the great nations of the earth can progress without occasionally cutting each other's throats, or assassinating with poison gases, is the man that is needed to save the [illegible] and lift from our shoulders the taxes for destruction, the fund for murder, the tribute for hate and deviltry. We hope that President Harding may find him too, or be that man.

Meanwhile, the present movement for economy will not affect very much the bureaus with which the mining industry is concerned. They are efficient and economical as it is. The more recently created bureaus were, some of them, wildly inefficient. The War Risk Bureau, for example: we know of a young [illegible] who was given a job with this bureau, and the service to which he was detailed was the supervision of the laying out of a tennis court, directing the workmen. Clerks got in each other's way. Another case reported to us was of a lady who, to pass the time, knitted all day, between 9 o'clock and the welcome signal for closing.

Applying the Cost Sheet to Mine Operation

WE CAN RECALL quite clearly our first impressions when we noted in the list of subjects included in our college curriculum that course known as "Mine Management and Accounts." The first part seemed most essential to the embryo engineer, but, as for "accounts," there surely must be some mistake. We were being fitted for mining engineers, for mine superintendents, for managers, even mine-company presidents—surely not bookkeepers. Single-entry and double-entry bookkeeping had been hammered into us during our high-school course, but now we were quite beyond that sort of thing.

Later on we were somewhat abashed when we were offered a job as timekeeper at a mine. We did take it, condescendingly of course, viewing enviously the while the mine surveyor with his transit, the mine chemist and his laboratory, and the rest of the men who had the "real" jobs. It was somewhat of a shock a little later (in the meantime we had graduated to transit pushing) when we learned that the chief clerk had been promoted to superintendent at one of the company's neighboring properties. He had started as a timekeeper. From that time on we have had the greatest respect for timekeepers, bookkeepers, and cost sheets; not only on account of this awakening, but because subsequent experience brought the realization that unless we knew the cost of doing things, all of our scientific knowledge, formulæ, and the rest would be of little use.

It is doubtful if any of the several branches of mine operation requires closer attention than that of the proper collection, distribution, and allotment of costs. The cost sheet serves as the barometer of the mine operation; without a suitable system of costs, comparisons are, of course, impossible, and the business of the mine is conducted in a haphazard fashion. We have at different times taken our fling at the inadequacy of the mine reports made by certain companies. There is the possibility, of course, that some of the information is purposely withheld, and we would venture the guess that in most instances a complete system of cost accounting is strictly followed.

Regardless of the particular system used in the distribution of mine costs, there are certain fundamentals that must be kept in mind if the mine manager is to be properly advised of the expense of operation. These points, we feel, have been well covered by Mr. MacDonald in his article, "A Standard Mine Cost Statement," appearing in this issue. There will no doubt be some discussion as to the correct distribution of production and development expense, and at most mines there is considerable overlap in these particular items. But an arbitrary agreement can always be reached, and so long as a consistent division is maintained between the two, a correct basis for comparison can be had.

We are told that the ore at the Blank mine, let us say, costs $2 per ton, the figure supposedly covering all mining expense. Another mine in the same district produces ore for $2.50 a ton, although our general, perhaps close, inspection of actual operations leads us to believe that the latter is operated along more efficient lines. The difference—oh, yes, the superintendent at the Blank mine has not included royalties, taxes, depreciation, and other overhead expenses in his figures; but surely he does not exclude such items in his final statements for the year. Perhaps the distribution of the miscellaneous expense is difficult on a daily or monthly cost account and may be regarded as unimportant, but if the cost figures are to be used in estimating future work it is quite essential that they include *all* items of expense that may be incurred.

In general, an accounting system from which monthly, or, better still, daily cost records can be obtained is invaluable to the mine manager. It enables him to judge his operation in a far better way than is indicated by tonnage or footage figures, and also provides the knowledge that he is either making or not making "the grade." The practice is merely the application of business principles to his work.

To What Information Is the Stockholder Entitled?

NO DOUBT the reader, during the last year, has been periodically deluged with stock brokers' literature entreating him to buy in the market and to take advantage of unusually low copper-stock prices. Attractive and often comprehensive prospectuses have been prepared analyzing the status of certain copper producers, valuable not only for their financial data but also as interesting historical digests. We have in mind, particularly, a folder prepared by Hayden, Stone & Co., which shows in great detail the comparative operating and financial statistics of the four porphyry coppers, Utah, Nevada, Ray, and Chino. Anyone desiring to investigate the advisability of purchasing any of these stocks has a wealth of information available which he can readily supplement by reference to the individual company reports. These prospectuses can only be prepared when mining companies believe in freedom in supplying financial information, which is an almost invariable characteristic of copper-mining companies in the United States.

Some copper companies are exceptions to the general rule of liberality in financial details of operation, and among these exceptions the Anaconda Copper Mining Co. is outstanding. The paucity of information given stockholders of this gigantic mining organization ($116,562,500 capital stock and $50,000,000 bonded indebtedness) is amazing. If you were an intending purchaser of Anaconda stock, or any other mining stock for that matter, what questions would you ask about the affairs of the company? Wouldn't it be well to know what ore reserves the company has? What it has cost to produce copper, lead, and zinc? How profitable or unprofitable some of the manifold subsidiary activities of the company have been? What policies the directors have pursued in the development of the company's activities? One can search in vain through the few pages of Anaconda's report for a clue to an answer to any of these questions. Page follows page, giving such information as "No. 2 air shaft was sunk an additional 120 ft."; "a new roof was placed in the Main Hoist house of the West Colusa Mine"; that "the sawmills cut 92,865,620 ft. of lumber and purchased 358,115 ft., of which 38,185,389 ft. were shipped"; that "the survey of the proposed pipe line (Andes Copper Mining Co.) was finished in May, 1920."

The really essential matters, the relation of the various units of Anaconda's operations to the whole, are omitted, and the intending stock purchaser will find naught to guide him in making an intelligent deduction about the company's activities.

Is a report such as Anaconda's the heritage of a lack of public education in financial matters? Contrasted to the thoroughness in British mining reports, South African and otherwise, and some excellent American reports, the Anaconda jumble cuts a sorry figure. Is a report such as Anaconda's the wish of a board of directors who seriously believe giving information to the owners of the company will result detrimentally to the company's interests? Only the directors can answer. Surely they do not believe that informing the public whether it costs Anaconda 15c. or 25c. to produce a pound of copper, or whether zinc-mining operations were unprofitable, will jeopardize the interests of the stockholder and competitors. On the contrary, the policy of financial reticence lends itself admirably to speculative manipulation of stock on the wildest and often unfounded rumors.

The Anaconda Copper Mining Co.'s report is not up to the standard set by its technical operations. Its meagerness and cloudiness and the evident unwillingness of its directors to allow the light to flood the financial details of its operations are not calculated to create the utmost confidence in the company's financial condition or record.

Optimism and Foreign Trade

THE SPEECH of Herbert Hoover in Boston on July 12, summarized briefly in our issue of last week, points out the importance of our foreign trade; and that our exports, though they cover only a small percentage of our total production, do make up a large proportion of certain industries—for example, normally 20 per cent of our wheat, 60 per cent of our cotton, and 75 per cent of our copper. He proceeds then to point out that the present depression came from Europe, and that our foreign trade can increase only with the prosperity of our customers.

He points out our recently increased surplus production of food and manufactures; and that we are shipping mainly food and raw materials to Europe, our manufactured goods mainly to countries outside of Europe. He points out that Germany must make her stipulated reparations payments mainly in the form of the credit produced by the sale of manufactured goods abroad, but that European increase in the amount of manufactures will favorably affect our market for the raw materials we supply, such as cotton and copper; but that, take it all in all, the consuming power of Europe for manufactured goods will be for some time less than before the war.

Mr. Hoover believes, apparently, that Europe will produce these manufactured goods at lower costs than before the war. "It seems to me that it was inevitable that the balance of the forces at work in Europe would improve their ability in competitive manufactured goods. Their production costs were bound to be low, both by better organized industry and by lower standards of living." However, he sees a chance for two classes of our manufactures—those where we can obtain lower production costs than Europe through our quantity production, and those in which we especially excel, like shoes. Of such classes of manufactures he believes we can recover and hold our pre-war share of business.

But as to manufactures containing a large element of labor cost, Mr. Hoover says we must get our production costs down if we are to compete in foreign markets. Increased efficiency is the answer. There must, he says, be smaller margins of profit, lower transportation rates; better foreign marketing agencies; the elimination of the wastes in industry; the super power power plan; tax reform; reduction of armament; more efficient management of the Shipping Board; and the payment to the railways of moneys due them from the Government. "It means that we must extend scientific research into the problems of waste, the perfection of processes and the simplification of methods that are beyond the ability of one manufacturer acting alone". . . . "I am confident we can hold our markets, our higher standards of living, and our wage if we will all put our backs into it."

Carefully considering Mr. Hoover's words, we do not altogether share his optimism. He skirts the main immediate problem of the day—the tariff—very cautiously. As a member of the Cabinet, he could not well do otherwise. We see no signs on the horizon that would justify us in cajoling ourselves into the conviction that we were going to secure the most remunerative of trades—a foreign market for our manufactures—to a greater extent than before the war, if as great. The tariff program is one of the signs that we have not adopted any new economic plan to match the changed times. Nor do we believe that with higher wages and higher standards of living we are going to compete in foreign countries with manufactured goods into which the element of labor enters largely. We will be efficient and eliminate waste, to the best of our ability, but other countries have always been our leaders in this respect and will continue to be at least our equals.

Even as regards the special quality manufactures that we sold abroad during the war, we shall have difficulty, if reports are true, in regaining our trade. The Guaranty Trust Company reports, "The post-war market for American agricultural machines in Germany is not so good as formerly, because many German factories which were engaged in the manufacture of war munitions are now turning out agricultural machinery on a large scale. Take the case of tractors. A certain small American tractor costs about 52,000 marks f.o.b. New York. A similar machine can be manufactured and sold in Germany for 25,000 marks, which is less than the cost of a span of horses."

One result of this condition is that these American industries are considering the establishment of plants in Germany. "The German government is favorably disposed toward these American plants, provided at least 50 per cent of their output is exported to other countries. One large American cash register company has already begun to manufacture in Germany, and other firms are about to follow its example."

The transfer of American plants to Germany or other countries where costs are lower is not going to help American prosperity, but the reverse. Altogether, far from seeing much promise, in the light of our present policy, of retaining the immense foreign trade forced on us by the war, it would seem that we would have to fight hard to retain even our pre-war position. Unbounded optimism, so highly rated as an economic factor by the optimist, is actually of no cash value whatever, when it comes to a showdown and to business competition.

The tariff policy of the present Congress is in effect a renunciation of the battle for foreign trade in manufactures, and an announcement of a defensive instead of an offensive program. We shut ourselves up within the walls of our tariff fortress, and trade with each other undisturbed, and we leave to our less fleshy antagonists the ranging of the fertile field and forest outside.

WHAT OTHERS THINK

Profit Sharing in Mining

I am addressing this letter to you in the hope that it may be published and elicit some correspondence on the subject of profit sharing in mining. Profit sharing is an interesting and important phase of industrial relations, and no mining problem today equals in importance that of the relations existing between the men who put their money into mines and the men who put their time and their energy into them.

There is a fairly extensive literature devoted to the principles and the results of profit sharing in general industry, but when we began to discuss the advisability of introducing a profit-sharing system to apply to the staff employees at our gold property in South America, we at once discovered that the inherent economic factors of the mining industry, and especially those obtaining in gold mining, greatly diminish the value of any data obtainable from experience in other industries. May I enumerate some of the questions that arose in our investigation of the problem?

In the first place, the selling department of most metal-mining enterprises is of minor consequence as compared with that responsible for production, distinctly the opposite of the conditions prevailing in most manufacturing or distributing businesses. This is overwhelmingly true in gold mining, where the price of the ultimate product is fixed. Such being the fact, should not the producing department of the organization, the mine and mill and shops, as chiefly responsible for the profit made, receive a larger proportion of those profits in any equitable distribution? Is there in general any formula deducible on which to base the distribution of profits among the management, the heads of departments, the bosses in the departments, and the body of workmen?

As the efforts of most of the employees of a mine have nothing whatever to do with the selling price of the metal produced, the custom of the copper companies, followed until recently at least, of varying their wage scale with the price of copper, though in effect a sharing of profits, cannot be considered a logical or a typical profit-sharing system, which should be based on the assumption that there is a relation between the efforts of the employees and the profits secured. Obviously, too, a gold mine cannot share profits by varying its wage scale with the price at which it sells its product.

In most metal mines, those in charge of operation have a considerable variety of raw material on which to draw, and it is usually considered good policy not to consume the best of this as rapidly as possible but to maintain a certain average; gutting a mine is poor business. Yet an employee working for a percentage of a year's profits, and uncertain whether he will have a chance at the profits of future years, might further his own interests more if he deliberately gutted the mine in his charge.

Similar considerations apply to the necessary current development, which most mines have to maintain and which is particularly important in considering the small or medium-size precious-metal mine. One year's profits can be materially increased if no development work be done, but a year or two later all profits may disappear. In the same way immediate profits can be swelled by neglecting maintenance work underground and on the surface, or by installing a mining system temporarily cheap but entailing expense and difficulties later, or by arbitrarily cutting wages and showing lowered costs for a while until rising discontent reflects itself in heavy expenses or disaster. Clearly, to offer an extra remuneration contingent on profits only, without limiting conditions, would tend to encourage poor mining and might wreck an otherwise successful enterprise. The stockholder shares profits with his employees in the hope of making his own share greater through stimulating economies in operation, but he certainly does not want to increase his immediate profits by jeopardizing those of future years.

How, then, can profits be shared and at the same time protection be secured against gutting, neglect of development, neglect of maintenance, and short-sighted policies in general? Especially when ore reserves are small and development of ore for the future is fully as important as current profits, what sort of a sharing of profits will stimulate vigorous search for new ore?

Finally, can any rational basis be established for determining the percentage of the profits to be segregated for distribution to the employee?

I should be glad to hear the testimony of mine managers on their success or failure with profit sharing in general and how they have met some of the problems I have outlined, especially where the principal product of the mine is gold. And I propound these queries fully alive to the probability that the general satiric answer will be to the effect that today's problem in mining is not how to share profits, but how in thunder to make any. L. O. KELLOGG.

Carmel, Cal.

He Made Gold Before Dr. Davis Did

I have ben reading Dr. Davis article on changeing base metal gold or silver or plattinum. I have don the same thing for the last three years, first silver then gold and last platinum now you say that it might be so if a man is a mining engineer or some geologist. I am not one of the above but I can make these mettles out of several base mettles and know all about the birth of the nugget. Not of those mining men seams to know every citty is full of gold all you want to get some one to point it out to you. It seams to be as the President of the Pulman Collage in Wash he told the people if they would eat more meat they would get more brains and would know more they claim gass makes gold and in that way it would take several years to make gold. I can take raw material and in forty-eight hours change it to gold and silver about one of silver and three oz. of gould to the tun. A man can mak his own ore and in that way can make it as rich as he wants to. Gold mines are so getting so lowgrade that it does not pay to work them there is one here that assay nine dollar a tun and it cost $8.50 to mine it. it use to pay at $5 per tun, some have spent $10,000 and only sunk 195 ft. of shaft. I have 75 quartz ledges that carry gold silver and copper now would pay to work and they are in a rich gold country the owners of the Cour D'Alene mines got one third of all they mine. I use to locate cole land in Pa. & I know more that men with book or geologist did. JOHN HIRTMAN.

Rathdrum, Idaho.

The Mining and Smelting Situation In Colorado

The mining and smelting industries in Colorado face a peculiar situation. The ordinary lead smelting practice in Colorado demands certain ore reserves, which are being rapidly depleted. Direct smelting of crude lead sulphide and lead carbonate ores is the exception rather than the rule. Iron ores are plentiful, but the majority of these carry very little gold or silver. Galena concentrates are available from the Joplin district, but the present price of lead, combined with high freight and the subsequent higher treatment charges, makes this source of lead prohibitive.

The lead smelters naturally refuse to accept ore which they cannot smelt at a profit. Such ore is principally a highly siliceous, dry silver ore of medium grade. "Dry" means with little or no lead. The mine owner cannot afford to do extensive development work to furnish the ore he can ship and at the same time leave good ore untouched because there is no market.

The Cripple Creek district has a satisfactory method in use; most ores in this district yield to cyanidation. Some pyrite concentrates are shipped direct to the lead smelters. Large bodies of good-grade copper sulphide have been opened up in this state, and an outlet for these ores would develop more.

The way out of this dilemma is the semi-pyritic blast furnace or copper matte furnace. A copper matte furnace can be run very nicely with a slag running 10 per cent higher in silica than a lead furnace slag, less iron is required, and lime rock can be utilized if iron is too low. The copper matte furnace requires less coke on the charge, as the heat of combustion of the raw sulphides replaces it.

Processes employing preliminary chloridizing and sulphatizing roasts are being perfected. Electrostatic methods of separating zinc from complex ores have made a marked saving of this metal, which heretofore was lost in the lead smelting practice.

Colorado has a bright future when the processes in use will treat the ores in sight instead of efforts being made to find the ores to meet the process. A large tonnage of ore susceptible to the semi-pyritic treatment is now opened up and awaiting. A. S. WALTER.

Denver, Col.

The Mining Engineer's Education

I have read the editorial, "Successful Engineers Need Not Apply," commenting upon a letter in "What Others Think" of the June 18 issue. This is interesting to me, and I am eligible. I had previously read in the *Atlantic Monthly* an open letter to the graduates of an eastern school by a graduate of thirty-five years ago. The night before I read your editorial I was discussing modern education with a successful banker, the head of two banks, and himself a graduate engineer. He has never followed engineering, but he has been the means of building up many businesses where engineering education has been helpful. The banker said: "I wish all of my important heads of departments had been educated as engineers." He holds that a knowledge of science and good English is essential to business tasks. The old classical education is fine when the student can afford the expense, but this must be regarded as additional education, and not primary.

One opinion held by many engineers is wrong. That is, that as a last resource any one can sell. If you cannot be a successful mining engineer, go into business. I am in favor of some education to change this view among mining engineers. A mining engineering education is a fine foundation for business success, and a general education, as given in a mining course, is broad and always useful. Why limit the number of mining engineers or talk about an oversupply of them? There are many business men who would pay cash for a good mining education.

You mention some engineers who have followed other work. I can contribute some information along that line. I know a mining engineer successfully running a bond house and one a paint factory; an electrical engineer is manager of a well-advertised brand of silk hosiery (all puns deleted). During the last year, I have had an opportunity to view many of the industries in the Middle West and the East. I find that at the present time in any business of this sort a broad engineering education is needed, and mining engineering seems to fulfill the requirements better than most of the other courses.

I would not recommend the automobile business, but an automobile is a high-priced machine and a technical engineering product. I wonder how many salesmen in the automobile business really are competent? I know that many machines of other kinds would be sold only by engineer salesmen.

An engineer is specializing in Chicago on advertising for engineering firms and is successful. Which would you prefer, a regular advertising man or an engineer with advertising experience to write the ads in the *Engineering and Mining Journal*?

It seems to me we should not worry about an oversupply of mining engineers; they have an education that will fit them for so many other things if they will only go into business. We cannot all be consulting engineers and managers, but we can find both honor and profit in many ways that the engineers of the last generation did not consider worthy. We will never have too much education. COMMERCIANTE.

Depths of Molybdenum Ores

In *Engineering and Mining Journal* of June 18, 1921, Otto Falkenburg, in his article "Molybdenum Mines in Norway," states, "The downward continuation of the deposits is of course a question of the utmost interest. Experience seems to have shown that the extent of a molybdenum deposit is relatively limited compared with deposits of iron ore, pyrite, and other ores which occur in great quantities, usually with 50 to 60 per cent and more iron and sulphur. The downward dimension seems also to be quite limited, and there is possibly no molybdenum mine over 100 ft. deep."

In regard to molybdenum reaching great depths, the Gold & Copper Deep Tunnel Mining & Milling Co., of Elizabethtown, N. M., has opened several veins of molybdenum ore at 1,500 ft. in from the portal of the company's tunnel and at over 1,100 ft. vertical depth. The veins are from 3 in. to 2 ft. wide and carry 40 to 50 per cent molybdenum. This ore occurs in a diorite formation and has a strong outcropping on the top of the mountain above the tunnel level. Picked specimens at this great depth show very high-grade material.

Elizabethtown, N. M. W. P. MCINTYRE.

A Standard Mine Cost Statement

Stoping and Development Expenses May Be So Recorded as To Give Clear Insight Into Past and Current Operations and To Indicate Future Economies—Basic Principles Common to All Mines

BY H. J. C. MACDONALD

Written for *Engineering and Mining Journal*

A SUMMARY STATEMENT of mining costs, clearly and concisely displaying the usual cycle of work, is of first importance in compiling mine reports. A comparison of these cost records for consecutive periods shows the outgrowth of changes in methods, regulation, and supervision; suggests further beneficial innovations; and aids directly in the elimination of unnecessary expense. Clear-cut records of mining cost also render a basic service when preparing a budget of future expenditures, or an estimation in justification of some alteration or extension to reduce costs.

Where mining costs at two or more mines, not under one administration, are studied, a mystifying diversity of items will generally be found. A standard cost statement, applicable to all mines, would aid in a clear recognition of natural obstacles encountered at different properties; of the relative efficiency of various types of organization and of personnel; and of the effectiveness of alternate mining methods. The outcome would be a general and increasing use of the more economic ways and means.

SEGREGATING STOPING AND DEVELOPMENT EXPENSE

The outstanding feature of mine work is its separation into dual spheres of activity—stoping and development—although the separate steps in breaking and handling rock in both of these provinces are similar. Development is from 10 to 20 per cent of the total mining expense; the rest belongs to stoping, and, being many times greater, will be investigated first. Stoping expenses group themselves into five divisions which will be found applicable to all mines. These five primary divisions are:

Breaking—Includes the cost of all efforts in the removal of the ore from place through drilling and blasting, but excludes money expended on the ore beyond a point where deposited by the initial blasting and bulldozing.

Handling—Includes the cost of all efforts aiding the movement of broken ore until such time as the ore shall be loaded for shipment.

Timbering—Includes the cost of all timber brought into the mine and the expense of placing it.

Stope Filling—Includes the cost of material either broken or handled, used to give support to the stopes.

Expense—Includes all costs which cannot be placed on the ore at any particular stage in its movement.

The breaking division represents the cost of breaking ore in the stopes. The ore broken will remain in the stopes a length of time, and in a volume, dependent upon the mining system or on the mine supervision. These pools of broken ore become the sources of ore streams that move forward over lines of transport to fill the shipment bins, but with the likelihood of further delay in some storage pocket along the route. Therefore, ore may not be shipped, or even leave the stopes, at the time when it is broken; hence three distinct figures can be recorded—the tons of ore broken, tons handled, and tons shipped, during any one period.

ADVISABILITY OF KEEPING SEPARATE COSTS FOR BROKEN AND SHIPPED ORE

All mine costs being referred to the shipments, a disagreement between this tonnage and the coeval mine tonnages will, if large enough, disguise the real costs per ton for the breaking and handling of ore. In this contingency, there must be an adjustment. The common way overlooks the usual small difference between tons handled and tons shipped, then reconciles the broken ore with shipped ore through opening a suspense account to take in all of the breaking expenditures, and from which to charge these out to operation as the ore is shipped. Office accounts of this type are a compromise between actual expenditures and estimated tonnages, here of broken ore in stopes, so there should be a conservative attitude toward the introduction of such accounts. Keeping separate costs for broken and shipped ore will always be well advised where the tons of ore stoped and shipped differ widely; where a large broken-ore reserve exists in stope storage, as in shrinkage stoping; or where the mine, stoping continuously, is shipping intermittently.

The active breaking and handling divisons have a closer relation to mine tonnages that have timbering, stope filling, and expense, for the greater part of the expenses in breaking and handling are per-ton charges which increase or decrease in direct proportion to the number of tons broken or moved. At open-stope mines, the breaking expenses will average 50 per cent and the handling expenses 25 per cent, or a total of 75 per cent of all mine expenses. However, as more timber and filling are used in support of the stopes, the timbering and stope-filling divisions will comprise a larger share of the mine expenditures.

VALUE OF ACCURATE TIMBER COST KEEPING

Timbering is measured best, not by the usual tons of rock, but by the kind and amount of timber framed and placed. The timbering operation demands, as do the other cardinal branches of mine work, ample accessory reports in extension of the necessarily abridged data on the main cost statement. Even where timber is extensively utilized within the stopes, the costs of this division can be readily assembled in detail. The timber requirement is controlled by the physical character and shape of the orebody and surrounding rock. The conditions that determine the stoping system also determine the auxiliary use of timber. The need of support for the rock while stoping, and the resulting practice and expense of timbering, being in this manner related to the nature of the mineral deposit, and thereby local to a mine, the costs of this division are one of the best indexes for comparison among mines.

Waste rock is broken partly because it cannot be avoided in mining ore, and in part with intent when it is needed as a material for stope filling. A normal burden of waste must always be accepted in the same spirit that is evinced toward the other conditions imposed by the nature of a mineral deposit. Of the waste rock some may be useful for stope filling; a quantity may be useless and be discarded; and a third part may become so thoroughly mixed with and so dilute the ore that sorting must separate the two. This continual load will increase the expenditures in most operating accounts in amounts always known and recorded by a careful operator. Unless the tonnage of waste is abnormal, however, there is direct representation on the cost sheet only in the expenses for sorting and stope filling. Of waste broken for the express purpose of filling and supporting the stopes, a small tonnage may have to be transferred, but the greater amount can be mined to fall directly into the stopes. The cost of all such waste rock, or of other material used for this purpose, becomes a positive expense for separate record in the stope-filling division only where a greater expense to the mine has been incurred than would otherwise have been the case. The expense of stope filling, being peculiar to each mine, affords a second pertinent figure to contrast mines with one another.

DEFINITION OF EXPENSE DIVISION

The expense division contains those expenditures which fall as blanket charges upon the shipments. Several periodic time charges are here found, as the salaries of accountants and engineers. Month to month, these are more or less unchangeable. Also, a number of arbitrarily fixed ton and time charges are included, which are placed in equal adjudged allotments on each ton, or on each month, from some subsidiary account of deferred charges to operation; for example, cost of stripping the surface at mines. These expenses have been so collected, and are thus distributed: because of their character, as taxes, royalties, insurance, and head office expense; because of their large size, as some costly machine advisable to charge to operating account; perhaps because of their unexpected occurrence and size, as legal suits and unforeseen mine caves and fires. Such expense cannot fall at hazard upon the operating costs without spoiling the record of the active mine work. In general, these are obligations which the operating department must still account for, but which the mining company has paid for, and are distinctively an office division of overhead expense and indirect charges in whose absorption the accountant will have to take considerable care not to mask the operating costs. Subject to a one-time disposition rather than to continual regulation, these expense accounts require only a small portion of a mine operator's time and attention.

THE SELECTION OF OPERATING ACCOUNTS

The selection of accounts within each major division which will render the greatest aid in the guidance of mine affairs should be made by the man who sees most clearly the structure of the work. This person will be the superintendent or an operating engineer. An accountant records without so critical a dependence upon a clear idea of the relation of the cost to the work as an engineer who is constantly called on to use his deductions therefrom as the basis of much future action. Accurate operating costs show where a smaller expense of labor and supplies, or any utility, could have accomplished in the past the same useful work and end. This finding becomes a criterion of all present and future work and costs. The superintendent should segregate the operating costs and select the accounts personally, piloted by the following principles:

PREFERRED PRACTICE IN MINE ACCOUNTING

1. Recognize the well-marked minor operations distinctive to, and necessary for, the mining of ore, and under representative titles group all cost items into accounts to coincide with these operations.

2. Always include in each account the two natural parts, labor and supplies, to the complete absorption of all labor and supplies used in the mine.

3. List the accounts so as to follow, in so far as possible and practicable, the movement of the ore from stopes and headings to mill and smelter bins.

4. At the end of the list add all accounts that cannot be placed in the regular order, but which are important from their size and character, or are chargeable to the entire mine operation.

In the selection of accounts, the existing sequence of operations will be the first consideration. Then the size of a mine, as shown by the daily output, limits the amount of beneficial subdivision.

The work at a typical mine producing 1,500 to 2,000 tons of ore per day can be grouped under the five major divisions, and arranged in the following schedule of accounts. With significant omission or addition of a few minor accounts, and with a slight rearrangement for local routine, this schedule will have a general application to all mines.

STOPING ACCOUNTS
Each Giving Labor, Supplies and Total
- Breaking
  - Drilling
    - Drill power
    - Steel sharpening
    - Drill supplies
    - Drill [illegible]
  - Explosives and blasting
- Handling
  - Shoveling
  - [illegible]
  - Haulage or tramming
    - Car and locomotive repair
    - Track maintenance
  - Hoisting
  - Crushing
  - Sorting
  - [illegible]
  - [illegible]
  - [illegible]
- Timbering
  - Framing
  - Placing
- Stope filling
  - Drilling
    - [illegible]
    - [illegible]
    - [illegible]
    - [illegible]
    - [illegible]
    - [illegible]
- Expense
  - [illegible]
  - [illegible]
  - [illegible]
  - [illegible]
  - [illegible]
  - [illegible]
  - [illegible]
  - General expense

A proper account title at once brings to mind the costs ordinarily included, yet a sure method must be devised to prevent these cost items being charged into one account today and into another tomorrow. For the disposal of current charges a clerical force cannot wholly be relied upon. In the best practice an up-to-date typed list enumerating the charges in each account is retained constantly on file at the mine office. The correct contents of every account, and the proper placing of any charge, can then be referred to at a glance. By this means absolute dependence is not placed upon the familiarity of office men with the work, or on their memory of the verbal decisions and precedents made by officials. Below is a specimen, the make-up for the main account in the drilling group, of what such a list should be:

DRILLING ACCOUNT

Labor: Miners, barmen and a proportionate part of the time of shift bosses.

Supplies: Bars, picks, hammers, shovels, scrapers, blow pipes, oil, oil bottles, pails, rope, wrenches, wedges, column parts, tripod parts, air and water hose with fittings.

All cost items occurring in the accounts can be placed in one of four groups: Ton, Time, Fixed-ton, and Fixed-time charges. As indicators of current mining costs, these rank in the order given. The several accounts are tempered by the character of the charges in the admixture, assuming in the main the characteristics of the predominating type. In this way arise the Ton accounts, varying from those reflective of a small number of tons, representing numerous workmen aided by tools, supplies, and the simpler machines, to those accounts which represent a few workmen directing machines of a power and capacity to handle large tonnages as a unit, such as locomotives, hoists, and crushers. The Time accounts, dependent on elapsing time, represent selected employees using their skill and training to the advantage of a greater part or the entire mine. The Fixed accounts represent obligations occurring in such a manner that the relation to present time or tons of ore has to be restored through set installments. Turning from Ton, to Time, to Fixed accounts, these are gradually transformed from active into passive guides for mine regulation, the expenses recorded in each account, compared to the changing volume of mine output, indicating less and less the efficiency of present mining.

APPORTIONING DEVELOPMENT EXPENSE

To complete the record of mine work, there must be added to the stoping expense, now grouped into accounts, the development expense. Owing to the multiple difference in the cost of breaking rock in the two provinces, notwithstanding similar routine work in each, there can be no intermixture of these two sets of cost figures with the preservation of comparative operating costs. It is immaterial whether a strict separation of the two results in a low or a high cost record for either: it is the sole manner by which clear-cut operating costs are retained. Stoping being in reality the breaking of rock in large openings or stopes, is referable to volume and the ton; development, the breaking of rock in restricted spaces or headings, is referable to cross section and the foot.

According to its threefold object—to gain access to, to expose, and to stope the orebodies—mine development can be placed in three groups.

Development of access includes those main haulage, drainage, and ventilation ways that are essential to secure and guarantee the uninterrupted succession of the desired daily shipments. The greater part of this type of development takes place just prior to the shipping days at the mine. The bulk of mine output issues forth along these working roads, so that their construction cannot be charged to a part of the ore reserves or to periodic shipments therefrom. Inasmuch as something is here created which will generally be of use throughout the life of the mine, this particular expenditure is charged to capital account. Thus, not being identified with the operating costs, development of access can be dismissed with the note that the expenditure for this work is not an asset, in full amount, after the utility of such development has been impaired or in part destroyed.

Exploratory development is carried out in at least partial ignorance of the locations, shapes, and extensions of the ore shoots and bodies, and the lengths thus driven may be so ill placed that limited sections alone become of service in later exploitation. This work is highly speculative, usually creates no working or permanent ways, and indicates, rather than utilizes, ore reserves. A similar objective is shown in churn and diamond drilling. The cost of all development of this nature driven prior to the time of shipments can be absorbed in an account of deferred charges for later distribution to operating costs. Where, through continual search for erratic ore shoots, sporadic orebodies, or the ramifications of known ore shoots and bodies, exploratory development extends in serious amount into the operating life of the mine, the uncertainty ingrained in it makes this expense an awkward figure in the costs. Should it not turn out well, such development will be lost; if successful it can become a part of the working development of the mine; and for this reason the expenditure may have to be retained in an office account until the result of such work has become evident. In any event, a suspense account must be maintained in cases where exploratory development occurs in considerable amount and without normal correspondence with the current shipments.

IMPORTANCE OF STOPING DEVELOPMENT ACCOUNT

Stoping development has an important duty in the breaking of ore, because it opens up, and keeps open, by-roads to the points of attack in the orebodies. Before the start of mine operation, costs are incurred through cutting the orebodies at enough points, and along sufficient lines, to enable the mine to begin shipping. This expense should be entered in a suspense account for later distribution to operating costs as that ore is shipped which this development makes available Unless a large footage has been driven, such past-work accounts will be wiped out during the first few years of operation.

When the mine begins to stope and ship ore, development of this nature becomes the ruling type, and is in fact the chief concern of the producing establishment. Always having a definite relation to the tons of ore mined, this expense is especially and most clearly seen at those mines with a uniform system of stoping. Consequently, the factor of linear feet of stoping development to tons of stoped ore, normal to each mine, can be calculated. After a mine is running smoothly, stoping development comes more and more into step with the rest of the mine work. Where the amount done each month becomes stabilized at or near that figure normal for the mine, the cost can well be placed upon current shipments; where it does not, a suspense account will have to be maintained to protect the operating costs.

Therefore, when a great deal of past development has to be accounted for, or when the relation between current stoping and development is abnormal, the development costs must be figured to apply to the tons of ore shipped. This procedure calls for a calculation at each mine of the numerical relation between stoping and development which is there normal. A general check on all accounting office and book dispositions of development exists in the fact that the costs of the several lengths must be charged off to expense or depreciation by the time these particular lengths have become useless.

Some of the smaller mines, however, are so uncertain in control and operation that obligations must be settled as incurred, and a final accounting made at the same time. Besides, in most well-established mines an opportunity exists—which can be taken advantage of by a discerning manager who looks well ahead of the present—to execute each month a predetermined footage, calculated so near the normal burden that its cost will blend into current mine expense. In this instance, the mine cost statement reports the cost of all development actually done, combined into a true expense of the shipments.

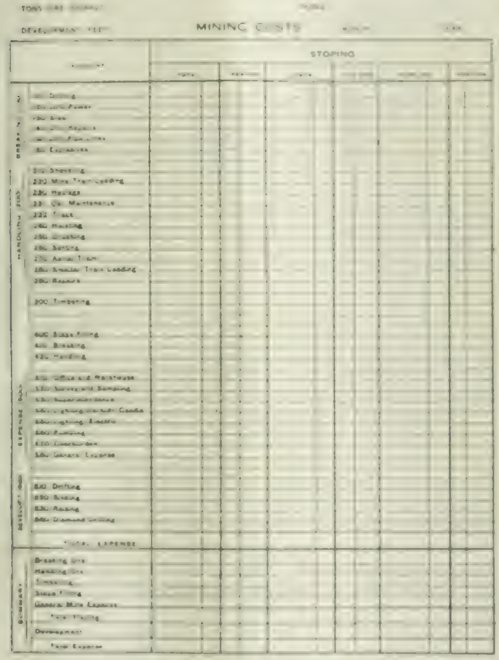

TONS ORE SHIPPED
DEVELOPMENT FEET
MINING COSTS
STOPING
Shoveling
Mine Train Loading
Haulage
Track
Hoisting
Crushing
Sorting
Aerial Tram
Smelter Train Loading
Repairs
300 Timbering
Stope Filling
Breaking
Handling
Office and Warehouse
Surveying and Sampling
Superintendence
Lighting, Candles
Lighting, Electric
Pumping
General Expense
Drifting
Sinking
Raising
Diamond Drilling
Total Expense
Breaking Ore
Handling Ore
Timbering
Stope Filling
General Mine Expense
Total Stoping
Development
Total Expense

FIG. 1. FORM FOR MINING COSTS FOR ONE MONTH

METHOD OF DETERMINING PREFERRED ACCOUNTING SYSTEM

The following method indicates whether or not such a course will be feasible: Estimate the entire development needed to ship the known ore reserves, and calculate from this the factor, tons of stoped ore per foot of development, normal for the mine. Whatever the disposal of development expense, this figure will be the foundation. Decide upon that development footage which must be driven during the ensuing year, and examine this footage in relation to the shipments that are expected for the year. Incidentally, note the effect of the mixture of the limited tonnage of byproduct ore broken in the course of development with the mass of the stoped ore: in large tonnage mines it will be negligible. Determine the difference between the factor for the year and the normal mine factor—feet development to tons shipped—and study the effect of the difference found on the record of operating costs and upon the cost of a ton of shipped ore. Where a thorough examination shows this effect to be not too great, the development expense can well be borne by the current shipments.

A twin member of mine work upholding the shipment of ore, development has to assume not only the obvious cost of its drilling, explosives, shoveling, and like expense, but also the implied cost in proportion with footage driven, holes or feet drilled, or tons broken or handled, of all mine expenditures. No phase of the basic relation can be ignored. A single item withdrawn from development costs and added by some sleight-of-hand to stoping costs results in the equal impairment of both.

DENOTING DEVELOPMENT COSTS

Development is given the following delineation on the cost sheets: First, a summary is affixed below the stoping expenses upon the mining cost statement, showing development under three headings, Drifting, Sinking, and Raising; second, in closer examination, three separate cost sheets show the details. Upon these three sheets development will be in accounts identical in construction with those used in stoping, but, stope-filling being absent, there are only four major divisions: Breaking, Handling, Timbering, and Expense. The summary below shows this disposition:

ON MAIN COST STATEMENT

Drifting	Labor
Sinking	Supplies
Raising	Total

Churn or Diamond Drilling
Labor, Supplies and Total

ON THREE SEPARATE SHEETS

Drifting, Sinking and Raising

Breaking	All detail accounts
Handling	Labor
Timbering	Supplies
Expense	Total

THE MINE COST STATEMENT

An active record of mine work should appear on the operating cost statements, reporting each month the bulk of expense for the stoping and development carried out during the month, and avoiding unnecessary use of suspense accounts for broken ore and development. The interdependence between stoping and development is so great that it is inadvisable to do otherwise. Through a reasonable local adjustment, the current work at each mine can be fully shown; the stoping and development costs for the month combined into an accurate figure of expense per ton of shipment. No small part in the value of mine operating reports consists in depicting actual work done, in order that the mine will be well regulated and its future safeguarded.

The accounts into which mine work has been grouped are arranged on a Mining Cost Statement (Fig. 1), printed, ruled, and spaced so that it can be filled in with a typewriter, compact, legible, and convenient in size 18 x 10 in., for filing, reference, and for mailing. Every account has an assigned number to facilitate ready reference between offices and officials of the mining company. Even details cannot be slighted in a form that is a complete expression of the entire mine work. These statements are compiled and issued at or near the first of each month to include the costs of the preceding month, an interval of familiar length and with an obvious seasonal variation which often affects the cost of operation. As a statement to distant officials, who must possess confidence in the local superintendent, this offers sufficient repetition of the detailed costs. Yet the superintendent, to obtain an average mining cost for the current month, will need daily and weekly cost summaries, with, at times, supplementary details, to keep him constantly informed as to the current cost of production.

Accounting Routine Practice

The mine office staff must issue the mine expenditures in the set division of accounts, promptly at the stated times. This implies a proper daily labor distribution through time books and payrolls, and a proper daily supply distribution through a well-organized mine warehouse; it also implies that all other charges which cannot be absorbed directly into expense come from Suspense and Distribution Accounts created in independent form to receive and allocate these. In office practice, the Operating Accounts are separated rigorously from Capital Accounts for Mineral and Other Lands, Development of Access, Headworks, Buildings, Machinery, Equipment, Surface, Construction, and other similar accounts; they are fed by Distributing Accounts such as Machine, Carpenter and Blacksmith Shops, and Power each month; and are protected by Suspense Accounts such as Overburden, Exploratory Development, Stoping Development, and Broken Ore in Mine whenever there is occasion. This is the domain of an accountant, with whom the engineer should actively co-operate without undue sacrifice of his valuable time.

The statement on the mining cost sheet and the control which it gives through analysis are essentials to successful operation. The figures given enumerate the labor cost, supply cost, and total cost—in dollars and cents, and per ton of shipped ore—for each of the divisions and subdivisions. The main divisions are summarized at the bottom of the sheet in a manner to contrast stoping and development. The large number of figures on the page makes month to month comparisons difficult, so, with the assistance of a second form (Fig. 2), the detail of each account is spread out for the current year. At the top is a list of the account expenditures, copied from the mining sheets of the several months. Running down these columns the expenditures for consecutive months pass in review; at the bottom, a plot assembles graphically the cost per ton for the same account, period to period, in such a manner that fluctuations with the progress of time are brought forcibly to the operator's attention. This flashes light on a low or a high cost, and turns the glare of investigation about the plant upon the circumstances, perhaps overlooked in the supervision, that have bred this abnormal cost.

Retention on the final sheets of the labor and supply costs for all operating accounts makes a sound structural feature in this particular method of report. Without increased work for the office staff, as both costs are directly transcribed from the two daily distributions, a much greater insight is given into the costs. A real advantage is apparent in bringing forward the wage paid a workman alongside the expense for supplies that he has used, or which are directed to the same end as his efforts.

As labor expense usually averages about two-thirds of the total mine expenditures, a longer time is permissible for its investigation. A list of mine workmen by occupation, customary and general in application to the mining industry, with numbers employed, wage, and total hours worked at the mine in each pursuit, accompanies the cost report. Also, a similar classification stating the numbers and occupations of the men engaged in each mine operation which is represented by an operative account. Increase or decrease in the numbers at the several tasks, and in the specific occupations, will be uncovered, revealing whether or not changes in labor efficiency have taken place. Further, to labor belongs a large share in the responsibility for the remaining third of mine expense, the cost of supplies, as the workmen are answerable for conservation in their use. A supply classification in a few well-defined groups, to apply to all mines, with the costs and quantities absorbed during the month, must also accompany the operating cost statement.

MINING COSTS

MINE ACCOUNT Drilling No. 110 YEAR

MONTH	TOTAL		LABOR		SUPPLIES	
	AMOUNT	PER TON	AMOUNT	PER TON	AMOUNT	PER TON
January	$12,402.74	0 221	$12,009.89	.214	$392.85	0 007
February	12,587.83	209	12,106.00	.201	481.83	006
March	11,344.90	190	10,747.80	.180	597.10	010
April	14,013.03	227	13,271.31	.215	741.72	012
May	11,593.80	180	11,014.11	.171	579.69	009
June	11,975.63	225	11,603.05	.218	372.58	007
July	8,369.20	178	8,134.11	.173	235.09	005
August	10,387.00	180	9,810.70	.170	577.29	010
September	13,815.70	204	13,138.46	.194	677.24	010
October	13,138.77	203	12,491.54	.193	647.23	010
November	15,656.87	235	14,657.50	.220	999.38	015
December	10,845.61	227	10,272.27	.215	573.34	012
TOTAL YEAR	146,131.91	207	139,256.76	197	6,875.15	010

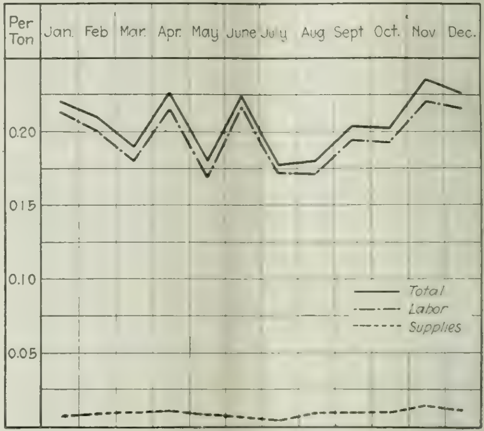


FIG. 2. FORM FOR SUBDIVIDED MONTHLY MINING COSTS FOR A YEAR

What a Cost Sheet Must Contain

Certain tonnage factors must be at hand, both in those amounts normal to the mine and in those recorded each month, to obtain an adequate conception of the operating costs when these are based upon the current shipments. These tonnage factors are indicated by the following composite statement of the ideal conditions that give absolute comparison of costs month to month. The stoping and development remain in normal relation; the mine handles and ships exclusively the ore broken during the month; the tons of ore to tons of waste in stoping, and the same in development, remain as two constant ratios throughout the months; furthermore, the tons of ore derived from these two provinces remain in constant proportion in the shipments. Therefore, there must at least be stated on the cost sheet, or upon companion tonnage reports, the following six figures: (1) Tons of ore and (2) tons of waste broken in stoping; (3) tons of ore and (4) tons of waste broken in development; (5) tons or ore shipped from stoping; and (6) tons of ore shipped from development.

Periodic investigations that utilize the record of past and current costs operate to cut down the mining expenditures and counteract their unceasing tendency to rise. In these investigations the general cost and tonnage figures for the month will be first observed; then the relation, and the expense shared, between stoping and development. Next, the nature of the charges will be considered, to find if the several types of cost items occur in normal amounts, and more carefully to canvass the relative disbursements through Ton, Time, and Fixed accounts. The dual participation of labor and supplies can now be traced through the work.

Turning at last to the meter of mine work, tonnage, one must investigate painstakingly all phases of this, the most vital and intricate aspect of the subject. Thereafter, aided by detail plots and tables, the accounts are probed into, one by one, and all those that parade an excessive outlay on a ton of shipped ore will be marked, and the precise reason for the excess and wasteful margin sought after. A diligent search for all those elements that deform the economy of mine work will unfold the more evident defects in operation and organization, and awaken a keen interest in the origin and elimination of even the smaller hidden flaws.

Through recurrent investigations of mining costs, occupying at most three or four office days out of each month, the operator competent in cost analysis can ascribe a great part of the result to his personal skill should he succeed in reducing expenditures satisfactorily. In any case, he has become a sound critic of his own mining costs, and knows what the desired lowest operating cost possible will be. Supervision is a mixture of physical overseeing with technical directing, each having its advocates; without concurrence with either side, it is certain that mine work can better be inspected through the tonnage costs if these are clear and accurate. And true and telling representation is easy to attain through an orderly and methodical arrangement of the mining accounts that presents faithfully the everyday features and routine common to all mine work. In fact, mining costs can be standardized by simply permitting the cost records at all mines to show the general, the universal structures, of mining.

Hunting for Mechanical Trouble

Trouble hunting is the particular job of the repair mechanic. Although careful listening is of service in finding the general location of faults in operation in a machine, the taking down of the parts and visual examination are the important methods generally used to ascertain the specific source of difficulty. Good light is of the greatest service, and there is nothing handier to the repair man than a portable lamp on a cable of sufficient length to give access to the principal machines in operation. A portable lamp with attached cable permanently installed at a central point should always be at hand, so that the repair man will not have to hunt around to get it when called upon to help a "sick" machine.

South African Diamond Mining in 1920

The estimated value of the diamonds produced in the Union of South Africa during 1920 constituted a record for the industry, according to *Commerce Reports*. The value of the mined, alluvial, and débris-washed diamonds totaled for the year the sum of £14,762,899. The bulk of this amount, or £12,289,602, came from the mines, £2,441,440 was won from alluvial mining, and £31,857 from débris washings. The previous record year was 1919, the output being valued at £11,734,495. Prior to 1918 the high mark was 1913, when diamonds were produced to the value of £11,389,807.

The last year's output aggregated 2,545,017.47 carats, of which 2,312,436.55 came from regular mines and 221,460.17 from alluvial mining; 11,120.75 carats were recovered from débris washings. It is to be noticed that production in the last six years has been practically constant, except for 1914, which was an abnormal year. The year 1917 was the high mark in this period, with 2,902,416.51 carats, and 1916 the lowest with 2,346,330.21. In the last three years production has fluctuated approximately by only 50,000 carats. The year 1910 is still the record by volume for the industry, 5,456,558 carats being taken in that twelvemonth.

Though production value constituted a record, the sales of diamonds in 1920 fell below the total of 1919 by £3,411,257—from £13,739,662 to £10,328,405. This decrease is accounted for by the large drop in the volume sales, which were only 1,765,993.82 carats, as compared with 1919 sales of 2,648,931 carats. The sales total would have been even less in value except for the increase in the price realized, which was 117s. in 1920, against the 1919 figure of 101s. per carat. This high figure reflects the effect of abnormal conditions on prices, as the price realized per carat in 1917 was 51s. 1d. and in 1918 was 54s. 9d. That these high prices stimulated production is evident in that there were nineteen mines producing in the Union in 1920, compared with sixteen in 1918 and eleven in 1917.

The fluctuating character of the diamond industry is indicated by the fact that though the value of diamonds from mines rose from 75s. 9d. in 1919 to 106s. 3d. per carat in 1920, the value of alluvial diamonds declined from 261s. 6d. to 220s. 6d. On the other hand, when the increase in the value of the alluvial output between 1918 and 1919 was from 134s. 6d. to 261s. 6d. mine output increased only from 51s. 5d. to 75s. 9d.

Because of the special manner in which diamonds are marketed through the Diamond Syndicate, it is interesting to note the difference between the production and sales figures. In 1920, sales by volume were 779,023.65 carats under production. In 1919 sales were 60,813.95 and in 1918, 104,572.45 carats above the output. In 1917 the position was reversed and production exceeded sales by 586,206.90 carats, whereas in 1916 such excess was 51,383.33. Taking this five-year period, the total production of diamonds exceeded the total sales by 1,254,228.48 carats. During this same period the value of output exceeded realization value by £4,114,[illegible]

The production within the Union is divided, in order of importance, among the Cape, the Transvaal, and the Orange Free State. The Cape contributed [illegible] carats, of which [illegible] were from the Kimberley mines. The Transvaal production was [illegible] carats. The share of the Orange Free State was [illegible] carats, of which 269,175 carats were from the nine mines situated in that district.

THE KELLY MINE, AT RANDSBURG, CAL., WITH GRADY SHAFT AT LEFT

A Sagebrush Silver Producer

Kelly Mine, at Randsburg, Cal., Establishes Enviable Record for Steady Output Of High-Grade Silver Sulphide Ore—Main Shaft 580 Feet Deep and Mine Opened Up to 350 Level—Adjoining Grady Lease Shows Interesting Ore Occurrences

BY JAY A. CARPENTER
Written for *Engineering and Mining Journal*

THE KELLY MINE has been described[1] as a mine that started at the sagebrush roots. To a depth of 50 ft. no dump was maintained, everything mined being shipped to the smelter and yielding $96,000 in dividends. At the time of my stay in Randsburg in the late fall of 1919, having come directly from the Divide district in Nevada, I was mentally comparing the two new silver mines, the Kelly and the Tonopah Divide, as both possessed remarkable bodies of oxidized silver-bearing ore, with the possibility of developing sulphide orebodies with depth.

A SPECULATOR'S PARADISE

Around the Divide mine the country was dotted with large headframes and with hoist houses filled with expensive prospecting equipment. In the town of Tonopah the many stockbrokers' offices were jammed with speculators scanning the blackboard for the latest sales of their favorite Divide promotion, and who sought the latest "dope" from their friends, be they promoters, superintendents, or miners.

In Randsburg a few lessees were to be seen slowly windlassing from as deep as 50 ft. to 75 ft. The more capitalistic lessees had low tripods and noisy little hoists. In the town, the people refused to be excited by this freak occurrence of silver in an old-established gold camp, and the only crowd on the street was that in front of the postoffice on the tri-weekly mail days.

In February and March of this year (1921) I visited both districts again. In the Divide district the cold winter winds were whistling unheard amid the many deserted headframes, and in Tonopah the minds of the people were so dazed by the meteoric descent of their hopes, as registered in the stock board, that they failed to realize in their gloom that the Divide is a steady shipper of oxidized milling-grade ore, and that the camp of Tonopah is one of the most fortunate and one of the busiest camps in the West.

In Randsburg the people are beginning to speak of the Kelly mine with pride, but they proceed on the even tenor of their way, and all the lessees except one have abandoned the windlass for a lease in the Yellow Astor, for a chair by the stove near the soft-drink bar, or at the round card table near by. Meanwhile the one lucky lessee has three shifts a day working to get out the ore in sight before the lease expires, and the Kelly mine is going steadily along shipping a car a day of high-grade silver sulphide ore and paying extra dividends on top of monthly dividends. Such is the contrasting psychology of the two camps under the same stimulus of the finding of a new mine and its development.

In contrast with the rapid development of the Divide properties, the Kelly mine has been opened up by crosscuts and drifts on the different levels to only the 350 level, but the main shaft has now reached a depth of 580 ft. with main east crosscuts being advanced on the 450 and 550 levels. In addition, the Grady lease is mining ore on its 315 and 360 levels, and has intersected the vein at 415 ft. in its vertical shaft, and in a crosscut from the bottom 450 level. Though the mine has been opened up by drifts on the veins only to the 350 level, this work has disclosed a remarkable change in the nature of the ore and in its occurrence.

ORE OCCURS IN FLAT, SLIGHTLY DIPPING LAYERS

The occurrence of the ore near the surface has been described as follows:

"The shaft more nearly resembles a glory hole, being about 20 ft. wide and 30 ft. long, the length being along the N. 10 deg. E. line of the bucket skids, and coincides with the approximate strike of the reef. The most noticeable feature on going down the shaft is that the ore lies in nearly flat layers. The layers are very distinct and are horizontal north and south, but dip from 5 deg. to 20 deg. to the east. They vary from hard blue quartz to oxidized soft quartz, all carrying silver, but the richest are the softer layers, which are splotched with horn silver. This appearance of the ore lying so flat led many to believe at the start that the ore was a shallow surface deposit, or more of a blanket vein. However, the bucket skids to the 50 level rest on a well-defined slip striking N. [illegible] deg. E. and dipping 78 deg. to the east, both dip and strike being the same as the main reef.

---

[1] *Engineering and Mining Journal*, Dec. [illegible] [illegible]

"A careful scrutiny of the sides of the shaft shows vertical stringers of quartz cutting in a continuous line through the flat layers. The stringers are parallel and have the same strike and dip as the foot-wall slip. A crosscut to the east shows one of these stringers 30 ft. away from the foot wall. It has a width of nearly 2 ft., assays high in silver, and could be called a vein by itself. From the above observations it is reasonable to form the hypothesis that the mineralizing solutions ascended along fissuring within and parallel to the dike, and that these solutions also spread out horizontally along the horizontal fracturing in the rhyolite. If this hypothesis be tangible, then there is excellent possibility of finding ore at depth along the strike of the reef."

The above description was written in October, 1919. The history of the development of the mine since that time I have obtained from an excellent report by M. B. Parker, consulting engineer during 1920, and from a personal observation and study of the mine.

Subsequent development work on the 50 level showed that ore of shipping grade extended for 220 ft. along this shaft-fracture plane. The ore on the south side of the shaft down to the 50 level still remains unbroken, and 14 ft. in width averages $329 a ton. The 2-ft. vein of rich quartz ore already mentioned proved to have a north-south course, and for 100 ft. to the south it is known now as the Meroney stope, and its intersection with the shaft fracture to the north made the wide orebody in the Kehoe stope.

Richest Ore at Vein Intersections

On the 90 level, 400 ft. of drifting was done along the shaft fracture. The first 125 ft. north from the shaft was in shipping ore, a good part of it averaging $250 to the ton, with the remaining 100 ft. of the drift of a fair milling grade. The richest ore was along the intersection with the north-south vein, producing the rich Parker stope. For a distance of [illegible] ft. south of the shaft spotted values were in evidence, but all of this was of milling grade for 85 ft., and the remainder showed low values only. The north-south vein was stoped for 100 ft. south of its juncture with the shaft fracture, and was known as the Treasure Box stope. One car of forty-two tons from this stope had a gross value of $52,000. Shorter parallel stopes were opened up on each side, but these with depth merged with the center one, thus showing the tendency of the ore to form along the parallel fracturing in the schist.

On the 150 level drifting on the shaft fracture gave practically no ore, although that on the north-south fracture gave shipping ore for 100 ft. in length. At 110 ft. east from the stope a cross fracture with a northeast-southwest course was encountered, and drifting disclosed considerable ore of milling grade. A crosscut to the west for 90 ft. back of the shaft fracture in the foot wall disclosed nothing but altered schist until it encountered another silicified parallel fracture plane. The work on this level was disappointing after finding such remarkable orebodies on the 90 level, and apparently confirmed the predictions of the many who compared the orebodies with the enriched bodies of silver chloride ore that had been found at Calico and other deserted camps of San Bernardino County.

Also, the work on the 90 and 150 levels had indicated that the veins did not persist far to the north, east or south, owing to their encountering a fan-shaped fault plane.

The fault plane on this level has an average dip of 45 deg., and is marked by a band of black clay containing pyrite. Back of the latter the country rock is soft and greatly altered, folded, and twisted. It appears to be the same granitic schist, but the horizontal bedding planes are not in evidence, and it lacks the silicification of the ore-bearing schist. From its appearance it became locally known as the "mud wall," and little prospecting work was carried on in this formation, as it was the same that the unsuccessful surrounding lessees to the north, east, and south had encountered in the shafts.

ANOTHER VIEW OF THE KELLY [illegible] AT LEFT, SHOWING DUMP. GRADY SHAFT AT RIGHT OF PICTURE

Depth of Silicification Determined by Foot Wall Crosscut

Crosscuts that were driven in the foot wall of the shaft fracture to the west under the big dike failed to find ore, and also determined the fact that the silicification of the reef at the surface did not go down, but partakes more of the nature of a crust. There is no acceptable evidence that the reef is a dike of silicified intrusive rock, parallel to many rhyolite dikes to be found in this district, but, rather, it appears to mark a fault scarf along which there was considerable movement and silicification. The crosscut from the shaft showed the country rock to be the granitic schist so common to the Randsburg district, although altered and silicified by the same intense fracturing and silicification that produced the reef. Frank L. Hess, of the U. S. Geological Survey, terms this schist a mica albite schist of probable sedimentary origin and speaks of strata-of quartzite 6 in. to 6 ft. wide interbedded with the schist.

With the limits of the persistency of ore found in all lateral directions and a diminution of values on the 150 level, the development of the 200 level was watched with apprehension. The shaft fracture was barren, and the fracture vein that yielded the rich ore on the 90 level was also barren. However, the first good ore was encountered at 120 ft. in the northwest-southeast cross vein, and at 140 ft. a new north-south vein was drifted on and the ore shipped for a distance of 135 ft. The stope on this ore is known as the Harrell stope, and it does not connect with the Jameson stope above or any known orebody on that level. A raise on this vein at the south end showed the vein to have the same dip to the east as the shaft fracture, but at 30 ft. it encountered the mud wall lying at a flat angle, and the vein stops. On the upper levels where the mud wall with a steep pitch intersects the veins there is naturally ore along the mud wall, but where the pitch is flatter mineralization has not occurred along this so-called mud wall. The crosscut was continued beyond this high-grade north-south vein, and at 30 ft. drifting was begun on another north-south mineralized fracture. An east crosscut from this drift connects with the west crosscut on the 190 level of the shaft of the Grady lease. The mud wall cuts across the west drift at a flat angle and through the Grady shift at about 200 ft. in depth.

The ore on the 200 level was mainly sulphide ore, and though the sulphide found in the oxidized ore was principally stibnite, the 200 level showed more pyrite and argentite.

Vertical Quartz Vein Regarded as Primary

On the 250 level the crosscut from the shaft at a distance of 112 ft. struck a vertical quartz vein from 6 in. to 1 ft. wide assaying 200 oz. in silver. The quartz was close-grained with the silver sulphide minerals and pyrite apparently deposited concurrently with the silica, which Mr. Parker terms primary ore. At 144 ft. another nearly vertical vein was encountered, and this has been opened up as a continuous stope of shipping ore for 150 ft. to the Grady lease line. This stope is known as the Hughes stope, and connects with the Harrell stope above. The vein found at 112 ft. joins this vein 60 ft. to the east, and the stope over this distance is known as the 112 stope. The main crosscut also encountered another mineralized north-south fracture at 220 ft. out, but in a distance of 260 ft. to the east the mud wall was not encountered, probably because it lies in a blanket formation above.

On the 300 level the crosscut from the main 74-deg. inclined shaft picked up the north-south vein, and for a distance of 100 ft. to the Grady lease line this is being stoped 6 ft. wide as the 614 stope. The vein here has a strike of a few degrees east of south, with a dip of 80 ft. to the east. The end of the stope against the Grady lease line shows a beautiful band of nearly solid black sulphides from 6 in. to 12 ft. in width, with streaks of sulphides into both irregular walls.

At 180 ft. in the crosscut another parallel vein has been drifted on for 70 ft., giving considerable shipping ore. The peculiarity of this vein or fracture is that, contrary to all the others, it has a dip of about 55 deg. to the west. It apparently shows up on the No. 5 level as the mineralized fracture at 220 ft. out from the shaft. The main east crosscut on the 300 level has been extended 280 ft. with the chance of picking up more north and south veins in the silicified schist.

On the 350 level a north-south vein containing good ore is being drifted on; on the 450 level a drift at 115 ft. on the crosscut gave mill ore, and the crosscut on the 550 level unexpectedly encountered shipping ore 4 ft. in width at only 80 ft. out, with 15 ft. of milling ore just beyond the shipping ore.

The development work on these three lower levels is necessarily north of the Grady lease line, though the rake of the ore shoots indicates that the best ore would be found in the Grady lease. However, the 550 level is below the depth limit of the lease, and a south drift on the vein will be carried out under the lease for a future connection. The east-dipping vein of stope 614 on the 300 level has been opened up at greater depth by the Grady lease from a vertical shaft sunk at a point 300 ft. S. 52 deg. E. from the main Kelly shaft.

The lessees on the projected outcrop of the Juanita vein just west of the Kelly shaft found no ore, and the workings in the Kelly mine show no vein with this strike, but a line through the center of the rich ore shoots takes the same course. The main shaft on the lease started in wash and then entered the same altered schist that characterized the formation beyond the mud wall in the Kelly mine. At about 200 ft. the shaft entered the siliceous schist, the dividing line in the shaft being shown to visitors as a black band striking across the shaft nearly horizontally at the same flat dip assumed by the bedding planes of the siliceous schist.

Below this point in the shaft the first silver values were obtained in narrow seams, striking northerly and southerly. On the extension of the time of the lease the disputed question of apex was dropped, but the lease was limited to a block of ground 120 ft. square, with the new shaft as a center, and to a vertical depth of 450 ft.

Shipping Ore Present in Good Quantity

The east drift from the 310 level of this shaft encountered rich ore, which has been drifted on north and south to the limits of the lease block, and a 25-ft. raise at the north face connects with the face of the south drift of the company's workings under the 615 stope, thus giving a continuous shoot of shipping ore 200 ft. long, with the southern limit still undetermined. This same rich vein has been drifted on for 40 ft. on the 360 level of the lease, but the drift is more like a room, as it produced shipping ore for considerable width. The shaft at 415 ft. cut through the vein, giving 12 ft. in its depth of shipping ore, and the crosscut on the 450 level has disclosed good ore below, which the company will mine at a later date. Meanwhile, the fortunate lessee has three shifts developing and extracting ore, with the lease to run until January of next year.

The ore as disclosed on the 300 level drift of the company workings and the 315-ft. and 360-ft. drifts on the Grady lease occurs in what would generally be termed a quartz vein. This vein does not have a consistent width or sharp walls, or any width of clay gouge. However, on one side or the other of the ore there is usually a well-marked slip, with a slickened clay or talc the width of a knife blade. Apparently it follows a fracture plane that in passing through the nearly horizontal schist made a ragged break. The vein filling is a dark quartz carrying pyrite and silver sulphide minerals, all finely crystallized. Where there is quartz there are sulphides also, but often for a few feet both vertically and horizontally the ore appears to the eye as nearly solid sulphides for a width of 6 in. to 18 in., and has a specific gravity of 5.0. A composite sample from 180 sacks of this sulphide assayed over 2,400 oz. in silver.

A few engineers believe that the sulphide ore of the 300 level, and that on the levels below on the Grady lease, are of secondary origin, but the general opinion of the engineers is that it is a primary ore. The soft black argentite and native silver are both absent from this ore. In fact, native silver, which is always presumed to be secondary, is not found in the ore in the Kelly mine. One engineer stated that he had seen small flakes of native silver in rich ore on the 150 level. The ore from the 150 level and upward carries the silver as the black soft sulphide and the flaky chloride of silver. If the present rich sulphide ore should prove to be partly secondary, its continuation to at least the 550 level has been assured by the present development work, which gives shipping ore for many months to come.

Mining Complicated by Enriched Vertical Cross Fractures

The veins containing the sulphide ore have so far disclosed ore shoots over 200 ft. long, but at the end of some of these the veins dwindle down to a mere but persistent seam or fracture in the schist, and may open up later into pay ore. In addition to the rich sulphide ore so easily traced by the eye as a distinct vein inclosed by country rock, this rock shows fine veinlets of sulphides parallel to or branching out vertically from the main vein. Thus the veins as finally mined for milling ore will have assay walls only, and this problem of mining is further complicated by enriched vertical cross fractures between the general north-south veins and by the fact that where the milling values play out on the north-south fracture they may come in on another one a few feet away.

The company owns the ground for several hundred feet to the south and north along the projected course of the sulphide veins, and also the ground for 500 ft. to the east beyond the Grady shaft, in which there is the chance to encounter parallel veins similar to those found in the present development to the east from the Kelly shaft. On the lower levels the mud wall has not been encountered, and it is probable that the mud-wall formation does not extend to this depth.

Surface Enrichment Theory Dispelled

Those who prophesied that the ore was just a surface enrichment in the softer schist above the harder unaltered granite of the district have seen the ore change from a silver chloride ore in a blanket or pancake formation to a silver sulphide ore in nearly vertical quartz veins, and they have yet to see the granite. It would appear that the silver-bearing solutions followed upward along the nearly vertical fractures in the horizontally bedded schist. Near the surface either the mineralizing solutions have penetrated horizontally into the softer layers of the schist or else the decomposition of the original minerals due to weathering resulted in the redeposition of the silver values as chloride and sulphide in the oxidized and altered horizontal layers of the schist.

M. B. Parker, the consulting engineer, in August, 1920, estimated the ore reserves above the 250 level to be about 19,000 tons of $100 shipping ore and 70,000 tons of $20 milling ore. After a careful sampling of the mine in narrow-width samples in August, and considering the new development work on the 300 level, he raised his estimate of shipping ore to about 18,000 tons of $180 ore.

The tonnage of milling ore has been difficult to estimate, for there has been no attempt to block it out, as development so far has been confined to the more profitable work of finding and blocking out shipping ore. Meantime, the management announces, "investigation has been begun in contemplation of the erection of a mill as against the return of pre-war prices of silver around 50c., and through which the management looks for continued if lessened profits," but "for the present the policy of the management will be to market every possible ton of shipping ore."

The mine was discovered in April, 1919, and by January, 1920, a dividend of $99,500 had been declared. Since that date, fourteen regular monthly 2c. dividends have been paid, amounting to $358,400. In addition, two special dividends of 10c. each have been disbursed, or an extra $256,000, giving a grand total of $713,900 in dividends. This amount, together with money in the treasury, March shipments, and March royalties, will give a million dollars in profits on the mine's second birthday, with ore reserves and possibilities of shipping ore that should give an equal profit in the next two years.

Ontario's Gold Production Recovering

Although there was a decline in Ontario's gold production for the first quarter of 1921, as compared with the first quarter of 1920, this situation will undoubtedly be reversed for the first half of the year, according to the Ontario Department of Mines, the falling off being due to hydro-electric power shortage. Since early in April an ample supply of power has been available, and the Hollinger mine is treating 3,300 tons of ore daily. The following table shows the output for the quarter:

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

In addition, 43 oz. of gold, worth $862, was recovered from nickel-copper refining operations. Gold mining companies received further a total of $331,356 by way of exchange premium, or as earnings on credit balances in the United States. Gold shipments go to the Canadian mint and are paid for by check on New York. Three mines at Porcupine—Hollinger, Dome and McIntyre—were producers, and at Kirkland Lake, Lake Shore, Teck Hughes and Tough-Oakes. In May the Wright-Hargreaves, at Kirkland Lake, commenced milling operations.

Electric Vibration Applied to Gyratory Crusher

A new type of gyratory crusher is attracting much favorable comment from mining engineers around New York who have seen the working model. The central shaft is electrically vibrated by a device similar to that used in the Mitchell screen. Much smoother operation and greatly increased capacity are expected to result. The new machine is not yet on the market.

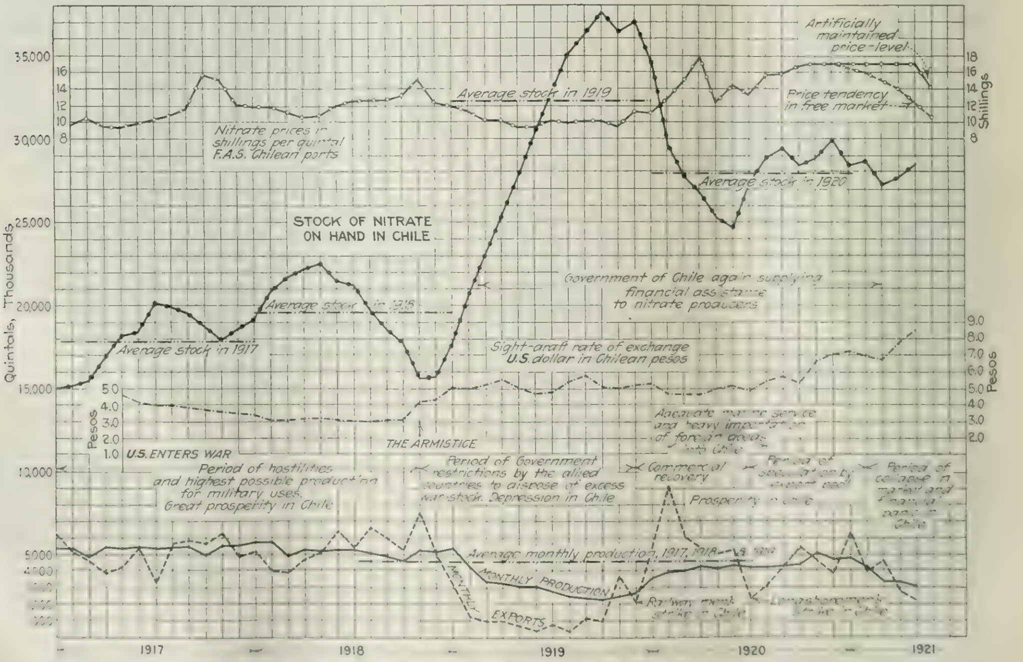
The New Price Levels in Chilean Nitrate

The Country's Prosperity Greatly Dependent on Local Nitrate Industry — Decline In Prices Has Caused Economies To Be Introduced — Chilean Government Is Participating in Solution of Marketing Problems — American Machinery Used

BY DONALD F. IRVIN

Written for *Engineering and Mining Journal*

IN COMMON with all regions that depend upon a single basic industry for their support, Chile has suffered greatly by the recent rapid collapse in prices and abstention from buying by the world at large. It is generally known that the nitrate industry normally furnishes employment for from 50,000 to 60,000 workers in the Chilean nitrate area, thus creating a demand for large amounts of staples to supply their needs. At the same time, the profits derived from an export tax on Chilean nitrate, set at 2s. 4d. per quintal of 101.4 lb., have provided the larger part of the Chilean government's annual revenue, and have exceeded usually the equivalent of $35,000,000, United States currency, in recent years.



NITRATE PRICES, STOCKS, PRODUCTION AND EXPORTS

The profits from the operation of the many stock companies engaged in the production of sodium nitrate in Chile have furnished large totals, which during 1920 reached as much as 19,500,000 pesos, Chilean, for one of the three larger nitrate organizations—a sum approximating $4,000,000 in United States currency at ordinary rates of exchange. Bearing in mind the scanty population of Chile, which is now claimed to be about 3,800,000, it is easily realized that the nitrate business bulks large in Chilean affairs, from any point of view.

The government bases its annual budget chiefly upon an estimated annual sale of Chilean nitrate in other countries for the fiscal year, and this budgetary estimate involves the interests of the governmental organization, the military establishment (army and navy), the civil employees, including the government railway, as the latter is not self-supporting, but has been the source of an enormous deficit annually in recent years, and the foreign holders of Chile's external obligations.

In the agricultural regions of Chile, the sale of beef cattle, flour, beans, and general farm produce depends greatly upon the purchasing power of the inhabitants of the nitrate region in the north of Chile, and the investing public looks to nitrate company shares to provide an income from invested capital, both foreign and Chilean in origin. Coastwise traffic in Chile has grown up from the needs of the several "nitrate ports," and the employment of unskilled labor in the nitrate fields has become of such importance in Chile that the degree of employment, or the lack of it therein, has become an accurate barometer of Chilean commercial conditions generally. This brief statement suffices to show the gravity of the situation caused in Chile, when nitrate sales fail to materialize at the expected season, which situation developed almost coincidentally with the downward slide in prices in the late fall and winter of 1920.

It should be noted that for over a year the "Association of Nitrate Producers" has regulated the selling price of nitrate in Chile, and hence natural tendencies were not duly reflected in the nitrate market, as is usual with those commodities marketed in free competition.

NITRATE PRICES SHOW A LARGE DECLINE

The accompanying graphs, compiled from official statistics, show that an immediate slump in nitrate sales followed the cessation of hostilities in 1918, and for many months afterward depression ruled in Chile. In the late fall of 1919 active buying was resumed, and the market quickly took on a "boom" character, the price running up to excessive figures. At this time speculation undoubtedly began in future sales of nitrate. Speculative interests in nitrate obtained a rigid price guarantee from the "Association of Nitrate Producers," covering the winter of 1920 and spring of 1921, during which period their venture should have culminated.

The enormous stock of nitrate which had accumulated in Chile during the post-Armistice slump was exported in large part, but the nitrate plants continued to produce at high capacity in 1920, and so kept the stock on the Chilean coast at a continuously high figure.

It had been customary to expect nitrate inquiries and sales for fertilizer use in the fall months, culminating in heavy shipments at the end of the calendar year, and this expectation prevailed in Chile in 1920, as in previous years. Coincidentally with the collapse of commodity prices at about that time, it was soon found that the cotton, sugar, and grain growers were not in the market for fertilizer, as their own products were not in the customary demand, and immense quantities of 1920 crops were being carried over into 1921, perforce. This condition left an unwieldy stock of unsold nitrate lying in the warehouses of the northern hemisphere, which was to have been sold in the fall and winter of 1920, but which instead remained to be a drag upon the already excessive stock lying unsold on the Chilean coast. Hope was still felt that sales for spring fertilizer could be made in January, February, and March of 1921, but commercial distress began to be felt in Chile at the end of 1920, and when March, 1921, was passed without sales, it was evident that stoppage of nitrate production was imperative in order to work off existing stocks and avoid a general crash.

REPARATIONS AND SYNTHETIC NITRATE IMPORTANT CONSIDERATION

Closely linked with the industry is the economic well-being of the Central European countries. The form of reparations payable by Germany is of great importance to Chile, as the purchasing power of Central European farmers governs the sale of nitrate to Chile's greatest single pre-war consumer of nitrate—the sugar-beet growers of Germany, Austria and Poland. Of great significance also is the attitude which may be taken by the German government toward adoption of a protective tariff for the stimulation and maintenance of the synthetic nitrate plants now operating in Germany, apart from the automatic restriction exercised upon imports into Germany by the unfavorable international exchange.

The Chilean producers of nitrate now find themselves facing a market temporarily oversupplied, and a compulsory stoppage of the industry, or most favorably, a very low rate of production, as compared with normal. At the same time, cessation of exports has developed a dislocation in foreign exchange, whereby the Chilean peso is now (May, 1921,) worth approximately $0.11, United States currency, instead of its usual value of $0.20, United States currency, and likewise there is widespread unemployment in nitrate and metal-mining districts.

For those nitrate companies whose direction has been conservative enough to maintain adequate reserves, and which amortize their investments heavily during the good years, the present era will prove to be an excellent opportunity to undertake mine development, owing to the cheapness of the Chilean peso, and a consideration of future competition (both among the Chilean companies and against their common competitor abroad, the synthetic nitrate) will show the pressing need of embracing every possible means for reducing the unit cost of nitrate.

CHILEAN GOVERNMENT TAKES A HAND

A radical step has been advanced this month, emanating from the present Chilean Administration circles, which contemplates the assumption by the government of all privileges of exportation and sale of nitrate, and the fixation of prices at such a point as would insure successful competition with artificial nitrate abroad. Payment for nitrate by the government to the producer would be made by issue of 4 per cent gold bonds, redeemable after conclusion of sales of nitrate abroad, and any profit derived by the operation of the industry would be divided equally between the government and the producers. Even though the provisions of this scheme include the abolition of the export duty, as such, it does not appear that this proposal is being welcomed by the producers as desirable, as government operation of the Chilean state railways has been blamed generally for the financial troubles in the country's railroad development and management.

The proposal for a governmental sales bureau having obtained so unfavorable a reception, the following counter proposal was evoked, and seems likely to be adopted as the means to remedy the existing situation:

First, the holders of the speculative stock of nitrate in Europe, which amounts to about one million tons, agree to reduce their asking price to £14 per ton, representing a cut of 33⅓ per cent in the reported cost, c.i.f. European ports.

Second, the nitrate producers in Chile are to sell one million tons of their own product at a price that will permit its sale at £14 in Europe. It is said that this will require a selling price of 8s. per quintal in Chile.

The loss of about £7,000,000, caused by the reduction in the asking price in Europe on the speculative stock, is to be shared between the speculators and the producers, in some manner to be agreed upon. It is stated that the proportion would be about 66 per cent by the holders of the European stock and 33 per cent to the producers in Chile.

Third, the one million tons to be sold by the producers shall be exported from Chile, beginning in September next, at the rate of 150,000 to 200,000 quintals per month.

Fourth, this exportation will enable the Chilean government to count upon the export duty from a definite exportation, even though the exportation should not occur in response to actual purchases abroad. Furthermore, renewal of nitrate operations would at once provide employment for the great mass of idle workmen in the nitrate business.

Fifth, it is claimed that the price thus set, £14 per ton in Europe, will undercut the competition of ammonium sulphate and other artificial competitors for fertilizing. Whether this be so or not, it is known that in recent weeks sodium nitrate has been offered without finding a market, at less than £14 per ton in North American distributing centers.

Sixth, the Chilean government, in consideration of the foregoing, is to agree that export duties may be payable at a fixed rate, thus waiving its existing privilege of collecting a super charge on the normal duty of 2s. 4d., which not infrequently reached a total of 3s., for that reason.

ECONOMIES IN MINING ARE NECESSARY

In view of the contemplated necessity of selling at the low price of 6s. per quintal in Chile, due to the requirement of absorbing a part of the loss on the speculative stock in Europe and of meeting a price of £14 per ton in Europe, at this time, it now remains for the nitrate producers to introduce economies within their own control, which would naturally occur in the present mining, transportation, and treatment processes. Such steps are essential for the success of future operations if prices are now entering upon a long period of low average levels.

There is persistent advocacy of the policy of "free sale" and abolition of the price-fixing policy adopted by the Association of Nitrate Producers, which has been blamed by many for the present situation. The adoption of such a step will depend entirely upon the success of the plan that has just been outlined, and whether it is carried out fully. If, and when, freedom of sales again exists, those plants in condition to produce at lowest cost will survive the era of depression and difficulties into which the nitrate industry has entered, and those not so situated will have the alternative of suspension or liquidation.

The graph of prices shows that some nitrate sales made outside of the association during the last four months have been closed at prices which are rapidly dropping below the official quotations of the association.

An example of foresight and preparation is shown by a number of large nitrate plants controlled by the Jugo-Slav financial group in Chile, in having their properties overhauled and remodeled on a basis of scientific economy, beginning about two years ago. These oficinas, as a result, have demonstrated a reduction in operating costs, and will be in an excellent technical position, after alterations are completed, to meet cut-price competition, whether local or foreign.

MODERN AMERICAN EQUIPMENT BEING INSTALLED

It is interesting to note that the cost-cutting equipment and methods that the Jugo-Slav group has installed embody in many instances the standard types of American industrial and metallurgical machinery. Electric power is used wherever feasible, employing "G. E." and Westinghouse material. An extensive conveyor system, supplied by the "Robins" company, handles the crushed caliche, or raw nitrate material, and a continuous tandem-filtration plant using "Oliver" filters has been selected for treatment of the clayey portion of the raw material.

It is a matter of common conviction that the era of huge profits in nitrate exploitation has passed, and that the basis of business hereafter will be founded on a regime of thrifty operation. The search for the utmost in economy, which was neglected during the frenzied period of war prices and unnatural stimulation of production, can now be scientifically undertaken. This economy can be sought in three directions: First, in a relief from external costs, such as export duty, railway freight, and handling charges; second, reduced mining and transport charges, by possibly applying large-scale earth-moving machinery, and third, better treatment plans, with a reduction in the losses of soluble nitrate now thrown away in the slimy tailings, and which saving has led to the erection of the "Oliver" tandem filtration plant, previously mentioned. Handling larger amounts of raw material implies lower grade in nitrate content, and therefore demands a modified treatment plan. Another factor demanding economy in nitrate treatment is presented in the item of fuel consumption, caused in the boiling of the raw material. This item is usually computed to be 50 per cent of the treatment cost.

From the foregoing sketch of conditions it is plain that a period of forced economy has arrived in the Chilean nitrate industry, and that it is becoming generally realized that those who have provided low-cost possibilities for their nitrate plants, by economical modern equipment, will be in position to affect sales. Low price levels and scanty sales make this an inevitable result, and for the technical improvement of the industry it is a helpful condition.

Italian Sulphur Production Declining

BY HENRY L. GEISSEL

Written for *Engineering and Mining Journal*

For the last few years production in, as well as exportation of, sulphur from Italy have largely decreased. This is shown by the following official figures:

	Production	Exports
	— In Metric Tons —	
1913	406,406	351,339
1914	403,558	260,333
1915	380,240	393,908
1916	287,965	326,435
1917	230,074	118,340
1918	253,390	192,227
1919	255,316	119,888
1920 (8 months)	225,249	120,551

The sulphur deposits on the Island of Sicily are still being exploited in the most primitive manner. The cost of production during the war and the following years was fivefold as high as in pre-war times. The high cost of living was, to a large extent, responsible for this increase. In 1914 the cost of production was 80 to 85 lire per ton; in 1920, however, 420 to 430 lire. The selling price at Sicilian ports rose from 110 to 115 lire in 1914 to 650 lire in 1920. As will be seen from the accompanying table, production and exports in 1920 increased somewhat. Great efforts are now being made further to increase production. Thousands of children are still employed in the Sicilian sulphur mines.

BY THE WAY

Addendum

To resume our exposé of the subject of cable addresses and the like, which we entered upon two weeks ago, we note with interest on the letterhead of W. J. Loring, president of the American Mining Congress, that his cable address is "Wantoness." And our consulting specialist in nomenclature didn't have a darned thing to do with it either.

Justice at Last

A grave injustice is about to be rectified; perhaps it already has been straightened out. All it needs is a signature, a flourish of the pen—that of President Harding. For countless ages the State of Colorado has been furnishing without charge 60 per cent of the water in the Colorado River that further along its course has carved out the Grand Canyon and then helped fill the Gulf of California, which might otherwise have been a desert basin full of horned toads, rattlesnakes and scorpions. But Colorado hasn't been getting full credit for this, in a way. That is, it hasn't been advertised as widely and extensively as all advertisers should advertise. This Colorado River, instead of being known as the Colorado right up to its principal source, has long been dubbed by the map-making dubs at Washington and elsewhere as the Grand River wherever it flows in Colorado and over part of its course in Utah. But now Congress has set it all straight and has passed a bill making it the "Colorado" from start to finish, hence forevermore. This is enough to make Colorado stay Republican. If Mr. Harding vetoes this important measure it will be simply surprising.

More About Water

Just think of Colorado furnishing all that water for so many ages! Water is a mineral, though not always mineral water, and Colorado is one of the most mineralized sections of the country. Nevertheless, Colorado has long been a dry state, and this is not the only paradox in Colorado. But it is positively painful to think of all that water going to waste. As Professor Remsen says, "Water is H_2O." Further, much of the carbonaceous material carried in suspension is largely C, combined or uncombined. Here, therefore, we have all the ingredients for a first-class brand of ethyl hooch. The reader, if there be one, is here reminded that the ethyl variety, which vivifies, is C_2H_5OH; and that the methyl kind, which petrifies, is CH_3OH. To distinguish between the two, therefore, it is only necessary to take three fingers of each and look at the samples through a magnifying glass and note how the molecules are arranged. One of the advantages of such preliminary inspection with a magnifying glass is that three fingers are made to look like five or six or even more. This helps stimulate the imagination. The samples themselves will complete the process of stimulation. But this is a digression. To return to the Colorado again, the waste that has been and still is going on is something for the proposed Federal Industrial Waste Commission to look into. On the other hand, to be fair, there is such a thing as having too much water, as people in Pueblo and elsewhere will admit, so that the only question in such cases is how the excess shall be disposed of. To repeat, as at the start, water is mineral. We're glad of this, for otherwise we would not feel at liberty to enter into a deep discussion of it here. It is also a great space filler, as the cattle on a thousand hills and a thousand brokers on stock exchanges will testify.

A Mystery

Friedensville, Pa., has its mystery, without a clew, of course. The body of a well-dressed man was found in an abandoned mine there on July 2. Is it suicide or murder? The *Philadelphia Record* says: "The suicide idea is scouted because the man wore a silk shirt and hose and had $29.60 in his clothes." Agreed, say we. With life so full as it must be for one who owns a silk shirt and sox, to say nothing of $29.60, the suicide theory is untenable. Mining companies and other readers of the *Engineering and Mining Journal* may expect to receive soon a questionnaire on the subject of the "Prevalency of the Silk Shirt in Industry." The data thus obtained will be very valuable if we are asked, as we hope to be asked, to prepare for the fall meeting of the Institute a paper on "Silk as an Index of Industrial Conditions." This probably will be in the nonmetallic section of the program. We shall put this up to Secretary Sharpless at the first opportunity.

A Matter of Doubt

"A chap's pretty safe takin' a ride on tha cage these days, m'son," said Cap'n Dick; "for tha rope 'olds, tha bale usually is in fair shape, an' tha 'oistin h'engineer mus' naw w'ot 'ee's doin'. 'Tain't much like tha h'old days w'en mos' places didn't 'ave moor'n bucket an' a rope. W'ich remin's me o' one time back long we. A party o' these 'ere college professors come h'out to 'ave a geek 'baout tha place I wuz workin'. Daown they gaws in tha bal, an' comin' h'out we 'ad to 'oist two o' they at one time in tha bucket. Finally tha last chap wuz comin' h'out with Jimmie Trebilcock, an' 'ee noticed tha bloody rope looked a bit frail. "Ow often," sez 'ee to Jimmie, 'does 'ee change these ropes?' 'Baout once h'every three months,' sez Jimmie, 'an' we changes this one tomorrow—h'if we get h'up safe.'"

The Desert Prospector

By M. M. St. Clair

Bent was his form, with the load of years,
  Sparse his hair and streaked with gray;
Dim were his eyes with age that sears
  And winter [illegible] chill and [illegible]

But his heart was [illegible] and [illegible] was [illegible]
And his soul [illegible] I [illegible]
As he gallantly trudged with his laden jack
His hard earned grubstake in its canvas pack.
"We'll strike it this time," he cheerily said
As they slowly climb the canyon walls;
"We'll come back rich, Jack and I",
But the patient burro [illegible] to reply.

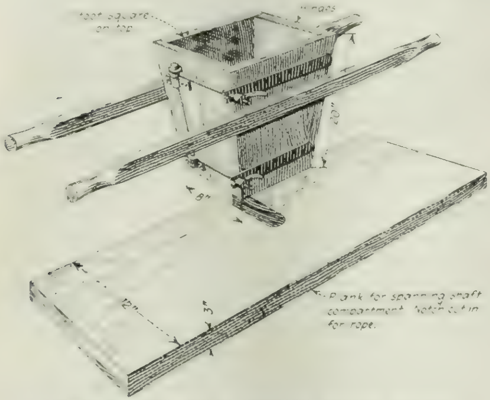
Alone in the night, when the work is done
And the desert stars show one by one,
Sometimes he wonders, in the shadows dim,
Just where he'll go when he "cashes in."
Half-hearted he hopes that the preacher's wrong
About the streets of gold and the heavenly throng.
No heaven for him is gold freely found
But hidden deep in the stony ground,
To be searched and mined and perhaps [illegible]
By some [illegible] by luck [illegible]
No heavenly music to him so sweet
As when steel and [illegible] [illegible]

HANDY KNOWLEDGE

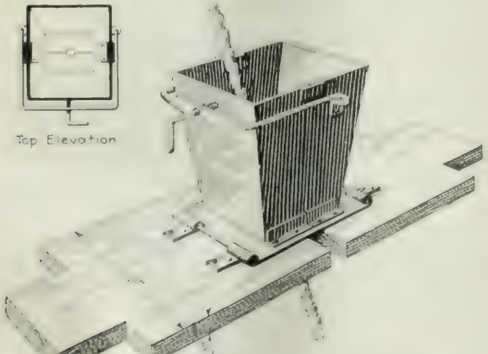
Applying Rope Compounds

Written for Engineering and Mining Journal

Compounds for lubricating hoisting ropes and preventing corrosion by keeping the wires from getting wet are used at all mines where hoisting is necessary. Many methods for conveniently applying the compound to the rope have been devised. Two appliances used at two mines on the Mother Lode in California, the South Eureka and the Central Eureka, are shown in the accompanying sketches. Both are similar in principle, but one is constructed of steel and the other of wood.


foot square on top
rags
10"
8"
12"
3"
Plank for spanning shaft compartment. Notch cut in for rope.

LUBRICATING DEVICE USED AT SOUTH EUREKA MINE, CALIFORNIA



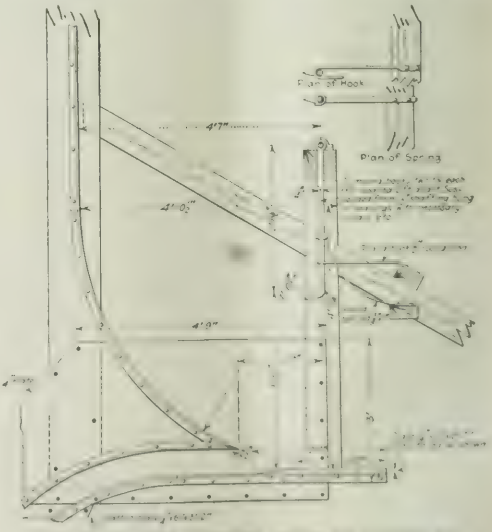
LUBRICATING HOISTING ROPE AT CENTRAL EUREKA MINE, CALIFORNIA

The device consists of a hinged hopper with an opening in the bottom of sufficient diameter to permit the hoisting rope to pass. At both of these mines the shafts are inclined at a steep angle. In "tarring" the rope, the rope compound is heated in a kettle in cold weather, and on hot days is used directly from the drum. The board shown in the sketch is placed over the compartment and additional planks to serve as a working platform are laid down. The hopper is adjusted in position. A piece of worn hemp rope (or rags) is put in the bottom of the hopper about the rope and tamped down by means of a stick. The compound is then poured in and the hoisting rope lowered so that it passes through the sticky fluid. The mass of hemp or rags is kept packed down by the stick and prevents leakage and at the same time wipes the rope free from excess.

Skip Dumping Irons

Written for Engineering and Mining Journal

In the use of vertical skips, dumping irons to track the skip wheels properly are necessary. In many installations these consist of two iron prongs on the front of the skip which bear upon a cross timber placed in a suitable position. At the main shaft of the Plymouth Consolidated Mining Co., Ltd., Plymouth, Cal., a different arrangement has been in use for some time, and has given satisfaction. The device consists of a pair of hooks suspended from a short length of shafting supported by the bin structure. The hooks are prevented from swinging forward toward the shaft by guard hooks and are returned to their vertical position by springs, which are shown in the sketch. The arrangement was necessitated by the fact that the skips used in this shaft are designed for a vertical as well as for an inclined shaft. The Plymouth shaft is vertical in its upper and inclined in its lower part. The top of the skip is consequently cut on an angle, instead of normal to the length of the skip, as customary in vertical shafts.



DETAIL OF SKIP DUMPING IRONS AT PLYMOUTH MINE, CALIFORNIA

THE PETROLEUM INDUSTRY

Deep Oil Wells in Texas

By Albert G. Wolf

[illegible] Engineering and Mining Journal

More often than not in describing a well the writer will refer to it as a "deep" well or a "shallow" well. A well of a certain depth would be a deep well in one field and a shallow well in another, so that those unacquainted with the field under discussion might wonder what constituted a "deep" well. The terms are merely relative.

In Texas, however, there are many wells, producing and dry, which would be considered as deep in any district. The deepest producing oil well in the state is the No. 2 Arnold well of the Texas Co., in Young County, which was completed in 1919 at a depth of 4,664 ft., making an initial production of 115 bbl. In February, 1921, this well was still pumping 15 bbl. daily. As a matter of comparison it might be added that the deepest producing oil well in the world is believed to be in Sicily and is 4,950 ft. deep. In Young County, the Texas Co. also operates No. 1 Arnold, which is making a small production from below a depth of 4,000 ft., and the Southwestern Miami Oil & Development Co. has No. 1 McKeen well, which came in in October, 1920, making about 100 bbl. of oil and four million cubic feet of gas from a depth of 4,010 ft. There are several other deep wells in this field, all having a small production but a fairly long life.

The first discovery of oil in the coastal or salt-dome oil fields was made on top of a dome in what is now considered a shallow well. This was at Spindle Top, in 1901. Oil in the same relative stratigraphic location was found in other domes drilled immediately thereafter, as at Sour Lake, Hardin County, and Big Hill, Matagorda County. It was not until later that the punctured and uptilted sediments lying around the peripheries of the salt cores of the coastal domes were tested by deep drilling and in many instances were also found to be productive.

The deepest producing well in any of the coastal fields was completed at Goose Creek, Harris County, on Feb. 9, 1921, by the Crown Oil & Refining Co. and the Gulf Coast Oil Corporation jointly. This well was called the Gaillard No. 31, and came in at 4,300 ft., flowing 2,500 bbl. of clean oil through a ½-in. choker. This is not only the deepest producing oil well on the Gulf Coast, but is probably the best well of that depth ever completed in the United States, at least so far as initial production is concerned.

SALT CORE NOT YET FOUND AT GOOSE CREEK

Goose Creek also boasts of several other producing wells over 4,000 ft. deep. In fact, Goose Creek is essentially a deep field, the salt core never having been found. In January, 1921, the Gulf Production Co. completed its No. 20 Hoffman-Gaillard well at a depth of 4,200 ft., making 75 bbl., and the Humble Oil & Refining Co. completed a 250-bbl. well at 4,195 ft. In December, 1920, E. F. Simms & Co. completed its No. 33 Ashbel Smith well at 4,103 ft., making some oil and gas. Later the well went to water, but in January of the following year a screen and packer were set, and the well then made 150 bbl. of oil daily. On Oct. 31, 1920, the Gulf Production Co. completed its Beaumont State Land well at 3,700 ft., making a flush production of 5,000 bbl. of pipe-line oil daily.

Another group of deep wells is to be found at Sour Lake, Hardin County, the second oldest field in the salt-dome area. Attention was first called to this field by gas seeps and a salt lake or swamp, and shallow wells were brought in. Successive drillings in certain directions farther and farther from the dome have resulted in the completion of deeper and deeper wells. In the southwestern part of this field the Yount-Lee Oil Co. completed its No. 6A Merchant well in July, 1918, at 4,000 ft., the well flowing 12,000 bbl. daily, initial production. Later, this same company completed another well at 4,200 ft. making 1,600 bbl. flush production, and a third at 3,930 ft., flowing 1,700 bbl. daily. When the price of crude oil again warrants, deeper wells undoubtedly will be drilled.

DEEP WELLS EXPECTED AT HULL

At Hull, Liberty County, very deep wells will probably be drilled when circumstances warrant doing so. In September, 1920, the Sun Oil & Refining Co. and the Texas Co. jointly drilled a well on the Carr homestead tract to 4,070 ft. Later the casing was pulled back, the screen set from 3,570 to 3,680 ft., and the well produced 300 to 400 bbl. of oil, with much water. Other wells in the southern part of this field have been drilled by the Higging Oil & Fuel Co. and the Empire Gas & Fuel Co., making, in the Barngrover section, fair production from much over 3,500 ft.

In February, 1921, the Gulf Production Co. brought in its No. 2 Taylor at Pierce Junction, Harris County, making from two to two and one-half million cubic feet of gas from a depth of 3,940 ft. Since it's completion it has been making a little oil, which has been gradually increasing in quantity. During the twelve or fifteen years previous to drilling this well many holes were put down, all over the top of this dome, but without finding more than traces of oil and gas. In June, 1921, the Texas Exploration Co.'s No. 1 Kifer found salt water at 4,580 ft. and was abandoned. It did, however, have a small showing of oil. Provided a deep producing area exists here, it is hardly to be doubted that it will some day be found.

West Columbia, in Brazoria County, the largest producing coastal field at present, has had no producing well completed to date that is as deep as 4,000 ft., although there are a number of producers approximately 3,500 ft. deep. So far as I am able to determine, the deepest oil well in the field is the No. 1 W. C. Hogg, of the Gulf Production Co., which came in making 2,000 bbl. from 3,720 ft. One of the largest deep wells in this field, No. 28 Japhet, was brought in Sept. 25, 1920, by the Humble Oil & Refining Co., producing between 15,000 and 18,000 bbl. daily, estimated production at the flush period, from 3,400 ft. The largest producing well in this field, No. 1 Abrams, of Texas Co., which came in making 15,000 bbl. daily and later increased to a maximum of about 26,000 bbl. daily at a time when coastal crude oil was selling at $3 per bbl., flowed from a depth of only 2,780 ft.

DEEPEST TEXAS BORE FINISHES A "DUSTER"

Several deep wells have been drilled in Texas, wildcat and otherwise, which did not prove to be producers, but are nevertheless of interest. The deepest bore hole in Texas was drilled on the Roy Henderson ranch, in Crockett County, by the Ryan Petroleum Co., of New York. The well reached a total depth of 5,908 ft., and was finished a "duster." The work was done with a cable-tool rig, and cost over $150,000. It was started on Sept. 9, 1919, and finished in December, 1920. The diameter at the top was 22 in. and at the bottom 5$\frac{3}{16}$ in. This is said to be the fifth deepest well in the world.

The second deepest well in the state is probably the Texas Co. well on the Wheeler & Pickens lease at Humble, Harris County, a salt-dome oil field. The salt core of the dome was encountered between 2,000 ft. and 3,000 ft., and the hole was still in salt when drilling was stopped at 5,410 ft. The W. W. Silk well on the Scott tract, Archer County, was abandoned at 5,004 ft.

A well that may yet be the deepest on the Gulf Coast or even in Texas is the No. 1 Mitchell of the Wichita Petroleum Co., situated about seven miles southeast of the West Columbia field. On June 18, 1921, 6-in. casing was being set at 5,030 ft., 8-in. casing having been set at 2,200 ft. The well is in good condition, and deeper drilling will be done, possibly to 6,000 ft.

Other wells in Texas that have been drilled to a depth of over 4,000 ft. and abandoned are too numerous to mention. Suffice it to say that today a well is not considered a really deep test in the coastal fields unless it has reached a depth of at least 3,000 ft.

Standardization Committee Considers Proposed Changes in Petroleum Specifications

WASHINGTON CORRESPONDENCE

The Technical Committee on Standardization of Petroleum Specifications at a meeting in Washington, D. C., on July 12 took under consideration a number of proposed changes in the text of Bulletin 5 of the committee which contains the specifications used by the Government for the purchase of gasoline, kerosene, fuel, and lubricating oils. N. A. C. Smith, petroleum chemist of the Bureau of Mines, and chairman of the Technical Committee, presided.

The committee discussed the proposition of adopting a number of new methods for testing various petroleum products which have recently been sanctioned by the American Society for Testing Materials. These relate to the following tests: Corrosion; flash; distillation; sulphur; cloud and pour; saponification in place of fatty oil; water and sediment; precipitation; viscosity, and melting point. The general sentiment of the meeting was that the new A. S. T. M. methods should be adopted, though it was pointed out that the new methods were still in the tentative stage and that the committee would do well to give careful study to each method before adopting it.

The Committee on Standardization of Petroleum Specifications, frequently known as the Presidential Committee, was a war-time committee originally under the direction of the Fuel Administrator, but later transferred to the Bureau of Mines. Bulletin 5 was its last official publication, and contained all of the committee's testing methods and specifications in their latest revised form. This committee went out of existence on Jan. 18, 1921, when the President authorized the Secretary of the Interior to form a new interdepartment Committee on Standardization of Petroleum Specifications.

Important Developments in Coastal Oil Fields

SPECIAL CORRESPONDENCE

Recently the No. 1 Bissonnet well of the Texas Production Co. at Humble field, Harris County, Tex., came in at 4,150 ft. making about 2,000 bbl. per day. The well soon sanded, but later on came in again, making a greater flow than before. The well is under control. It is of great importance, as it is by far the deepest well in the field.

Snowden & Sweeney's No. 1 Kane well, at Pierce Junction, blew in at 3,010 ft., the gas pressure throwing oil over the derrick. The well soon sanded, but it is believed that deeper drilling will not be necessary to complete it. This well is about 1,200 ft. east of the Gulf Production Co.'s No. 2 Taylor, which came in several months ago as a gasser, later turned to oil, and is now making about 100 bbl. per day. This well is the second in this field which has made any appreciable quantity of oil, and it now appears certain that the oil pool of this salt dome, for which drilling has been carried on for a period of twelve or fifteen years, has at last been located.

Oil Placed on Fordney Tariff Free List

By a vote of 196 to 86, the House of Representatives on July 18, sitting as a committee of the whole, voted to amend the Fordney tariff bill by removing crude petroleum and fuel oil from the dutiable list and placing them upon the free list. A record vote will be taken on the question in the House proper, but it is practically certain that the vote in the committee of the whole will be sustained.

The crude petroleum item proved to be even more of a storm center than was the dye schedule. An unusual situation was presented in that the return of petroleum to the free list was urged by the Governor of Massachusetts, while the Governor of Louisiana used his influence in an effort to retain it on the dutiable list. This is typical of the departure from party alignments. Representative Treadway, of Massachusetts, advocated free petroleum in his speech. The reply was made by Representative Blanton, from Texas, who pleaded for the full amount of duty recommended by the committee for petroleum and fuel oil. His argument was to the effect that producers of Mexican oil, notably the Standard Oil Co., without duty and under present labor conditions there, could afford to reduce petroleum prices so that profitable production by independent companies operating in Texas would be impossible.

Technical Papers

Copper Specifications — The American Engineering Standards Committee has recently approved four copper specifications submitted by the American Society for Testing Materials, as follows:

9-1921—Soft or annealed copper wire.

10-1921 — Lake copper wire-bars, cakes, slabs, billets, ingots, and ingot bars.

11-1921 — Electrolytic copper wire-bars, cakes, slabs, billets, ingots, and ingot bars.

12-1921—Battery assay of copper.

These standards may be obtained for 25c. each on application to the American Engineering Standards Committee, 29 West 39th St., New York, N. Y.

Ferro-alloys—The U. S. Tariff Commission has issued a 160-page pamphlet, giving tariff information surveys of the ferro-alloy industries. The following subjects are discussed for each alloy: Description, Raw Material, Equipment and Method of Production, Geographical Distribution and Organization, Domestic Production and Consumption, Foreign Production, Prices, Imports and Exports, Competitive Conditions, and Tariff Considerations. The book may be obtained from the Superintendent of Documents, Washington, D. C., for 15c.

Manganese—The latest bulletin of the Imperial Mineral Resources Bureau is on the subject of manganese and consists of 151 pages. It is a digest of statistical and technical information relative to the production, consumption, and value of manganese in the British Empire and foreign countries during the war period, 1913 to 1919. Copies may be obtained for 3s. 8d. from H. M. Stationery Office, Imperial House, Kingsway, London, W.C.2, England.

Asbestos—"Past and Present Methods of Mining Asbestos" are discussed in the June issue of *Asbestos* (Secretarial Service, 721 Bulletin Building, Philadelphia; price, 20c.). Milling methods will be discussed in the July number.

Gases From Fire Extinguishers—The U. S. Bureau of Mines, Washington, D. C., in its *Reports of Investigations*, No. 2,262, describes some tests with carbon tetrachloride and Foamite Fire-foam extinguishers which were made chiefly to determine the amount of poisonous gases which would be the result under normal conditions of use in putting out mine fires. The report is free.

U. S. Mineral Resources—A preliminary report on the mineral production of the United States for 1920 compared with preceding years has been issued by the U. S. Geological Survey, Washington, D. C. Some figures are also given for foreign countries. The [illegible] page book may be obtained on request to the Survey.

Oil Shale—"Nature of Shale Oil Obtained From Oil-Shale Assay Retort Used by the Bureau of Mines," by Martin J. Gavin and Lewis C. Carrick, is the title of a paper appearing in *Reports of Investigations*, June, 1921, issued by the U. S. Bureau of Mines. A brief description of the method used for the distillation analyses of shale oils is given, and the results obtained from different products are tabulated.

Microscopic Mineral Determination—In *Reports of Investigations* No. 2,257, the U. S. Bureau of Mines describes the quantitative microscopic determination of chalcopyrite, chalcocite, bornite, and pyrite in a porphyry ore. The five-page bulletin may be obtained on request to the Bureau at Washington.

Alaska Mining Activities—The annual report of the territorial mine inspector for 1920 is now available from the Governor of Alaska, Juneau, Alaska. The bulletin is of seventy-two pages and describes briefly mining conditions on various properties in that territory. Thirty pages are devoted to the accident record.

Book Reviews

The Salt and Gypsum Deposits of South Australia. By R. Lockhart Jack. Bull. No. 8, Geol. Surv. of South Australia, Department of Mines. Paper; 6 x 9¾; pp. 118, 7 plates, 3 maps, several regional sketch maps. Adelaide, 1921.

The author's study of the origin of the South Australian salt deposits indicates that they are somewhat unique, having resulted from accumulation of "salt dust" transported from the ocean by the wind, and carried down by rain. Evaporation from the salt areas is sufficient to prevent return of the salt to the ocean by surface drainage, and the salt accumulates in deposits of commercial size. Thus every year new supplies are added to the lake salt beds. South Australia can readily supply the whole continent with its requirements. A minor part of present production is from solar evaporation of sea-water, and conditions are favorable for a considerable extension of this branch of the industry. Detailed descriptions of the saline areas occupy thirty-six pages.

South Australia produced over 25,000 tons of gypsum in 1919. Since 1914, practically the entire domestic requirements have been supplied, and a small export trade has been developed. The deposits are extensive, but, except for local use, those close to seaports are the only ones that can be exploited profitably. A discussion of the origin, types of deposits, uses, and the probable future of the industry is followed by a detailed description of the various deposits, with many analyses. The importance of the salt and gypsum industries of South Australia justifies the issuance of a bulletin, and the author handles the subject matter in a comprehensive and interesting way.

O. B.

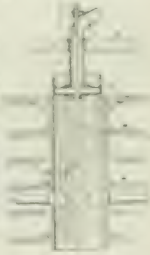
Recent Patents

Hydro-metallurgy of Zinc—No. 1,380,712. A. E. Hall, Omaha, Neb., assignor to American Smelting & Refining Co., New York. A method of electrolyzing a zinc-salt solution whereby the zinc is deposited and the acid radical liberated; adding a solution of iron to the acidic solution in amount equal to about 0.044 lb. of ferric sulphate per gallon of solution; treating an excess of zinc-bearing material with the solution, which dissolves the zinc, neutralizes the acid, and precipitates any antimony present; and returning the solution for electrolysis. Patent No. 1,380,711, also issued to Mr. Hall, is on the same subject.

Flotation Machine — No. 1,380,650. J. Hebbard, Broken Hill, New South Wales, assignor to Minerals Separation North American Corporation, New York. A froth flotation apparatus in which the agitation and aëration are effected by the hydraulic action of a gravity flow of the ore pulp through successive separating vessels.

Flotation — No. 1,380,665. F. J. Lyster, Broken Hill, New South Wales, assignor to Minerals Separation North American Corporation, New York. A new design of separating box for flotation purposes.

Method of Firing a Roaster—No. 1,380,529. H. A. Clark and J. F. Hill, Douglas, Ariz., and A. G. McGregor, Warren, Ariz. In a mechanically rabbled, multiple-hearth roasting furnace, the oil burners are introduced through the central shaft instead of from the outside, as is the common practice.



Smelting— No. 1,376,479. Bradley Stoughton, New York, N. Y. A method of heating the blast supplied to a smelting furnace and so varying its temperature that the temperature of the furnace products may be controlled.

Amalgamating Sluice Box — No. 1,381,159. J. P. Beaupre, Butte, Mont., assignor of one-half to G. E. [illegible], [illegible], Cal. An arrangement of amalgamating plates and riffles in a sluice box.

Concentrating Table—No. [illegible]. [illegible] Deister, Fort Wayne, Ind., assignor to Deister Machine Co., Fort Wayne, Ind. A concentrating table made up of sections with different inclinations. Patent No. [illegible], also issued to Mr. Deister, relates to a [illegible] system in which the riffles are tapered and the ends of each riffle facing the feed side of the table is higher than the other side.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Nicholson Bill Recommended by American Mining Congress

A great many reasons, says the *Mining Congress Journal,* may be assigned in favor of, but none can be advanced against, the creation of a Department of Mines to be presided over by a member of the Cabinet, the Secretary of Mines, as contemplated in the bill introduced by Senator Samuel D. Nicholson, of Colorado. Among all the measures providing for reorganization and regrouping of Government activities, this stands out as pre-eminently proper and the most timely.

The miners, speaking through their national chamber of commerce, known as the American Mining Congress, went on record a decade ago in favor of the establishment of a Department of Mines. During most of the period which has since elapsed they, in common with other business men, devoted their energies to the winning of the war and to reconstruction, allowing their own recommendation to remain in abeyance, but they have never receded from their position. Their recommendation stands today with every reason of economy and efficiency to back it up and with a much larger number of constructive business men behind it than at the time it was first made.

Mining is one of the two great basic industries of the country and decidedly the bigger of the two. It furnishes two-thirds of all railroad tonnage, without which the transportation of the other third would be impossible. Its manufactured products alone pay nearly one-third of all the corporation taxes collected by the Government, or seventy-five times as much as incorporated manufacturers of agricultural products. Forty states depend upon it in more or less degree for employment for sizable portions of their population and all states look to it to contribute a hundred thousand times more permanent wealth than all other industries combined. No wisdom can be seen in cluttering up the administration of this, the country's greatest industry, any longer with the administration of hospitals, institutions for the deaf, public buildings and playgrounds in the capital, Indian disputes and governmental affairs in distant Hawaii.

The Interior Department will not lose either in prestige or in the amount and importance of its work through the loss of its mining bureaus. With the retention of its other existing bureaus and the addition of a score or twoscore of independent bodies which by all odds ought to be made directly accountable to one of the executive departments, it will probably expand its influence and its usefulness. The mining industry will appreciate and make the best use of the richly deserved recognition and assistance which the establishment of a Department of Mines will afford, but the country as a whole will be the greatest gainer, for it is only when the mines are prosperous that the nation is prosperous.

Senator Nicholson is to be congratulated. The miners are with him to a man.

Cornishmen Asked To Aid Residents in Old Country

A striking appeal to newspapers in mining centers where Cornishmen are employed in mining has been made by the Central Relief Committee of Camborne, Cornwall. The letter states that mining there has been virtually extinguished as a result of the war, and paints a dark picture of conditions among the people. The following are excerpts from the appeal:

"If you could imagine yourself in the old towns of Camborne and Redruth and look to the north and south, the arrested toil would both pain and surprise you. Only here and there an engine works, and that only to keep the mine from being flooded.

"At the present time every 'bal' in the old country stands idle! These are terrible facts and require some courage to state them. It is not always pleasant to tell grim truths. What does this state of collapse mean? It means no work and no money; no money means the wolf at the door."

The letter states that between the years 1851 to 1891, about 170,759 Cornishmen left for other lands and that many thousands have left since the latter date. Each of these or their descendants is asked to do something for the old district in its great distress.

First Congress of the Rumanian Association of Mining Engineers

On June 3, 4, and 5, 1921, the first congress of the Rumanian Association of Mining Engineers was held at Ploesti, Rumania, which is the center of the oil industry in that country. More than two hundred members of the association attended; also delegates sent to the ministers of industry and labor. Among the various subjects of mining interest papers on the following were discussed: "The Exportation of Oil Products," by Mr. Birkenthal; "Ore Deposits and Metallurgy in Translyvania and the Banat," by Mr. Andrea; "The Participation of the State in the Exploitation of the Oil Fields," by Mr. Ficsinescu; "New Opinions on the Oil Deposits," by Dr. Murgoci; "The Exploitation of the Salt Beds in Rumania," by Mr. Popescu; "The Industry of Coal in Rumania," by Mr. Damaschin; "Natural Gas in Transylvania," by Messrs. Damaschin and Lazar; "Professional and Technical Teaching for Mining Engineers," by Mr. Filipescu; "Mining Legislation," by Mr. Gheorghiade, and "The Participation in the Benefits," by Mr. Dacu.

The meeting brought out the fact that the development of the mining industry in Rumania cannot be put upon a solid basis, until (1) the state retains the ownership of the subsoil for the oil fields as it has done for other mineral deposits; (2) the professional and technical teaching is sufficiently developed; (3) a wide participation and co-operation of foreign capital is brought about without a spirit of domination, and (4) a participation of profit is assured to all workers who help to increase the production.

Mining Engineering Finds a Place in Princeton's New School

Princeton has given an undergraduate course in civil engineering and a graduate course in electrical engineering for many years. In the fall of 1922 undergraduate courses in mining, chemical, mechanical and electrical engineering will be added to the curriculum. A four-year course will lead to the degree of bachelor of science in engineering, and is designed to meet the needs of the student who does not expect to practice, but wishes engineering training to fit him for business or manufacturing. For those who decide to follow engineering as a profession, an additional year of special work in the chosen branch will bring the engineer's degree.

This enlargement of the Princeton School of Engineering will be coincident with the inauguration of Prof. Arthur M. Greene, Jr., of Rensselaer Polytechnic Institute, who has accepted the call of the Trustees of Princeton University to become dean of the engineering school and professor of mechanical engineering.

Nine new members have been added to the American Engineering Council's Committee on Foreign Relations, to complete the personnel of the committee, of which Lewis B. Stillwell, of New York, is chairman. Dugal C. Jackson, of Boston; Louis S. Cates, of Salt Lake City; Nelson P. Lewis, J. Parke Channing, C. O. Mailloux, and John W. Lieb, of New York; T. A. Rickard, of San Francisco; B. J. Arnold, of Chicago, and M. O. Leighton, Washington, are the appointees approved by the board.

MEN YOU SHOULD KNOW ABOUT

C. E. Chaffin left for Bolivia on July 13.

J. M. Callow is returning to Salt Lake City after six weeks in New York.

Louis A. Wright is spending two months in Spain on professional business.

H. W. Hardinge has returned to New York from a trip to the Lake Superior iron and copper districts.

W. W. Cowan has recently taken a position as mining engineer with the Thomas Iron Co., Wharton, N. J.

Herbert G. Officer, recently with the Anaconda Copper Mining Co., at Potrerillos, Chile, is now in New York.

C. J. Garvin, mining engineer, who has been managing magnesite mining enterprises in Washington, is in New York.

S. Ford Eaton, engineer and resident manager of the Dardanelles Mining Co., Chloride, Ariz., left recently on an extended auto tour.

Thomas H. Allan, mining engineer, who has been mining in the Yukon during the last year, was in New York recently on his way to Colorado.

A. E. Moynahan, mining engineer, who examined mining properties in Colorado and Arizona recently, is in New York on professional business.

C. H. Palmer, Jr., has been elected vice-president of the United Eastern Mining Co. to fill the place left vacant by the late **Frank A. Keith**.

N. O. Lawton, mining engineer, will be in Salt Lake City, Utah, on professional business from July 20 to Aug. 15. His address will be care of the Alta Club.

M. R. Hull, designing engineer for the Chile Exploration Co., has returned to New York from a three months' trip to the company's South American properties.

Alex Richardson, principal of the School of Metalliferous Mining, Cornwall, England, is visiting mines and mining schools in the United States and Canada.

Charles Y. Clayton, professor of metallurgy at the Missouri School of Mines, will be at Dr. Howe's laboratory at Bedford Hills, N. Y., during the summer.

Charles Trezona, general superintendent of mines on the Vermilion Range for the Oliver Iron Mining Co., has gone to the Presbyterian Hospital, Chicago, for treatment.

Lewis C. Chapman has just completed a six months' exploration trip in the southern part of South America and will be at Maracaibo, Venezuela for several months.

Stuart B. Marshall, consulting engineer, Washington, D. C., was recently elected president of the Virginia Military Institute Alumni of the District of Columbia.

Dr. G. J. Fink, formerly with the Hooker Electrochemical Co., has joined the technical staff of the Chemical Department of the National Lime Association, Washington, D. C.

R. V. Whetsel, mining engineer, with Henry L. Doherty & Co., at Tampico, Mexico, is in New York on professional business. Following a visit in Colorado, he will return to Mexico.

F. W. Denton has been appointed by Governor Groesbeck to succeed **James MacNaughton** as a member of the Board of Control of the Michigan College of Mines at Houghton, Mich.

L. D. T. Geery, superintendent of the electrolytic tank house of the Chile Exploration Co., Chuquicamata, Chile, spent a few days recently at the plant of the New Cornelia Copper Co., Ajo, Ariz.

P. R. Hines has opened an office in Portland, Ore., for consulting work on crushing and ore-dressing plants. He will also represent the Stephens-Adamson Manufacturing Co. in the Northwest.

E. F. Burchard, of the U. S. Geological Survey, is examining deposits of magnesite in Cranberry, N. C. Later, in company with **Joseph Hyde Pratt**, state geologist of North Carolina, he will make a general inspection of the iron-ore districts of North Carolina.

A. D. Chisholm, Gogebic Range manager for the Steel & Tube Co. of America, has been elected vice president of the Rogers Brown Ore Co. and will spend most of the summer on the Cuyuna Range in charge of the Kennedy and Meacham mines of the latter company.

Weld, Liddell & Lazenby announce the dissolution of the firm. **C. Minot Weld** and **Donald M. Liddell** will continue to practice as consulting engineers, under the name of Weld & Liddell, at 2 Rector St., New York. **Paul H. Lazenby** will continue his practice independently at 2 Rector St., New York.

W. W. Odell, fuels engineer of the Bureau of Mines, is now in North Dakota, where he will co-operate with Professor Babcock, of the University of North Dakota, on an extended series of tests of lignite carbonization. The experimental work will be done in the small lignite coking plant of the university as a part of the co-operative work of the Bureau of Mines and the university.

Mining engineers and metallurgists recently in New York City included **G. W. Prince**, Clemenceau, Ariz.; **E. H. Dickenson**, Calcutta, India; **Thayer Lindsley**, Peterboro, N. H.; **J. W. Mather**, Pacific Grove, Cal.; **W. H. Seamon, Jr.**, [illegible], Md., and **C. A. Filteau**, Cobalt, Ont.

SOCIETY MEETINGS ANNOUNCED

No local section meetings of the **American Society of Mechanical Engineers** will be held during the summer.

American Chemical Society will have its headquarters at the Waldorf-Astoria Hotel during the society meeting, Sept. 6 to 10.

The seventh **National Chemical Exposition** will be held in the Eighth Coast Artillery Armory, New York City, during the week of Sept. 12. The exposition will follow the meeting of the American Chemical Society and the Society of Chemical Industry.

The Michigan College of Mines Alumni Association has selected Aug. 5 and 6 as reunion dates. Committees have been appointed, and the following program has been decided upon: Aug. 5, registration, business meeting of association, reception by president and Mrs. McNair, smoker and night-shirt parade; Aug. 6, trips about the Copper Country, lunch at Eagle Harbor, and dance at the college gymnasium in evening.

Preparations are under way for the entertainment of members of the **Columbia Section, A. I. M. E.**, at Cranbrook, B. C., for three days beginning Aug. 21. The program is being arranged by the **Cranbrook Board of Trade**, and the East Kootenay division of the **British Columbia Prospectors' Association**, and includes an inspection by the visitors of the Sullivan mine of the Consolidated Mining & Smelting Co. at Kimberley. It is likely that several other mining projects of the district will be visited. Dr. Schofield, of the Dominion Geological Survey, is scheduled to deliver an address, "The Rocky Mountain Uplift as Applied to East Kootenay."

OBITUARY

J. H. Miles, of Oroville, Cal., a builder and operator of gold dredges, died on June [illegible] while returning from Nome, Alaska.

H. B. S. Randall died at [illegible], Texas, July [illegible], 1921. He was a graduate of the Michigan College of Mines and was interested in mining in Mexico for many years.

Albert Taylor, manager North Atlantic district of the Electric Storage Battery Co., died on July [illegible] in New York City. Mr. Taylor became suddenly ill in his office, [illegible] West [illegible] St., and was taken to a near hospital where he died a few hours later.

THE MINING NEWS

LEADING EVENTS

Honduras Rosario Mines Shut Down

Closing Reported To Have Serious Effect on Internal Conditions

Tegucigalpa, June 27—The Rosario and Sabanagrande mines of the New York & Honduras Rosario Mining Co. have been flooded, and it will probably be many months before they are reopened. All the native employees except about fifty watchmen and powerhouse assistants have been dismissed, and many members of the foreign staffs have left. This is the largest industry in Honduras save the United Fruit, and the effect of its closing has produced an almost panic condition in the country. Honduras has no money of its own and very few banknotes. The Rosario mine imported American gold and banknotes monthly, which provided the standard medium of exchange in Tegucigalpa and southern Honduras.

There is some possibility that operations on a large scale will be started in December in the placer district near Juticalpa, Department of Olancho. The United Central American Corporation has acquired control of eleven square miles of placer ground, which the corporation purposes working with a dredge. Tests have shown satisfactory results.

The Honduras Petroleum Co. has opened offices in Tegucigalpa, and looks forward to the active exploration of its zones. This company, of which 52 per cent of the stock is held in London and 48 per cent in the United States, has acquired valuable concessions from the Honduran government, by which it obtains the exclusive right to drill for oil in three departments of Honduras for a period of fifty years. In return the company is required to build an automobile road from Comayagua to the Lake of Yojoa and keep it in repair during the life of the concession. This road is now being constructed and will be completed early next year, thus making the trip from Tegucigalpa to the United States much quicker and more comfortable.

Some work is being done in the Mura district of Nicaragua, where the Meyers properties are being electrically equipped.

OPERATIONS CURTAILED IN EL SALVADOR

The Divisadero and Monte Mayor groups of the El Salvador Mines Co. are closed down, and nearly all the foreign employees have left. Frank Estes, the new general manager, is making some explorations in the Monte Mayor group, and some assaying is being done.

The San Sebastian Mines (Charles Butters interests) are also closed and partly dismantled.

WEEKLY RÉSUMÉ

Thus far at Washington, in the discussion of the new Tariff bill, little reference has been made to the metal schedule. Representative Arentz has introduced a bill which practically embodies the report of the Ingalls committee on the proposed revision of the United States Mining Law. Copies of this bill are now available for distribution. Secretary Fall has finally made certain recommendations in regard to the liberalization of War Minerals Relief legislation.

At Eureka, Utah, at the Chief Consolidated mine, a shaft-sinking contractor has announced that he will seek to break the world's record for shaft sinking. Industrial conditions are practically unchanged from last week, in particular at Tonopah. Another mine on the Mother Lode in California, the Central Eureka, has made a cut in wages. Word comes from Central America that the New York & Honduras Rosario mines have shut down, seriously affecting conditions in Honduras. The Honduras Petroleum Co. has secured a concession for drilling in three departments. In the Coeur d'Alene district in Idaho steps are being taken to rebuild the Prichard Creek railroad. From Wilmington, Del., it is announced that Minerals Separation North American Corporation has been admitted as party plaintiff to the Miami Copper Co. suit.

Minerals Separation North American Corporation Made Plaintiff in Miami Suit

Judge Morris Hands Decision Down at Wilmington—Minerals Separation, Ltd., Still Has Rights in Patents

Through the granting of their petition by Judge Morris in the U. S. District Court at Wilmington, Del., on July 15, Minerals Separation North American Corporation has become a party to the suit of Minerals Separation, Ltd., vs. Miami Copper Co.

The granting of this petition was opposed by the Miami company on the ground that the evidence which was adduced by Minerals Separation North American Corporation showed that Minerals Separation, Ltd., had disposed of its legal interest in its patents on July 8, 1913, more than a year before it had brought suit against the Miami Copper Co. Had the court so found, the effect of the decision would have been to vitiate the Miami suit. Judge Morris, however, did not so find, but, on the contrary, ruled that Minerals Separation, Ltd., had not disposed of its legal rights in its patents in the transaction of July 8, 1913, as noted above.

Out for Shaft Sinking Record

Walter Fitch, Jr., Co. Starts Work of Deepening Water Lily Shaft at Eureka, Utah

An attempt to break the world's record in shaft sinking, now held by the Crown Mines in South Africa, was started on July 15 at Eureka, Utah, by the Walter Fitch, Jr., Co., which began the work of deepening the Water Lily shaft of the Chief Consolidated Mining Co. The start was made at 8 o'clock in the morning, at which time the measurement from collar to bottom, made by certified engineers, was 115.5 ft.

Ford Willing To Finish Nitrate Plant at Muscle Shoals

Henry Ford has offered to take over and operate the Government nitrate plant at Muscle Shoals, Ala., on which $80,000,000 has been spent. Secretary Hoover has transmitted the proposal to the Secretary of War. Mr. Ford has made the following four proposals:

First. He will take a 100 years' lease upon the Wilson Dam and No. 3 Dam and electric installation when completed. This work is estimated to cost $28,000,000. After a short preliminary period, Mr. Ford proposes to pay interest at the rate of 6 per cent on the sum of $28,000,000 and to amortize not only this sum but the entire cost of both dams over a period of 100 years.

Second. To purchase all the nitrate plant and equipment, lands, steam plant, and appurtenances, for $5,000,000.

Third. To convert and operate the large nitrate plant (No. 2) for the production of fertilizer compounds and as a stand-by for Government explosives in case of war, and to keep it up to date in both lines.

Fourth. To limit the profits of the fertilizer plant to 8 per cent, an independent board embodying representatives of the American Farm Bureau and the National Grange and the Farmers' Union to certify to this maximum.

The Tennessee River will be rendered navigable to Chattanooga by the completion of this project.

To Rebuild Prichard Creek Railroad in Cœur d'Alenes

What is commonly known as the North Side section of the Coeur d'Alene district in northern Idaho has been without a railroad since December, 1917, when high water washed out the track of the O.-W. R. & N. Co. along Prichard Creek for about fourteen miles. It is now announced that Patrick Burke, president of the Bear Creek

Mining Co., operating on Prichard Creek, has contracted to purchase the right of way, rails, and all other equipment along the line for $35,000 payable in four annual installments. Mr. Burke will undertake to rebuild and operate the line, and expects to be joined by other mining companies which will be served through the restoration of the line. The O.-W. R. & N. Co agrees to lease Mr. Burke a locomotive and necessary cars and will receive and deliver tonnage at the Prichard terminal at the established rates. The railroad company also reserves the right to repurchase the Prichard Creek line if it should find it desirable to do so.

Events in Progress of State Mining in Queensland

Minister To Try Experiment in Reopening Chillagoe Smelter and Holding Bullion

Brisbane, June 4—It has just been announced that both the copper and lead furnaces of the state smelters at Chillagoe have been re-started. The Minister for Mines, who has control of this company, asserts that he will give at Chillagoe a practical demonstration of the feasibility of his suggestion (reported on p. 111 of the issue of July 16) regarding Mount Morgan, and hold the copper, silver, and lead produced at the state smelters until a remunerative price can be got for it. What will be the ultimate result, from a commercial point of view, time will tell.

CHILLAGOE STATE SMELTER, QUEENSLAND, AUSTRALIA

The Minister of Mines is having trouble with another of the state mining enterprises. At the private coal mines of Queensland the owners pay their men a hewing rate, but to true Laborites all piecework is objectionable, and at the Baralba state coal mine colliers have been paid a high wage per shift, irrespective of the quantity of coal produced per man. In return for this wage, it seems, these men have been working only until "crib time," occupying the remaining half of the shift in getting ready for the next one. As a result of this "go slow" foolery it has cost 17/6 to produce each ton of coal, and the coal having been sold to the railways at 14/9 per ton, the same price which they had been paying to a private company that had made a profit on the business, the government has been losing 2/9 per ton. The minister has now decided that he will have no more of this, insists upon the men in future working at a hewing rate, and has closed down the colliery until they see fit to accept this method of payment.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Metal Schedule Ignored So Far in Discussing Tariff

Tilson Alone Makes Reference to It—Duty on Potash To Be Strongly Opposed

An unusual feature of the discussion in the House of Representatives on the tariff is the absence of reference to the metal schedule. This is due largely to the fact that no amendment to that schedule is permitted under the rule under which the House is operating. Representative Tilson, of Connecticut, the chairman of the subcommittee which compiled the metals schedule, made a statement in regard to that schedule, but it provoked no discussion. He said in part:

> During the war, not only such old-established industries as lead, zinc, and quicksilver underwent unusual development, but a considerable number of new industries were undertaken and to a considerable extent developed. Under Government stimulus, mining was encouraged to a very marked degree. Rare metals used as alloys for steel, such as chrome, tungsten, molybdenum, and others, were eagerly sought for. The mining of manganese ore was especially encouraged and reached a production of more than 40 per cent of the total domestic consumption in 1918. Many of these newer enterprises have suffered severely since the close of the war. In some cases, such as tungsten, molybdenum, and manganese, it is here attempted by protective duties to preserve the industries. Others like chrome, also encouraged by the Government and now destined to lose what has been invested unless recouped by the Government, the committee has deemed it unwise to attempt to save, because the results of the war development do not seem to warrant the belief that an economical industry can be built up in this country, and, if not, then the duty imposed would place a needless burden upon the entire steel industry.
>
> In the metal schedule, as throughout the bill, specific, rather than ad valorem, duties have been imposed wherever possible, first, because they are more readily determined and applied, because they furnish a greater degree of protection in a falling market when protection is needed most. In comparing the rates in this bill with those contained in previous laws it should be borne in mind that by reason of the war production costs have been generally increased, but nowhere to the same extent as in the United States, which means that a specific rate now furnishes a less degree of protection than was furnished by the same specific rate when the value of the article was less. In view of the well grounded belief that it will be a long time before production costs in this country again approach normal, it has been found necessary in fixing rates to take these changed conditions into account."

It is certain that great difficulty will be experienced in retaining the potash duty in the tariff bill. Allegations that this duty will cost the farmers [illegible] or more will be accepted by many members of Congress who represent large agricultural constituencies. Unusual interest is being taken in the matter by the representatives of the farmers, as most farmers have allowed their lands to become under-fertilized and have reached the point where they must make much larger purchases next year. To have anything interfere with possible decrease in price brings forth loud complaint.

On the other hand, the representatives of the domestic potash producers point out that the duty is the form prescribed by the committee is not as satisfactory as a straight 50c. duty, for which they contended. The duty as provided in the bill may take care of the plants in existence, but certainly will not encourage any new capital to enter the industry.

Bain Gives Reasons for Drop in Demand for Zinc

Director Returns From Visit to Tri-State Field—Stocks at Plants Equal to Quarter-Year's Consumption

After a personal visit to the Tri-State zinc district, H. Foster Bain, the Director of the U. S. Bureau of Mines, has returned to Washington with some clear-cut impressions as to the zinc situation. In summing up what he saw and heard during his visit, he said:

"The industry is selling zinc at a price which it has not had to face since 1897. Stocks of spelter at plants are at least 25 per cent of the normal year's consumption. This is a heavy load to carry, and the industry is staggering under it. Zinc is worse hit than oil. Oil is in trouble enough, but the petroleum interest can dispose of current production, whereas the zinc interest cannot.

"Another serious phase of the situation is the very large substitution of black sheets for galvanized sheets and the development of various forms of protective coverings as an alternative for galvanization. It is going to require unusual effort on the part of the zinc industry to win back this loss of market, which had its inception during the war period. The galvanizing trade prior to the war absorbed some 50 per cent of the output. The increased use of black sheets can be blamed in part on the increased tendency, particularly during the war, of certain manufacturers of galvanized wire and galvanized sheets to use too thin a coating of zinc. The finished product looked as good as the better quality, but the early failure of this material has brought galvanized products into a certain amount of disrepute, especially among the smaller buyers who are not in a position to make close determinations of quality. This, combined with the fact that the steel interests, which also do the galvanizing, are more interested in pushing their ungalvanized product, has made a very material difference in the demand for spelter.

"The zinc industry is one of those activities which feels a general business depression with peculiar intensity. In addition to the business depression there have been a number of minor factors which in the aggregate have affected the industry adversely. Important among these may be mentioned the reimportation of zinc sold abroad."

First Quarter Shipments Slump to Less Than Half

Shipments of products of mines slumped decidedly during the first quarter of 1921, according to figures just made public by the Interstate Commerce Commission. The average shipments of products of mines, during 1920 were around 300,000,000 tons per quarter. For the first quarter of 1921, mines contributed only 115,836,502 tons to the tonnage hauled by rail

Fall Proposes Amendments to War Minerals Relief Act

Secretary of Interior Makes Recommendations to Committee—Raker Would Exclude No One From Benefits of Measure

The Secretary of the Interior has submitted to the House Committee on Mines and Mining drafts of the amendments to the War Minerals Relief Act which he would like to see enacted. These amendments reflect the policy of the new administration of the Interior Department and of the new War Minerals Relief Commissioner. The matter has been the subject of extended conferences between the Secretary, the War Minerals Relief Commissioner, and the chairman of the House Committee on Mines and Mining. Pending the presentation to the committee of these amendments, they are not being made public.

The extent to which some members of Congress would liberalize the law is reflected in an amendment introduced by Representative Raker, of California. His amendment would extend relief to all those who responded to "any personal, written, or public request, demand, solicitation, or appeal from any of the Government agencies mentioned in the act." The much controverted "request and demand" feature of the law would be expanded by Representative Raker so as to indemnify those who responded "to such request, demand, solicitation, or appeal." Claimants are to be reimbursed for "such net losses as they may be found to have incurred and are in justice and equity entitled to."

So that no claimants may be barred from reconsideration proceedings, Mr. Raker includes the following proviso in his amendment:

"The Secretary of the Interior is authorized to review and reconsider for an award claims in the settlement of which arithmetical errors have been made and all claims wherein decisions have been determined by rulings contrary to the provisions of this amendment, and to ascertain as a matter of fact if such claims are raised upon a request and to ascertain as a matter of fact if such claims are based upon a request, demand, solicitation or appeal as provided by this amendment, and that the unexpended balance of the appropriation carried in said act be continued available for the purposes set forth above until all such claims shall be fully settled or disposed of."

The latter part of Mr. Raker's amendment doubtless is inspired by the inquiry from the Director of the Budget as to whether or not the balance of the War Minerals Relief Appropriation now remaining should not be turned into the Treasury.

Government's Silver Purchases

Purchases of silver under the Pittman Act during the week ended July 16 totaled 1,135,000 fine ounces. This brings the total purchases to date under that act to 62,551,816 fine ounces.

Bureau To Reorganize Work in Alaska

Territory Is To Be Divided Into Four Districts, Each in Charge of an Engineer

With the purpose of fostering a more rapid and better development of the mining industry in Alaska, the U. S. Bureau of Mines is reorganizing its work in that territory. D. A. Lyon and George S. Rice are now in Alaska on a tour of inspection to determine how the bureau can best assist the industry. It is proposed to divide the territory into four districts, each being in direct charge of a Bureau of Mines engineer. A supervising mining engineer will be in general charge of the four district engineers. The experiment station at Fairbanks will be headquarters. District 1 has been assigned to Bert W. Dyer, who will also continue to discharge his duties of Federal Mine Inspector of Alaska. This district embraces the south coast, including the Matanuska, Kenai, and Bering River coal fields, the Copper River basin, and, for the present, the Katalla oil fields and southeastern Alaska. The special duty of this district engineer will be in connection with coal, copper, and lode gold.

J. A. Davis will continue as superintendent of the Fairbanks station and, in addition, will be in charge of District 2, which consists of the territory tributary to the Government railroad from Seward to Fairbanks. This area includes the Nenana lignite field.

District 3 consists of interior Alaska, comprising the Yukon and Tanana basins. This district has been assigned to K. T. Sparks, assistant mining engineer. District 4 is the Seward Peninsula. No assignment of an engineer for this district has been made as yet. It is believed, however, that the best way to assist the mining industry in this district lies in the development of a practical and economic method of cold-water thawing. Charles Janin, consulting engineer of the bureau, is now compiling and studying the results of experiments made by various companies, preparatory to investigation by the bureau.

Co-operation will be arranged and maintained with the Geological Survey and with the Territorial Government.

Copies of Proposed Mining Act Ready for Distribution

As a result of the action of Representative Arentz, of Nevada, in introducing as a bill the proposed revision of the mining laws, printed copies of that measure now are available for distribution. Copies of the bill may be obtained upon application to the Washington office of *Engineering and Mining Journal*, 610 and 611 Colorado Building, Washington, D. C. Mr. Arentz and the committee on Mines and Mining of both the Senate and of the House are anxious to receive comment on the proposed changes in the existing mining law.

NEWS BY MINING DISTRICTS

London Letter

Bantjes Consolidated May Be Liquidated — Conditions Improving at Randfontein—South Crofty and East Pool Agree on Pumping

London, July 4 — It would almost appear that the Bantjes Consolidated Mines, which has been in a parlous condition for a long time, will go out of existence at about the end of the current year. Nature has not favored this company, and though work by its own labor force has stopped, a forlorn hope attempt was made to prove the property by means of an arrangement with its eastern neighbor, the Consolidated Main Reef. The idea was to test the ground at a lower level than the mine workings by driving from the Consolidated Main Reef. In the early stages indications were quite encouraging, 270 ft. sampled giving an average value of the Leader and Main Reef of 6.7 dwt., over a reef width of 62 in. This portion of the ground, 1,000 ft. along the strike and 2,000 ft. on the dip, was leased to the Consolidated Main Reef. As the drive westward progressed, values became less satisfactory, and the Consolidated Main Reef decided to discontinue development of this area. Work for the Bantjes continued, but a dike 285 ft. wide seems to have disturbed conditions, for unpayable ground continues. Another 300 or 400 ft. are to be driven, when, should results still prove of a negative character, steps will be taken to liquidate the company. This part of the Western Rand has proved particularly unfortunate.

At Randfontein, which forms the major portion of the western boundary of the gold field, conditions appear to be looking up. The financial position of the Randfontein Estates & Central has been considerably eased by the payment which the court decided Sir Joseph Robinson was to make for past transactions in which the company was interested. Underground work is progressing at the Central, and it is hoped that before long the ambitious program mapped out may be put into execution. One of the troubles with the Rand [illegible] companies is over capitalization. If this matter could be remedied the prospects of shareholders would improve. At present there is little chance of a return upon the shares. In connection with the two Randfonteins, a dis [illegible] of [illegible] warrants [illegible]. The companies were to be amalgamated to reduce the capital, but the holders of the Randfontein Estates [illegible] be required to [illegible] because their [illegible]. Consequently, the scheme has had to be abandoned.

The rich strike made on the 8th level of the Descubridora vein in the Esperanza mine has proved to be what mining men generally expected—a small and erratic orebody. The indications are encouraging on account of the fact that there is a long run of unexplored ground on the course of that orebody. For the shareholders' meeting, the latest development results were cabled, and the few feet accomplished were satisfactory, 4 ft. in No. 8 winze showing a width of 27 in. assaying 7.74 oz. gold and 100 oz. silver. These were the high values, however.

Though, of course, with tin at its present price, and the enormous stocks that have yet to be consumed, there is no possibility of any revival of activity in Cornish mining, every step is being taken to keep the mines in the Duchy free from water and ready to resume operations immediately the statistical and financial position will permit. Some time ago I remarked on the divergence of opinion between the directors of South Crofty Co. and those of the East Pool & Agar, as to who should bear the expense of keeping the mine free of water. I now learn that the directors have together agreed upon a scheme. The two mines are connected at various points, and according to the arrangement some of the water from East Pool will be conveyed to and pumped by the Cornish engine at South Crofty. This will greatly benefit the East Pool, which has more water than the Crofty.

CANADA

British Columbia

Dissolution of British Columbia Chamber of Mines Averted

Alice Arm—It is reported that 3,000 tons of ore is to be shipped from the Dolly Varden mine. The railroad also is to resume operations. No definite announcement, however, has been made regarding the resumption of continuous work at the mine.

The Copper Group on the Upper Kitsault River is to be developed by the Homestake Mining & Development Co. G. H. Garhardi is in charge. He plans completing the trail, installing a compressor, and driving a tunnel that is expected to strike the surface lead at [illegible] ft. depth.

Trail work is under way by the provincial government along the [illegible]. This is a promising mineral district hitherto handicapped because of transportation difficulty.

Hope — [illegible] ore, carrying uniform values, has yet to be proven.

Vancouver — The threatened dissolution of the British Columbia Chamber of Mines, at Vancouver, B. C., has been avoided. A substantial grant has been promised by the government, and the members have responded to an appeal to advance the additional funds necessary to permit the continuance of the work of the organization.

Nelson—A car of high-grade ore is being mined at the Silver Reef group, Anderson Creek.

Trout Lake—Mill machinery from the long inactive mill of Ferguson Mines, Ltd., owning Silver Cup, Nettie L. and Ajax mines, near Ferguson, has been hauled down and shipped. Another deal is reported as pending for disposal of the Silver Cup mine, which has been under lease all winter.

Smithers—Development work is to be resumed on the Babine Bonanza group, in the Babine Mountains, by James Cronin. Last year he ran a long adit that tapped the vein about 350 ft. below his former workings and over 1 000 ft. below the apex of the hill.

Greenwood — Morrison & McGillis, owners of the Tam O'Shanter property, in Deadwood camp, in sinking a winze from the main tunnel, encountered the vein at a point where it contained a shoot of ore carrying grey copper and native silver. This is the first time native silver has been found in any place on the south side of Boundary Creek.

Trail—Ore shipments received at the Consolidated company's smelter for the week ended July 7 totaled 6,969 tons, of which 57 came from the Surprise mine at Republic, Wash., and the rest from the company's mines.

Alberta

Edmonton—The gold rush into the Peace River district has proved to be a "false alarm." The prospectors did not obtain results warranting undue enthusiasm.

Ontario

Price of Powder Dropping Gradually — Wasapika Expects To Build Mill

During the past few months the mines of Northern Ontario have been [illegible] by several cuts in the price of powder. The third and largest cut was made a few days ago when the price was lowered from $19.50 to $17 per 100 lb.

Cobalt—[illegible]

as other mines in the district, has been hampered by frequent occurrences of power shortage, so that the mill ran only 76 per cent of the possible running time.

It is officially stated that the mill heads of the Kirkland Lake Gold are running from $9 to $10 per ton. The average for the last fiscal year was slightly over $6.

Work has been resumed on the Granby-Kirkland property, preliminary to sinking a shaft.

On the old Buffalo property, now owned by the Mining Corporation, a winze has been sunk 40 ft. on a new vein, which shows an average of 2½ in. of high-grade ore.

During June the Nipissing mined ore of an estimated net value of $162,824, and shipped bullion from its own mine and customs ores of an estimated net value of $208,526. The value of the silver production is estimated at 59¾c. per oz. This production is higher than that for any other month of the current year.

The Kerr Lake mine has recently made two shipments of high-grade ore, which were obtained from the development and exploration work carried on since the property closed down last winter.

Gowganda—The equipment is being installed in the small hydro-electric plant at Hanging Stone Falls, in Gowganda. As the company has no immediate market for power, however, installation is not being energetically pushed.

Swastika—During the recent bush fires the plant of the Bourkes mine, in the Swastika district, was destroyed by fire.

The Miller Independence, in the Swastika district, which recently floated a bond issue of $50,000, has let a contract for diamond drilling to be carried on from the 500-ft. level.

The Kirk Gold Mines, in Western Ontario, has arranged to buy the mill of the Havilah company, and expects to have it in operation by the first of next year.

West Shining Tree—In the West Shining Tree district, the Wasapika is taking a large quantity of supplies and machinery into the property. It is expected that this company will start the construction of a 150-ton mill.

The White Rock mine, in the same district, recently resumed operations, and has begun to sink a new shaft.

NEW CALEDONIA

Nickel and Chrome Ore Mining Undergoes Serious Decline—Shipping Laid Off

The *Bulletin du Commerce* of Nouméa, New Caledonia, for May 13, discusses among many other adverse experiences now visiting that French colony, the serious situation in its mining industry.

The situation affects chiefly and seriously la Société des Hauts Fourneaux de Nouméa, which has deferred the evil day as long as possible, but at last has had to reduce activities because of closed markets. Development work has stopped at the Téné mines, Bourail, and ore extraction has been cut to the minimum at other properties. On May 15 came the first reduction in the force, affecting 130 laborers and skilled workmen, and further reductions in personnel were then confidently expected. Imported Javanese and Tonkinais were being retained however. The effect of the depression also strikes the shipping, a large proportion being in the ore-carrying traffic. There have been 7,200 tons (ten steamers) released or laid up, and 312 ship hands are said to be affected.

The effect on the chrome-ore industry is not yet evident in full. However, the Tiébaghi chrome mine will ship only half the tonnage of last year; and the chrome mines of the Coulée district are already both cutting output and discharging all but the Asiatics and the *canaques* of their forces. As for la Société le Nickel, at the date of writing it was held certain that it would not reduce production; and there was also reason to expect the work on construction of the Yaté hydro-electric plant to continue.

KOREA

Mine Fire at Oriental Consolidated Property Believed To Be Out

Unsan—The Oriental Con. Mining Co.'s cleanup for June was $94,000, practically the same as in May. The mine fire is probably out. It was hoped that the Tabowie mill would be running at full capacity by the end of June.

MEXICO

Coahuila

Peso Assessment Levied by La Perlita y Anexas

Torreon—The Mexico department of transportation of the American Smelting & Refining Co. has announced a new arrangement with the National Railways of Mexico for better freight service. Ore shipments and mining supplies will be handled more promptly and at a reduction in rates.

Saltillo—La Perlita y Anexas mining company, with offices in this city, has called for an assessment of 1 peso per share on its second issue of stock, payable during July. Work at the company's mines in the state is to be pushed with more vigor, so as to have them in condition for the regular shipment of ore as soon as conditions improve and the smelters resume operations.

Recently a number of new zinc properties have been located in the State of Coahuila. At Monclova, near the old Tsan Yi Yan mines, a new location has been filed on by Attorney Alvino Espinosa, from which property some fine zinc ores have been extracted. The San Juan group in this same region is producing good zinc ore which carries silver, lead, and copper also. Contiguous to this group lie the Maria, Juana, and Perla mines, which have produced high-grade zinc ores.

Zacatecas

San Manuel y Anexas Levies Assessment

Zacatecas—The Cia. Minera San Manuel y Anexas has levied an assessment of 1 peso per share, payable at the office of the company either in Mexico City or Zacatecas. Henry Barnhof, formerly of Mapimi, is president. The company is developing some valuable properties in Zacatecas.

Edward Palmer has recently added a number of new claims to his extensive mineral holdings in this state, having applied for patent to La Perla, a group of copper mines in the La Parroquia Mountains, near Zacatecas City.

Chihuahua

Scattered Holdings of Pedro Alvarado Taken Over by New Company

Parral—The Mexican Natural Resources Co. was recently organized at San Antonio, Tex., for the purpose of taking over about fifty properties in Chihuahua, Sonora, and Durango belonging to Pedro Alvarado. A party of engineers is said to be reporting on these properties, which are scattered, with a more or less unknown value. The properties are not to be confused with those of the Alvarado Mining & Milling Co., in the Parral district.

ARIZONA

Big Ledge Copper Co. Offers Further New Stock

Globe—H. D. Brackman, a chemist, formerly with the Inspiration Consolidated, after some experimental work, is reported to have perfected a leaching process by which, with a makeshift equipment, he is said to have succeeded in saving 95 per cent of the assay value of silver ores from Richmond Basin and Rambo district. He is starting on the erection of a ten-ton plant in Globe.

Additional bin capacity has been provided at the International smelter at Miami for storing concentrates from the Miami mill, which are being received at the rate of five carloads a day. It is understood that payment for the concentrates is being made in copper at the refinery in New Jersey.

Inspiration is reported to be negotiating for the purchase of the adjoining property of the Southwestern Miami Development Co.

Prescott—Only the tall stack is to be left in junking the plant of the Great Western Smelting Co., at Mayer. The smelter was erected about five years ago, and for a few months was operated in charge of Arthur Cole, who had been with the Cananea smelter. It was closed in June, 1917, a number of lawsuits being brought then. Heading the enterprise were Charles Batre, an Arizona promoter, and H. LaDuc, of St. Paul. The plant and property are now owned in New York, the purchasers being locally represented by Herman A. Wagner, manager of the Grey Eagle reduction plant, near Mayer.

Heavy machinery is being taken from the old Garford property in the Cherry Creek section to mines near Wickenburg, owned by L. N. Butler, of Phoenix. The Trinity mine, on Pine Flat, is being equipped with a [illegible], compressor, and other machinery from mines on Turkey Creek.

Mayer—The Big Ledge Copper Co. is offering $500,000 in 8 per cent preferred stock at par $5 a share. The original capitalization was $7,500,000, with shares at $8. Late in 1917 this was increased to $15,000,000, the new stock being offered at $2. The corporation's property, near Mayer, includes the Butternut and Henrietta mines, both well-esteemed properties, but hardly worth $15,000,000, and the old Treadwell smelter, a small plant not modernly equipped. The smelter in past years was the scene of a number of experiments in ore treatment, none of which appear to have been successful.

Jerome—Calumet & Arizona has just completed an arrangement whereby it is to secure control of the Verde Central property. It has an option on the majority of the shares of this company, which it can exercise after it is satisfied that the property is worth it. According to George A. Newett, a director of Calumet & Arizona, the shareholders of Verde Central are assured that the prospecting of their claim will be intelligently and fairly done, and if there is a mine the Calumet & Arizona will probably find it. There are 400,000 shares of stock of Verde Central issued. Prospecting has been under way for several months, and directors of Calumet & Arizona have been prominent in this work. James and Thomas Hoatson and Thomas Collins were attracted to this location, and have been aiding in prospecting that portion of the tract which has looked best to them. This point is not far distant from the old United Verde mine. Ore has been shown, and further opening of the formation, with drifts and shafts, will be undertaken.

Duncan—The Oro Plata Consolidated [illegible] of New Mexico, which owns a number of gold and silver mines and prospects in the Mount Royal district, states that it will undertake work soon. It [illegible] that it has secured the prior rights to the water of the district from the state. It plans to bring all to a central milling point. Financing is being arranged. Harold C. E. Spence is president.

NEW MEXICO

Lordsburg—The ore shipments from the district for June amounted to [illegible] cars of ores and concentrates, a total of [illegible] tons.

The Co-operative Mining Co. shipped three cars of silver-lead concentrates in June to the El Paso smelter.

Steins—Sam Houghton, of [illegible], N. M., formerly geologist with the [illegible] Copper Co., has taken a lease on the "66" claim. A strong vein of [illegible] silver ore is exposed, which will be developed in the near future.

COLORADO

Golden Empire Resumes Development in Arvada Tunnel

Empire—Development has been resumed in the Arvada tunnel of the Golden Empire Co., which is about 3,000 ft. long, and will be advanced to explore veins in the Union district north of Empire. The scheme of development which the company has in view will involve the expenditure of about $100,000. E. D. Payne is manager.

The Randolph Gold M. & M. Co. has started development work in the Empress tunnel. W. A. Snyder is president and manager.

Telluride—The shipments of concentrates during June were as follows: Smuggler-Union Mining Co., 71 cars; Tomboy Gold Mines Co., Ltd., 51; Liberty Bell Gold Mining Co., 11; total, 133.

CALIFORNIA

Central Eureka Cuts Wages 50c. Per Shift—U. S. Smelting Co. Asks for Reduction in Assessment

San Francisco—The present ocean freight rate on copper from San Francisco to Baltimore is $8 per ton. Shippers are agitating for a reduction of $2 per ton, and steamship companies have been considering such a reduction in view of competition with rail transportation. The recent special meeting held by the North Atlantic and Pacific Eastbound Conference in San Francisco failed to approve of the proposed reduction, and the present rate is likely to continue.

According to local newspapers, warrants have been issued in Oakland, Cal., for the arrest of George Graham Rice and others in connection with alleged stock deals in which employees of the California Cotton Mills of Oakland, Cal., were swindled in their endeavor to get rich in the Broken Hills promotion.

Jackson—The Volcano ditch has been cleaned preparatory to supplying the Elephant Deep hydraulic mine at Volcano, where plans are being made to operate several hydraulic giants in the fall. Production is being steadily increased at the Argonaut.

Sutter Creek—The Fremont and [illegible] mines, [illegible] of [illegible] materials, [illegible] satisfactory results.

The Central Eureka posted notices announcing a wage reduction of 50c. per shift, effective from July [illegible].

Angels Camp—Fire is reported to have destroyed the surface plant of the [illegible] Mines Co. near [illegible]. The fire consumed the [illegible] which destroyed the hoist, headframe, compressor, engine and [illegible] plant, and [illegible] buildings.

Bishop—The Dawson Silver Co., of which A. [illegible] is superintendent, is sampling three properties at Dawson. The Consolidated [illegible] Mining Co. has resumed operation of its [illegible] plant. Jack Allison is superintendent.

Kennett—The U. S. Smelting Co. has petitioned the county officials for a reduction of its assessments from $1,015,210 to $[illegible]. The changes in assessment values are: Mammoth mine from $148,[illegible] to $[illegible]; [illegible] mine from $[illegible] to $[illegible]; Keystone group from $[illegible] to $[illegible]; employees' cottages at Kennett from $15,000 to $6,720; smelting plant from $435,330 to $141,780.

Bridgeport—A gravel deposit containing gold is reported to have been discovered in Dog Creek Canyon. H. G. Beck and associates investigated the long-abandoned placers in this district and discovered an encouraging lead. Preparations are being made to begin work.

NEVADA

Strikers and Operators at Divide Holding Firm—Original Klondyke Lessees Start Shipping

Virginia City—Active work is under way in the Con. Virginia, Ophir, and other mines on the Comstock Lode, with little developments of importance reported. Considering the optimistic reports on underground conditions in these mines, the recent assessment of 3c. per share on the increased capitalization of the Con. Virginia and Ophir would appear to be justly criticised.

At Gold Hill, the V. & T. railroad spur to the portal of the main haulage tunnel of the United Comstock Mines Co. has been completed, and building material is now being hauled to the proposed mill site. Excavation for the crushing plant and other necessary buildings is under way. About 300 men are employed.

Tonopah—No particular effort is apparently being made by either companies or strikers to effect a settlement of the wage controversy which has tied up practically all mining operations in the Tonopah and Divide districts since April 16. Both sides are standing pat, all the advantage being with the operators because the reduced wage scale is higher than that of other mining camps in the district. However, the strike committee continues in power, and even though it is generally conceded that the majority of the men are ready to return to work at the reduced wage, they are held in line by the leaders.

Lessees in the Montana, where several thousand tons of ore is broken and awaiting shipment, have refused to ship ore to custom mills paying the reduced scale of wages. As all the mills that accept custom ore, including the Tonopah Mining, Belmont and MacNamara, are not paying the reduced scale, or not operating, no shipments will be made at present by lessees.

The Tonopah Belmont and Tonopah Extension each have about three months of a reserve [illegible] and are running their [illegible] and [illegible] plants at [illegible] per cent capacity. Limited development work is being done, and mining operations as a whole are gradually being resumed as more men are brought in. The Tonopah Extension on July [illegible] shipped $[illegible] worth of bullion, which

JUDGE MINING & SMELTING CO.'S CONCENTRATOR AND FLOTATION MILL, EMPIRE CANYON, PARK CITY, UTAH. DUMP IN BACKGROUND THAT OF SILVER HILL SHAFT OF SILVER KING COALITION MINES CO.

is the first since the shutdown. The West End, on July 3, shipped thirty-three bars of bullion with an estimated value of $75,000.

Goldfield—The Donald and Giles lease in the Florence, with work being done from the 365 level, is showing up well, and the ore shoot bids fair to extend through to the surface. Two inches on the foot wall assays over $11,000 per ton, and the average ore broken is said to average $300 per ton.

Klondyke—Lessees on the Original Klondyke property began on July 6 to ship ore at the rate of fifty tons per day to the Belmont mill at Tonopah. The Knox Divide, controlling the Golden State mine, has not yet started shipping, although there is plenty of broken ore in the stopes and on the surface awaiting shipment. The Ben Hur Divide, which owns ground between the Original Klondyke and the Golden State, has sunk its vertical shaft to a depth of 110 ft. and started crosscutting from the bottom of the shaft to cut the vein at what appears to be the most favorable point as projected from the 60-ft. level.

Rand—Nevada Rand Mines Co. recently shipped 15½ tons of ore running 2.99 oz. in gold and 83.7 oz. in silver, or $142.87 per ton, from its property seventeen miles northwest of Nolan at Walker Station. This ore was taken out by J. D. Walker. Two other shipments have been made running $115 and $294 respectively.

Ely—C. B. Lakenan, manager of the Nevada Consolidated Copper Co., recently stated in Ely that there was reasonable hope for the resumption of limited operations toward the end of this year. The new contact orebody in the Ruth mine, now being developed, continues to show copper ore of direct smelting grade, both in the northerly and southerly drifts on the contact, and has already been proven for a length of 150 ft. along the strike. The limits of this orebody are as yet unknown.

A number of discoveries of rich gold ore have recently been made in the Ely district, the most important being that of the Millick brothers in Spring Valley. The inclined shaft sunk on the vein is now down 85 ft. Assays from the vein run $150 in value, and a carload is now on the dumps awaiting shipment.

The Mollie Gold Mining Co. has recently been formed to work valuable gold claims in the Osceola district. The discovery of rich ore by Tilford and Baird is responsible for much prospecting in this section.

UTAH

Output of Mines Expected To Drop Greatly This Year—Body of Miner Killed in Cave-in Recovered at Judge

Salt Lake City—Indications are that the 1921 output of metal by Utah mines will be far below normal. Operations at the smelting plants in Salt Lake Valley and vicinity are a fair index of conditions. The Murray plant of the American Smelting & Refining Co. has three out of eight lead furnaces in blast. The United States Smelting Co. at Midvale has four furnaces in blast, including one furnace on matte concentration; the International at Tooele has recently finished cleaning up, and on July 5 closed down its two lead furnaces.

Regarding the output of gold in Utah, this has steadily decreased since 1911, and will be notably less this year than in 1920 on account of the lessened output from copper ores and siliceous ores. Most of the gold comes from the lead ores and copper ores of Bingham Canyon and from the siliceous ores and lead ores of Tintic. Shipments from the Tintic district have been even less than in the first part of 1920, and the principal copper and lead mines of Bingham are closed. Gold-bearing ores in Piute and Box Elder counties continue to be mined.

Silver will probably be below normal also. Some of the producers of silver-lead ores at Park City have had difficulties over smelting contracts, and several mines in the Tintic district have been closed down on account of the expense and difficulty in marketing ores. The Chief Consolidated, the largest producer of silver in 1920, has, however, maintained shipments, and the Tintic Standard, the second largest shipper of silver ores in Utah, has shipped more smelting ore in the first half of 1921 than in the corresponding period of 1920, and has completed and is operating a milling plant for the treatment of siliceous silver ore. The Vipont, in Box Elder County, has upheld its production of silver ore.

Regarding copper, the Utah Copper Co., which produces most of the copper of Utah, was active in January, February, and March, and produced nearly 24,000 000 lb. of copper, but the mine was closed in April. The Utah Consolidated, a producer of both copper and lead, closed its mine at Bingham in February. The Tintic district contributes a comparatively small part of the copper output of the state—less than 3 per cent of it in 1920.

The lead output was somewhat below normal in 1920, and will probably be far below normal in 1921. The United States Mining Co. at Bingham, the principal producer at present, has continued to ship lead ore, but the Utah Apex and Utah Consolidated mines, both large producers of lead, were closed. The mines at Ophir, in Tooele County, were closed in January, and the output of lead from Park City was less than in the first part of 1920. In Tintic, the Chief Consolidated and the Tintic Standard have shipped more lead-bearing ore than ever before, but the output from the other mines of the district has been much less.

Regarding zinc, little effort was made to produce this metal in Utah in 1921, on account of the unusually low price. The electrolytic zinc plant at Park City closed down because the rate for electric power was greatly increased, contrary to the agreement with the power company. Zinc concentrates from the ores of Bingham and from tailings at Midvale are not being marketed, and the Scranton mine, in Tooele, is closed.

Eureka—Shipments from the Tintic district for the week ended July 9 amounted to 156 cars. Production was as follows: Tintic Standard, 47; Chief Consolidated, 36; Grand Central, 12; Iron King, 9; Eagle & Blue Bell, 8; Victoria, 7; Iron Blossom, 11; Dragon, 6; Swansea, 8; Colorado, 8; Mammoth,

PORTAL AND SNOW SHEDS OF JUDGE MINING & SMELTING CO.'S SNAKE CREEK TUNNEL, LOOKING NORTHEAST TOWARD PARK CITY, UTAH

1; Yankee, 1; Eureka Hill, 2; total, 156 cars.

During the week the Horn Silver at Frisco shipped 28 cars of ore to the Tintic Milling Co. at Silver City.

The Chief Consolidated has declared a dividend of 5c. a share, or $44,201, which will be paid Aug. 1, this being the regular quarterly dividend. The company has maintained production through difficult times, sending out chiefly higher-grade ores and holding back the lower, following the principle that a continuance of operation to preserve the organization is the better course in spite of some sacrifice entailed. The Grand Central has permitted a number of employees to lease old workings during the period of suspension, and considerable ore is being shipped from a clean-up of these workings. The Eagle & Blue Bell and the Victoria are making heavier shipments, and both properties are in excellent condition. The Tintic Standard announces that it will install two new roasters at its new mill, making a total of nine roasters, which together will have a capacity of 180 to 190 tons daily.

Park City—Shipments for the week ended July 9 amounted to 1,267 tons, as compared with 1,957 the week preceding, the lessened output being due to the Fourth of July holiday. Shippers were: Silver King Coalition, 598 tons; Judge allied companies, 388 tons; Ontario, 266 tons; Naildriver, 56 tons.

At the Judge mine, the body of Antonio Allegris, trapped in a cave-in early on the morning of June 21, has been recovered after considerable effort and risk on the part of the rescuers. Indications are that death was instantaneous.

The Spiro tunnel of the Silver King Consolidated is in 14,400 ft., and stringers of galena and gray copper have been cut.

Bingham Canyon—Operations at the Bingham Galena continue. There has been some agitation in regard to the stock of this company, as Californians have been seeking the extradition of George Graham Rice, in connection with the promotion of the Broken Hills property in San Francisco and Reno. It appears that stock letters have appeared in California sent to stockholders in the Broken Hills, offering them a chance to make good their losses through the Bingham Galena.

IDAHO

Coeur d'Alene District

Amazon-Dixie Crosscut Cuts Vein—Marsh Mines Stops Development—Nabob Consolidated Sued

Wallace—A crosscut from the main tunnel of the Amazon-Dixie has intersected the Leslie vein, showing it to be 20 ft. wide and carrying considerable lead and copper ore. With this accomplished, work has now been transferred to the shaft, which will be deepened from 400 to 800 ft. below the tunnel or 1,500 ft. from surface. The shaft is sunk from the main tunnel, and the vein has been explored from it at 200 and 400 levels, each having good ore showings and improving as depth is gained. The sinking will be done under contract. The company has complete modern equipment and takes electric power from the Montana Power Co. The Amazon-Dixie is at Sildix, Mont., on the Northern Pacific R.R. near the Idaho line.

The Marsh Mines Consolidated has suspended development and has made no announcement as to its future plans. Since the apex litigation with the Hecla was settled, a few men have been employed in drifting on the Russell vein, the apex of which was the issue in the litigation. It was announced some time ago that when this work was completed, deep development of the vein would be undertaken in the Marsh ground, either through the Gertie tunnel or No. 3 tunnel of the Hecla. The Gertie company has refused to make this concession, and why the other alternative is not being acted upon does not yet appear. The right to use Hecla No. 3 tunnel in the development of Marsh was one of the terms of the litigation settlement.

The directors of the Western Union, one of the new mines near Wallace, have issued a statement to the stockholders, in which it is stated that since November 15, 1920, the company has shipped [illegible] tons of ore having a gross value of $[illegible] and which gave a net smelter return of $[illegible]. These shipments averaged 40.86 oz. of silver per ton and 50 per cent lead. During this period the mine has been operated by lessees, the company receiving a royalty of 25 per cent on net smelter returns. The lease expires on Aug. 18, and before that date the directors will meet and decide whether they will take over the operation of the property or renew the lease, with the chances favorable to the former.

J. W. Codd, of Spokane, has filed an action in the district court in Wallace against the Nabob Consolidated Mining Co., in which he alleges that he is the owner of 1,450,000 shares of the stock of the company now standing in the name of the Stewart Mining Co. and asking for an order requiring the company to transfer the same to his name. The claim is made that Codd and his associates advanced about $70,000 to the Nabob company, which is controlled by the Stewart Mining Co., and that they demand the delivery of this stock in order to put in their own directors at the annual meeting of stockholders at Kellogg on Aug. [illegible]

Mullan—Underground work has been stopped by the American Consolidated M. & M. Co. Preparations are being made to install a compressor. It is expected that the plant will be in operation by Aug. 1. During the last year the company drove a crosscut 500 ft. to the vein and drifted 100 ft., the latter showing 3 to 6 ft. of low-grade carbonate and sulphide ore. This was in the nature of prospecting work, and will be resumed as soon as the compressor is installed by crosscutting to the vein from No. 4 tunnel 400 ft. below, and later by exploring the vein from No. 5 tunnel, 500 ft. below No. 1.

Eagle—An important strike was made recently by the Columbia Mining Co. The tunnel is following the South vein and what appears to be a new vein carrying gold, silver and lead. This has been followed about 40 ft.; it is 4 ft. thick and the ore has steadily improved. A fair assay returned 0.4 oz. gold, 24.1 oz. silver and 18.7 per cent lead. A compressor has been ordered and is expected to be in operation by Aug. 15. Control of the Columbia company is held by E. F. Gallagher, of Philadelphia

MONTANA

Anaconda Successful in Fighting Tramway Fire With Slimes

Butte—Considerable "drag" ore is being found on the 1,600 level of the Main range mine of the Tuolumne, where a crosscut is being driven for the Spread Delight vein, carrying a comparatively higher silver than copper content, seemingly indicating the existence of ore at this depth. Cutting of the Spread Delight fissure is now looked for within two weeks.

Davis-Daly is averaging a daily output of about 330 tons from the Colorado mine.

The Anaconda company's success in fighting the fires in the region embraced by the Tramway, West Colusa, and Leonard mines, through pumping fine slimes from the slime pond of the Butte & Superior into the burning area, resulting in smothering the fire, continues to attract attention, particularly in view of the report that the corporation has succeeded in reclaiming two large stopes of good ore on the 2,000 level of the tramway.

Butte & Superior is expecting to cut within the next two weeks or so the so-called copper vein on the 2,200 level of the Black Rock mine. This is the fissure which was uncovered on the 2,050 level.

Neihart — A meeting of the stockholders of the Cascade Silver Mines & Milling Co. is scheduled for Aug. 24, in Butte, when it is expected plans will be considered for building a concentrator and possibly a smelter for treating the ores of the district.

Victor—Recording of a deed shows the transference of the old Curley mine near here, in Ravalli County, to W. R. Price, presumably representing New York parties, for $125.000. The property was worked about twenty-five years ago. Plans are under way to reopen the mine.

De Borgia—Machinery is to be installed at the Silver Rock Mining Co.'s property, the first of which will be delivered within sixty days. An extensive program of development is planned, according to those interested.

Melrose—The Montana-Silver Copper Co. has opened a new vein which gives considerable promise, according to the management. Years ago this property was a fairly important producer of silver ore.

Trout Creek—A favorable gold ore showing is reported at the property of the Vermillion company, where upraising is in progress to reach a shoot disclosed on an upper level.

Libby—One shift has been put to work at the Lukens-Hazel mine and mill.

Lump Gulch—A new company is being formed to operate the old Liverpool mine, recently taken over by Detroit interests.

WASHINGTON

Washington Water Power Co. To Buy Granby's Kettle Falls Site

Spokane — The Washington Water Power Co. has announced its intention to purchase the Kettle Falls power site near Marcus from the Granby Consolidated Mining, Smelting & Power Co., Ltd. The site has been held for years by the Granby company, but has not been developed. It is said to be the second largest potential source of hydro-electric power on the Columbia River, and can be developed to supply 150,000 hp. Application has been made to Federal authorities for permission to proceed with its development.

MICHIGAN

The Copper Country

Quincy To Modernize Another Furnace—Development Work Continues in Seneca

Houghton—There is yet no indication of a reopening of mines now closed in the Lake Superior copper district, and the managements confess they are as much in the dark about it as anyone else. That the mines will be ready to stage a quick "come-back," so far as physical condition and plants are concerned, there is no question, for every advantage has been taken of the period of idleness to make repairs and changes to increase output and lower costs.

Copper continues to move out of the district. One steamer has just taken a cargo of 900,000 lb. of Calumet & Hecla, Copper Range, and Quincy metal, about an equal amount from each smelter. This shipment included 300,000 lb. of Calumet & Hecla copper for domestic buyers, previously reported.

Calumet & Hecla is preparing to fill orders for 600,000 lb., half of which will be for export to France and the remainder for domestic consumers.

At the Quincy smelter, preparations are being made to modernize No. 3 furnace. It will be enlarged to a capacity equal to that of No. 5, or 150,000 lb., which will give Quincy two of the largest and most modern furnace units in the district. No. 5 furnace is practically complete. It has been partially in operation for some time. Like No. 5, No. 3 will be served by automatic casting machines, electric cranes and a trolley dipping system.

At the Seneca property work is proceeding in the 4th level stope and in extending the drifts on the 3d, 5th, and 6th levels. Good ground continues to be developed in the stope. The 6th level drift, north, is now in poorer ground than usual. The average ground in the level is good milling "rock."

Gogebic Range

Oliver Company Shipping About 45,000 Tons Per Week

Ironwood—The Townsite mine has started a steam shovel in its stockpile, and expects to ship it all before the season closes. The mines of the Oliver Iron Mining Co. are shipping about 45,000 tons a week.

Gogebic Range in Wisconsin

Montreal Mining Co. to Sink New Shaft

Hamilton, Wis.—The Montreal Mining Co. is formulating plans for sinking a 2,000 or 3,000-ft. vertical shaft to be situated between the present No. 4 shaft of the Montreal mine and No. 6 shaft of the Ottawa mine. The site selected is near the top of the hill west of the Montreal River. Test borings, however, have shown that there is over 90 ft. of overburden at this point, and the shaft will probably have to be concreted through this soil. The shaft will be in the footwall slate and greenstone. It will be lined with steel sets built up of "H" sections and concrete may be used to complete the lining. The outside dimensions of sets are to be about 11 x 17½ ft. with a large cage road at one end, and two skip roads with ladder and pipe roads beside them. Hoisting will be done by electricity. The work of sinking the No. 6 shaft of the Ottawa mine is nearing completion. It has been sunk from the 17th level under a pentice, as the shaft was in use above that point for regular hoisting.

MINNESOTA

Cuyuna Range

Meacham Mine Shuts Down With 50,000 Tons of High Grade Stocked

Crosby—Mining operations have been discontinued for the present at the Meacham mine, of the Rogers, Brown Ore Co., and the surface force has been reduced to minimum. Steam power units formerly used for hoisting and pumping will be idle, but the mine will be kept unwatered by electric pump reserves. The Meacham has been developing ore on its 350 level with a small crew since last April, when active stoping was suspended. The mine has more than 50,000 tons of high-grade iron ore in stock piles.

Mesabi Range

Chester Surface Plant Being Dismantled—Shenango Gives Up Lease on Tioga Mine

Chisholm—The surface plant at the Chester mine, a property formerly operated by the Oliver Iron Mining Co., is rapidly being dismantled, as the lease on the property has been given up by the Oliver company.

The lease on the Tioga mine has been relinquished by the Shenango Furnace Co. The surface equipment is being removed to other properties of the same company on the Mesabi Range.

Buhl—The removal of the shafthouse and other equipment at the Shiras mine is rapidly nearing completion. This property was operated by the Oliver Iron Mining Co., which gave up the lease several months ago.

ALABAMA

Bessemer—The ore mines of the Tennessee Coal, Iron & Ry. Co. at Muscoda, with the exception of mine No. 4, closed down July 8.

THE MARKET REPORT

Daily Prices of Metals

July	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
14	12.375	27.125	28.00	4.40@[illegible]	4.30	4.25
15	12.375	26.75	27.75	4.40	4.25	4.25
16	12.25	26.50	27.50	4.40	4.25	4.25
18	12.25	26.375	[illegible]	4.35@4.40	4.25	4.20
19	12.00@12.25	26.00	27.00	[illegible]@4.40	4.20@4.25	4.20
20	12.00@12.25	25.75	26.50	[illegible]@4.40	4.20@4.25	4.15@4.20

*These prices correspond to the following quotations for copper, "delivered": [illegible]

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of [illegible] per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

July	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
14	71[illegible]	71¾	[illegible]	[illegible]	[illegible]	[illegible]	23[illegible]	[illegible]	27¼
15	70[illegible]	71⅛	75	165½	167¾	23⅜	23½	[illegible]	27
16									
18	70[illegible]	70[illegible]	74½	[illegible]	[illegible]	23[illegible]	23[illegible]	26¾	27
19	70⅜	70⅝	74½	161½	164	[illegible]	[illegible]	26	26¾
20	70⅜	70¾	74½	160	162½	23[illegible]	23[illegible]	26	26¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

July	Sterling Exchange "Checks"	Silver			July	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
14	[illegible]	99½	60[illegible]	37[illegible]	18	[illegible]	[illegible]	59[illegible]	37⅞
15	361[illegible]	99½	60	37[illegible]	19	[illegible]	[illegible]	59[illegible]	37⅞
16	361[illegible]	99½	60⅛	37[illegible]	20	[illegible]	[illegible]	[illegible]	37

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, July 20, 1921

Utter absence of consuming demand worthy of the name, coupled with the efforts of some weak interests to dispose of small lots of metal, has resulted in further recessions in the prices of all of the major metals during the last week.

Copper

Not in weeks has the copper market been so devoid of actual business. Possible buyers do not seem to be interested at any price, and generally refuse even to make bids. Those who formerly bought 500 or 1,000 ton lots now take 25, and would take even less probably except for the fact that they could not get the carload rate on smaller lots. Yesterday over 100 tons of electrolytic wire bars were freely offered at 12.00c., New York warehouse, but, so far as we have been able to learn, were not marketed. Producers have sold practically nothing for domestic delivery, the little business being done going to second hands. Producers are generally quoting [illegible], delivered, and show no desire to meet the outside market except in the case of those producers who have a settled policy of selling current production.

Export sales through the Copper Export Association have been fair, chiefly to Japan. Present Japanese production is about [illegible] tons per month, with consumption possibly 1,500 tons greater than this. Added to this is the Chinese demand of approximately 1,500 tons per month, making about 3,000 tons monthly in the Far East, which must be satisfied by shipments from this country. English dealers continue to quote prices to consumers which American producers are not willing to meet. Sales have been made during the last few days in London at the equivalent of 12.20c., c.i.f., which is the equivalent of around 11.65c., New York.

Lead

The American Smelting & Refining Co. continues to quote its official contract price of 4.40c.

By stretching the imagination, one might consider that the buying movement of two weeks ago is continuing, but no one will admit that he is participating in it. Sales have in general been limited to carload lots, and they have not been frequent at that. The one bright spot of the week was an order from the Remington company for 1,000 tons of July-August lead, which was sold for 4.40c. delivered Connecticut valley, according to reports in the trade. In the Middle West demand seems to be entirely absent, and St. Louis quotations are largely nominal. Chemical lead is bringing a premium of 5 to 10 points over the prices which we quote, and corroding lead from 10 to 15 points.

Zinc

The market has yielded to further pressure, and sales have been reported at 4.20c., East St. Louis, early this week, although business was also consummated on a 4.25c. basis. On Monday it is reported that zinc sold for 4.15c., but these sales have not been confirmed. Owing to the great increase in stocks since the first of the year, producers are seizing the only weapon in their possession, a further decrease of production, with the hope of holding off increases in stocks and possibly making some inroad in the accumulation. [illegible] of some companies which have already cut production to the bone. European [illegible]

Tin

[illegible] change, have resulted in some inquiry [illegible] at greatly reduced capacities, and in general have four or five months' supplies of tin on hand. About the only present demand is from solder and babbitt manufacturers and for general industrial purposes. Electrolytic is in fair demand at the same prices as for Straits. Futures are quoted the same as spot.

Arrivals of tin, in long tons: July 13th, London, 50; Straits, 5; 16th, Straits, 350; 18th, Straits, 425; 19th, Liverpool, 25.

Gold

Gold in London: July 14th, 113s. 2d.; 15th, 113s. 4d.; 18th, 113s. 9d.; 19th, 115s.; 20th, 114s.

General stock of money in the United States: July 1: Gold coin, $3,223,351,644; standard silver dollars, $288,789,326; subsidiary silver, $271,108,323; United States notes, $346,681,016; Federal Reserve notes, $3,000,429,860; Federal Reserve Bank notes, $150,772,400; National Bank notes, $743,290,374; total, $8,024,422,943. Money in circulation per capita, $53.42.

Foreign Exchange

"Cables" are now quoted one-half cent higher than the "demand" figures given in the table on page 155. On Tuesday, July 19th, francs were 7.785c.; lire, 4.54c.; and marks, 1.3075c. New York funds in Montreal, 13½ per cent premium.

Silver

From July 13 to 16 the London price held steady at 37⅝d., but demand in the New York market from that quarter was slight and the Eastern exchange rates weakened, causing a falling off in the China inquiry. On the 18th and 19th London came 37⅜d. With these lower prices and the fall in sterling exchange, the New York market also declined. Sellers, however, were not inclined to meet the lower rates, with the result that business was nominal. Purchases by the Treasury Department under the Pittman Act amounted to 62,201,816 oz. up to July 14.

Mexican Dollars—July 14th, 46⅝; 15th, 46½; 16th, 46⅜; 18th, 45⅝; 19th, 45⅝; 20th, 45⅝.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 21@23c. per lb.; 22½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 4⅝c.; market dull. W.C.C. brand, 5⅜@5⅝c. per lb. Cookson's "C" grade, spot, 9@9½c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500-lb. lots.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb.; black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $165@$185 per oz.

[1]**Molybdenum Metal**—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz.

Palladium—$60@$65 per oz.

Platinum—$72@$75 per oz.

Quicksilver—Nominally, $43.50@$45 per 75-lb. flask. San Francisco wires $46.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—22c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., July 16—Zinc Blende, per ton, high, $24.20; basis 60 per cent zinc, Waco, $22; Picher, $21, premium; Prime Western, $21@$20; fines and slimes, no offerings; average settling prices, all grades of zinc, $22.15.

Lead, high, $54.50; basis 80 per cent lead, $47.50@$45; average settling price, all grades of lead, $46.14 per ton.

Shipments for the week: Blende, 6,179; lead, 1,495 tons. Value, all ores the week, $205,840.

The market on zinc ore slumped at the close, several buyers dropping to offerings of $20 basis, the bulk of purchases being made early in the week on $21 basis, Picher. The quotations: "Waco" and "Picher" cover the same grade of ore, but buyers figure one dollar higher at Waco, on account of a freight differential of 80c. and a 20c. lower hauling cost.

A few lots of lead sold late last week $47.50 basis, with the highest offering this week reported at $46 basis and the general market $45.

Platteville, Wis., July 16—No market for zinc and lead ore. Shipments for the week, none. Shipments for the year: blende, 11,461; lead ore, 978 tons. Shipped during week to separating plant, 40 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,700@$2,000; No. 2, $1,200@$1,500; spinning fibers, $400@$800; magnesia and compressed sheet fibres, $275@$400; shingle stock, $95@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats $8.50@$15, all per short ton, f.o.b Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $7@$9; washed, $9@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $20@$25, f.o.b. New York.

---

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Emery—Turkish emery, 6[illegible] per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

Feldspar—No. 1 soap grade, [illegible] per ton, f.o.b. North Carolina points; No. 1 pottery, $6.50; No. 2, $5. Market dull. Large stocks are available and quotations are nominal. Producers report cancellations of orders. No. 1, Canadian, ground, $26@$28, f.o.b. cars.

Fluorspar—Gravel, guaranteed [illegible] per cent calcium fluoride and not over 6 per cent silica, $20 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $13.50, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7@8c. per lb.; chip, 5½@6c.; dust, 3@4½c. No. 1 flake, 6½@7c.; amorphous crude, 2@2½c. Market quiet.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead Burned—$33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa.; Austrian grade, $5[illegible] per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.; No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, [illegible]@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

Monazite[1] — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports, 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $6.75; 68 per cent, $6.25; 68@66 per cent, $6.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 14c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 12 @ 14c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $8@$12 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic — White arsenic, 6½c. per lb. in carload lots.

Sodium Nitrate—$2.85@$3 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $16@$18 per ton, f.o.b. Western mines, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.50@$1.75 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 14c. per lb. of chromium contained; 4 to 6 per cent carbon, 15c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, [illegible] f.o.b. furnace, resale, $90, delivered; English, $70, c.i.f. Atlantic [illegible] 18@20 per cent, [illegible], f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works. Imported material, $1.70@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $40@$42; 50 per cent, [illegible]; 75 per cent, $1[illegible].

Ferrotungsten—Domestic, 70 to 80 per cent W, [illegible] per lb. of contained tungsten, f.o.b. works. Foreign, 50c. [illegible] f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—[illegible] per lb. of V contained according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 20¾@21¾c. per lb.; wire, 14¼@14¾c.

Lead Sheets—Full lead sheets, 8.25c.; cut lead sheets, 8½c. in quantity, mill lots.

Nickel Silver — 31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets 16¾c.; sheathing, 16¼c.; rods, ⅜ to 3 in., 13¾c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $60@$65 per net ton, shipping point; arches, keys, wedges, $66; splits, soaps, $84.

Fire Brick—First quality, 9-in. shapes $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $70@$75 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, July 19, 1921

The long-continued decrease in demand for steel seems to have definitely ended, at a point where the demand was less than 20 per cent of capacity, and to have begun a definite though naturally slight improvement. In sheets, the increase in demand is distinctly marked, and is apparent with practically all classes of buyers. In bars, the most basic commodity of all, the demand may not have increased noticeably in point of total tonnage, but it has become much more widespread.

No increase in actual ultimate consumption of steel is observed nor is there any more cheerful feeling on the part of steel buyers, the development being rather that liquidation has proceeded far enough to require that more steel be shipped from mills.

Steel prices, long considered in some quarters the key to the situation, are not an important factor. Buyers are seeking prompt shipment and are taking only such steel as they can promptly dispose of, so that they incur little risk.

Pig Iron—The market [illegible] [illegible] has [illegible] to make spot prices 50c. more [illegible]. Valley market now standing in [illegible] at $21 for bessemer, $19.50 for basic, and $[illegible] for foundry.

Coke

Connellsville — Furnace, $2.75@$3; foundry, $4@$4.50.

---

[1] Foote Mineral Co., Philadelphia, Pa.

Zinc One of the Most Depressed Metals

Despite Curtailment of Production, Stocks Have Continued To Rise — Imports of Foreign Zinc Have Ceased—Depression May Result in Improving Mining and Smelting Practice—Recovery Depends on Iron and Steel Trade

EDITORIAL MARKET STUDY

ASK A PRODUCER what ails the zinc market and you will get a variety of answers. Most producers, however, permit one outstanding deduction to be made. The zinc trade is so closely allied with the galvanizing business that improvement cannot be expected until a prior or simultaneous improvement takes place in the iron and steel trade.

The use of zinc as a handmaiden to iron, giving protection against corrosion in return for the greater strength and cheapness of iron, is not conducive to the freedom of the zinc market. Great trouble and much time and money have been spent in an effort to widen the uses of zinc, but the fact still remains that the zinc industry is rather firmly welded to the galvanizing industry. The manufacture of zinc roofing material, doorknobs, and other articles has small chance of changing this status. Nevertheless, the wish to expand the consumption of zinc in new channels is deserving of the greatest commendation, as new uses for this metal cannot fail to be beneficial to the industry.

Zinc companies have sharply curtailed production, so that at present the monthly output is not much over 18,000 tons, compared with a monthly output of 38,440 tons in 1920 and 25,850 tons in pre-war times. The question may well be asked, why, in view of the dearth of trade in zinc, production is not cut further? The answer is that most companies have shut down as far as it is possible to do so, without completly abandoning operations, and that, despite the extraordinarily low price of zinc, a few mines blessed with unusually rich ore are just about able to break even. Furthermore, leasing arrangements may preclude shutting down entirely.

Zinc mining, compared with the mining of its sister metals, copper and lead, is in several ways at a disadvantage. The copper and lead miner as a general rule receives some compensation for gold and silver recovered in the course of mining and reducing his product. Notable exceptions are the Michigan copper mines and the Missouri or Middle Western lead fields. Mining of strictly zinc ores, on the other hand, rarely results in the recovery of byproduct silver or gold.

Zinc mining is not practiced on the large scale customary with the copper companies or even the lead companies. The greatest zinc producers in the United States acquire their metal through the operation of many small mines; that is, small in comparison with the copper operations. Then again, zinc mining is hampered by leasing arrangements in Middle Western fields, which ordinarily have the grave disadvantage of not being conceived for the best working of the zinc mines, frequently leaving them "gutted," the best parts worked out, and development planned with little regard to the future working of the property.

Zinc production is also noted for the secrecy with which some of its operations, particularly the reduction of the metal, are veiled. This has resulted in much inefficiency and the retention of inferior methods. It is only recently that a wholesome solidarity among the units of the industry has begun to appear, and a common ground for the solving of problems peculiar to the zinc business has been found—the American Zinc Institute.

Zinc producers have been much concerned since the first of the year with the importation of foreign zinc into the United States. The record of importations for the first five months of the year strikingly shows that a heavy volume of foreign zinc has been entering the country. Although this inflow ceased in May, during March and April of this year over 12,300,000 lb. of zinc was imported. When one considers that prior to the war importations were mainly in the form of ore from Mexico and Canada, to be smelted in this country, it is clear that the importation of such a heavy tonnage of finished zinc is bound to disturb the market. The incoming pigs or slabs were mainly of German origin—from the Silesian field—and although the imports have ceased, due more to political complications and the chaos in the status of the Upper-Silesian zinc mines than anything else, they are an indication of the strong competition that the American zinc industry must meet. Averaged over the five months of the year, however, the heavy European importations do not abnormally swell the total figure, which is still below the pre-war average of imports.

The figures given in the table show that exports are now practically nil.

Stocks of zinc have shown a disappointing rise, and are now at a record high figure, about 91,000 tons, compared with 71,040 tons on Jan. 1, 1921. In pre-war years, stocks at the beginning of the year averaged about 12,000 tons; after the war they were higher, around 40,000 to 50,000 tons, so that the present accumulation is abnormal. Although attempts have been made to cut into surplus stocks, efforts so far have not been successful, decreased production being met with a greater decrease in consumption.

Much reliance is being placed upon the passage of a tariff to relieve the zinc situation, but in view of the fact that no foreign zinc is now being imported in any great volume, and that prices are still very low, 4.25c. East St. Louis, is it not too much to expect that the tariff will cure the ailments of the industry? Could not some attention be paid to more efficient mining practices? Or removing objectionable features of the leasing system, or introducing a better spirit of "give and take" in the industry, so that technical processes may be improved?

We have in the United States some of the richest and highest grade zinc mines in the world, and it would be a pity if the bountifulness of nature were relied upon to make up for the introduction of the more efficient working of zinc properties. If some of the lessons to be learned from low prices of zinc are taken to heart, the losses of the industry with zinc around 4.25c. per lb. will be greatly ameliorated.

MOVEMENTS OF ZINC TO AND FROM THE UNITED STATES

(In Pounds)

IMPORTS

Class of Product	Average Monthly Pre-War	Average Monthly, 1920	January, 1921	February, 1921	March, 1921	April, 1921	May, 1921
Ore	3,018,100	3,747,800	946,532	2,968,835	281,493	83,283	5,820
[illegible] and pigs	716,500	2,400	86	909,777	6,162,061	6,269,176	
[illegible]	395,160(a)	2,700					

(a) In addition, about [illegible] 300 [illegible] were imported monthly

EXPORTS

Class of Product	Average Monthly Pre-War	Average Monthly, 1920	January, 1921	February, 1921	March, 1921	April, 1921	May, 1921
[illegible]	1,340,000	4,757,500	69,000		7,340		
[illegible] from [illegible]		12,344,200	2,580	263,460	174,106	115,840	135,360
[illegible] from foreign ore	660,000	4,688,500					
[illegible]	1,050,000	1,?72,100	419,934	498,225	171,860	338,412	214,747

COMPANY REPORTS

Oroville Dredging Co.

Gold, Silver; United States and Colombia

A report of the operations of the Oroville Dredging Co., Ltd., for a year ending Sept. 30, 1920, states that dividends were received from the company's holding of shares in Nechi Mines (Colombia), Ltd., amounting to £28,348 8s. 6d., and in Pato Mines (Colombia), Ltd., to £88,186 3s. 6d., the other credits in the profit-and-loss account amounting to £2,235 11s. 6d. From the total credits of £118,770 3s. 6d., after debiting all charges in London, the balance to credit of profit-and-loss account for the year, carried to the balance sheet, is £111,829 5s. 10d., compared with £69,653 14s. 8d., for the previous year. Adding to this amount the credit balance from last year of £25,367 7s. 5d., a total is shown of £137,196 13s. 3d. Deducting from this one dividend of 6d. per share paid on Dec. 30, 1919, and three of 9d. per share on March 31, June 30, and Sept. 30, 1920, respectively, amounting to £94,398 19s. 6d., a balance of £42,797 13s. 9d. remained to the credit of profit-and-loss account as on Sept. 30, 1920, subject to excess-profits duty and corporation tax (if any).

The company controls the operations of Nechi Mines, Ltd., and Pato Mines, Ltd., and its American operations through the American Oroville Co. are being liquidated. The company is capitalized for £700,000, of which £686,538 has been issued in £1 shares. Holdings in other companies are 125,993 ordinary shares of 10s. each in Nechi Mines, Ltd.; 89,021 shares of £1 each in Pato Mines, Ltd.; 255,000 ordinary shares of £1 each, 5s. paid, in Colombian Corporation, Ltd.; and 10,291 shares of £1 each, 10s. paid, in National Mining Corporation, Ltd.

Beaver Consolidated Surplus Decreases

Silver; Ontario

The fourteenth annual report of the Beaver Consolidated Mines Co. for year ended Feb. 28, 1921, states that 157,274.3 oz. of silver was produced. Mining account follows:

MINING ACCOUNT

[illegible]		
[illegible]	$[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	$[illegible]
[illegible]		
[illegible]	$[illegible]	
[illegible]	[illegible]	
[illegible]		[illegible]
	$[illegible]	$[illegible]

PROFIT AND LOSS ACCOUNT

[illegible]		
Balance [illegible] Feb. 29, 1920		$[illegible]
[illegible]	$[illegible]	
[illegible]		
[illegible] Feb. 28, 1921	[illegible]	
[illegible] Feb. 28, 1921	[illegible]	[illegible]
[illegible]		$[illegible]

One dividend of $30,000 was paid on the $2,000,000 capital stock (2,000,000 shares of $1 par each).

Silversmith Mines, Ltd.

Silver, Lead, Zinc; British Columbia

A report of operations of Silversmith Mines, Ltd., for the year ended May 31, 1921, states that $[illegible] was received from the sale of 2,195 tons of ore. Mining expenses, including depreciation and depletion, totaled $[illegible],297.93, which left a profit of $30,106.61. Profit-and-loss account shows a balance of $1,1[illegible] after the payment of dividend No. 1, amounting to $[illegible],000.

North Butte Shows Large Deficit

Copper; Montana

A report of operations of North Butte Mining Co. for 1920 states that 16,666,819 lb. of copper, 693,633 oz. of silver, and 1,004 oz. of gold were produced. Cost of copper production was 17.638c. per lb., including all expenses and depreciation, but not depletion, and crediting value of gold and silver. There was sold 14,235,895 lb. of copper, at 18.719c. per lb., and 729,732 oz. silver at $1.105 per oz. Income account follows:

INCOME

[illegible] copper, silver and gold		$[illegible]

EXPENDITURES

Mining and development	$2,[illegible]	
[illegible]	[illegible]	
[illegible]		
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	$[illegible]
Deficit		$[illegible]

COSTS

Classification	Amount	Cost per Pound
Mining and development	$2,[illegible]	$0.[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
	$[illegible]	$0.[illegible]
[illegible] silver and gold	[illegible]	[illegible]
	$2,939,659.29	$0.176378

Surplus account Jan. 1, 1920, was $2,826,863.92. Subtracting deficit for the year, $576,233.18, and depletion charges of $500,004.57 leaves a balance of $1,750,629.27. Capitalization, $6,450,000.

St. John del Rey Mining Co., Ltd.

Gold; Brazil

A report of operations of the St. John del Rey Mining Co., Ltd. (British), for the fiscal year ended March 1, 1921, states that 98,311.5 oz. of gold was produced and silver to the value of £4,888 recovered. The premium realized on the sale of gold amounted to £126,811. Income account follows:

INCOME

Morro Velho gold [illegible] Feb. 28, 1921		
[illegible]	[illegible]	
[illegible] Feb. 28, 1921	[illegible]	
	[illegible]	
[illegible]	[illegible]	
	[illegible]	
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]
		[illegible]
[illegible]		[illegible]
		[illegible]
[illegible]	[illegible]	
Ordinary share dividend [illegible]	[illegible]	
[illegible]	[illegible]	[illegible]
		[illegible]
[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]

This mine, the deepest in the world, has reached a vertical depth of [illegible] ft., and plans have been made for still deeper operations. Work is hampered by the [illegible] high rock temperature of the lower levels, which in places is over 117 deg. F. The lode is [illegible] and flattens out at depth.

MINING STOCKS

Week Ended July 16, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Ahmeek	Boston	50	48	48	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*49	*35	*37		
Allouez	Boston	....	....	20	Mar. '19	1.00
Anaconda	New York	38¾	36½	36½	Nov. '20, Q	1.00
Arcadian Consol	Boston	....	....	2 1/16		
Ariz. Com'l	Boston	8½	8	8	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*30	*17	*27		
Bingham Mines	Boston	....	....	9	Sept. '19, Q	.25
Calumet & Arizona	Boston	45⅞	45⅞	45⅞	June '21, Q	.50
Calumet & Hecla	Boston	225	220	220	June '20, Q	5.00
Canada Copper	N. Y. Curb	*26	*21	*21		
Centennial	Boston	7½	7½	7½	Dec. '18, SA	1.00
Cerro de Pasco	New York	26	25½	25½	Mar. '21, Q	.50
Chile Copper	New York	10¼	10	10		
Chino	New York	23½	22½	22¾	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*32	*26½	*30½		
Con. Arizona	N. Y. Curb	*3	*3	*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1¼	1⅛	1¼		
Copper Range	Boston	33¼	32¼	33	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*35	*32	*32		
Davis-Daly	Boston	6	5¾	5¾	Mar. '20, Q	.25
East Butte	Boston	8¼	7¾	8	Dec. '19, A	.50
First National	Boston Curb	*52	*50	*52	Feb. '19, SA	.15
Franklin	Boston	2⅛	1¾	1¾		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol	New York	17¼	17¼	17¼	May '19, Q	1.25
Greene-Cananea	New York	21½	20¾	20¾	Nov. '20, Q	.50
Hancock	Boston	....	....	3¼		
Howe Sound	N. Y. Curb	2⅛	2	2	Jan. '21, Q	.05
Inspiration Consol	New York	34½	33¼	33¼	Oct. '20, Q	1.00
Iron Cap	Boston Curb	5½	5½	5½	Sept. '20, K	.25
Isle Royale	Boston	20½	20½	20½	Sept. '19, SA	.50
Kennecott	New York	20¼	19¼	19½	Dec. '20, Q	.50
Keweenaw	Boston	1½	1⅜	1⅜		
Lake Copper	Boston	2¾	2½	2½		
La Salle	Boston	1½	1¼	1¼		
Magma Chief	N. Y. Curb	*4	*4	*4		
Magma Copper	N. Y. Curb	20	6	6	Jan. '19, Q	.50
Majestic	Boston Curb	7	6	6		
Mason Valley	Boston	1½	1¼	1⅜		
Mass Consolidated	Boston	1½	1½	1	Nov. '17, Q	1.00
Miami Copper	New York	21¼	20	20½	May '21, Q	.50
Michigan	Boston	....	....	2		
Mohawk	Boston	48½	48	48½	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	5⅜	5¼	5¼		
Nevada Consol	New York	11	10⅞	11	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	14½	14½	14½	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	5		
North Butte	Boston	9½	9¼	9¼	Oct. '18, Q	.25
North Lake	Boston	*25	*25	*25		
Ohio Copper	N. Y. Curb	8	8	8		
Old Dominion	Boston	25½	22	22	Dec. '18, Q	1.00
Osceola	Boston	27	26	26	June '20, Q	.50
Phelps Dodge	Open Mar.	†150	†145	....	July '21, Q	1.00
Quincy	Boston	....	....	37	Mar. '20, Q	1.00
Ray Consolidated	New York	13	12½	12½	Dec. '20, Q	.25
Ray Hercules	Boston Curb	....	....	*24		
St. Mary's Min. Ld.	Boston	33	33	33	June '20, K	2.00
Seneca Copper	Boston	....	....	14		
Shannon	Boston	*90	*80	*90	Nov. '17, Q	.25
Shattuck Arizona	New York	6¾	6¼	6¾	Jan. '20, Q	.25
South Lake	Boston	1¼	1	1¼		
Superior Copper	Boston	3⅜	3	3	Apr. '17,	1.00
Superior & Boston	Boston	1¼	1 1/16	1 1/16		
Tenn. C. & C. cfs.	New York	7¾	7¾	7¾	May '18, I	1.00
Tuolumne	Boston	....	....	*55	May '13,	.10
United Verde Ex.	Boston Curb	25	23½	25	May '21, Q	.25
Utah Consol.	Boston	†4	†2½	....	Sept. '18,	.25
Utah Copper	New York	50¾	47¼	47¼	June '21, Q	.50
Utah Metal & T.	Boston	1⅛	1⅛	1 1/16	Dec. '17,	.30
Victoria	Boston	1¼	1¼	1¼		
Winona	Boston	....	....	*50		
Wolverine	Boston	11	10	11		
		NICKEL-COPPER				
Internat. Nickel	New York	14½	13¾	13¾	Mar. '19,	.50
Internat. Nickel, pf.	New York	84	84	84	May '21, Q	1.50
		LEAD				
National Lead	New York	75¾	75¾	75¾	June '21, Q	1.50
National Lead, pfd.	New York	1.01	1.01	1.01	June '21, Q	1.75
St. Joseph Lead	New York	11¾	11	11¼	June '21, Q	.25
		QUICKSILVER				
New Idria	Boston	....	....	*50		
		ZINC				
Am. Z. L. & S.	New York	8¼	8¼	8¼	May '20,	1.00
Am. Z. L. & S. pfd	New York	....	....	24	Nov. '20, Q	1.50
Butte C. & Z.	New York	4½	4	4½	June '18,	.50
Butte & Superior	New York	12⅜	12	12	Sept. '20,	1.25
Callahan Z.-Ld.	New York	4½	4½	4½	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	111	111½	111	May '21, Q	2.00
[illegible]	N. Y. Curb			*2½	[illegible] '16,	.03
Yellow Pine	Los Angeles			*55	Sept. '20, Q	.03
		GOLD				
Alaska Gold	New York	½	½	½		
Alaska Juneau	New York	1¾	1⅝	1¾		
Carson Hill	N. Y. Curb	....	....	13½		
Cresson Consol. G.	N. Y. Curb	1 13/16	1¾	1 13/16	June '20, Q	$0.10
Dome Extension	Toronto	....	....	*75		
Dome Mines	New York	17⅛	16½	16½	Apr. '21, Q	.25
Florence Goldfield	N.Y. Curb	*33	*31	*32		
Golden Cycle	Colo. Springs	*70	*70	*70	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*6	*6	*6	Dec. '19,	.05
Hollinger Consol.	Toronto	7.15	7.00	7.00	July '21, M	.05
Homestake Mining	New York	55½	55½	55½	June '21, M	.25
Kirkland Lake	Toronto	*53	*31	*53		
Lake Shore	Toronto	1.19	1.17	1.17	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.88	1.85	1.86	May '21, K	.05
Porcupine Crown	Toronto	*12½	*12½	*12½	July '17,	.03
Portland	Colo. Springs	52	52	52	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	....	....	*4	May '19,	.05
Silver Pick	N. Y. Curb	*11	*9	*11		
Teck Hughes	Toronto	*11	*10½	*10½		
Tom Reed	Los Angeles	....	....	*71	Dec. '19,	.02
United Eastern	N. Y. Curb	2 1/16	2½	2½	Apr. '21, Q	.15
Vindicator Consol.	Colo. Springs	*27	*27	*27	Jan. '20, Q	.01
West Dome Consol.	Toronto	*6½	*6½	*6½		
White Caps Mining	N. Y. Curb	*8	*6	*6		
Yukon Gold	N. Y. Curb	*96	*90	*90	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*19	*18	*19	Apr. '20, M	.03
Batopilas Mining	New York	⅜	⅜	⅜	Dec. '07, I	.12½
Beaver Consol.	Toronto	*28½	*25½	*25½	May '20, K	.03
Coniagas	Toronto	1.70	1.68	1.68	May '21, Q	.12½
Crown Reserve	Toronto	....	....	*7½	Jan. '17,	.05
Kerr Lake	Boston	....	....	3	Apr. '21, Q	.12½
La Rose	Toronto	....	....	*20	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*15	*14	*14	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.12	1.07	1.07	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4½	4½	4½	Apr. '21, Q	.15
Ontario Silver	New York	....	....	4	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	*18	*17	*17	Jan. '12,	.10
Peterson Lake	Toronto	....	....	*4½	Jan. '17,	.01½
Temiskaming	Toronto	*20½	*20½	*20½	Jan. '20, K	.04
Trethewey	Toronto	....	....	*12	Jan. '19,	.05
		GOLD AND SILVER				
Barnes-King	Butte	....	....	1.10	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*60	*49	*60		
Cash Boy	N. Y. Curb	*5	*4	*4		
Consol. Virginia	N. Y. Curb	*24	*24	*24		
Dolores Esperanza	N. Y. Curb	2½	2¼	2¼		
El Salvador	N. Y. Curb	*14	*12	*14		
Jim Butler	N. Y. Curb	*8	*8	*8	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*4	*4	*4	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	¼		
MacNamara M.& M.	N. Y. Curb	*16	*13	16	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	‡...		....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1	1	1	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*85	*80	*83		
Tonopah-Extension	N. Y. Curb	1 7/16	1⅜	1⅜	July '21, Q	.05
Tonopah Mining	N. Y. Curb	1¼	1⅛	1⅛	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	*84	*80	*80	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N. Y. Curb	*10	*9	*9	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1.20	1.07½	1.20	Dec. '21,	.15
Chief Consol.	Boston Curb	....		2½	May '21, Q	.05
Consol. M. & S.	Montreal	†13½	†13	....	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†2½	....	....	July '20, Q	.10
Daly-West	Boston	2½	2¼	2¼	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....		2	Apr. '21, K	.05
Electric Point	Spokane	*3	*3	3	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*32	*29	*30		
Federal M. & S.	New York	7	7	7	Jan. '09	1.50
Federal M. & S., pfd	New York	22	22	22	June '21, Q	1.00
Florence Silver	Spokane	*5	*5	5	Apr. '19,	.01½
Grand Central	Salt Lake	†*45	†*35		June '20, K	.03
Hecla Mining	N. Y. Curb	4	3 13/16	3 13/16	June '21, Q	.08
Iron Blossom	N. Y. Curb	....		*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†3.00	....		Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*5	*4	*5	June '21, I	.02
Prince Consol.	N. Y. Curb	....	....	*26	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*4½	*4	*4	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*8	*7	*7		
South Hecla	Salt Lake	3.09	3.05	3.09	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*14	*12	*13	Oct. '17,	.05
Stewart Mining	Boston Curb	....	....	*6	Dec. '15	.05
Tamarack-Custer	Spokane	1.70	1.65	1.70	Jan. '21 K	.04
Tintic Standard	Salt Lake	2.50	2.27½	2.37½	July '21, Q	.05
Utah Apex	Boston	2	2	2	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*2	*2	*2	Nov. '17	.01
		VANADIUM				
Vanadium Corp.	New York	29½	27½	28½	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal			46	Apr. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	...	†76½		Apr. '21, Q	1.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	38	37	37½	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf.	New York	72	71	72	June '21, Q	1.75
Am. Sm. pf. A	New York	67	67	67½	July '21, Q	1.50
U. S. Sm. R. & M.	New York	30	30	30	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	Boston			39	July '21, Q	.87½

* Cents per share. † Bid or asked. ‡ Quotations missing. Q, Quarterly. SA, Semi-annually. BM, Bi-monthly. K, Irregular. I, Initial. X, Includes extra.

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
CLEVELAND ABBE, Jr.
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, July 30, 1921 *Number* 5

Against Engineer Licenses

AS WE HAVE REPORTED in previous editorials, there have already been enacted, in a number of states, laws requiring engineers to take out a license before they will be allowed to carry on their profession. In many other states such legislation is proposed and is being pushed. The American Association of Engineers, a strong organization numerically, with chapters in many parts of the country, has been most active in pushing and securing this legislation. The American Association is not an exclusive organization, but takes in the whole of the engineering fraternity, including surveyors, draftsmen, construction engineers, road engineers, and the rest. It is an organization designed to increase the welfare of the engineer—quite frankly, a sort of engineers' union.

The more carefully selected and assorted engineering societies, which are organized for technical purposes—which the American Association is not—have not taken, on the whole, action or intelligent interest in this movement, but it is significant and important for them. Some time ago Engineering Council considered the matter, and, we hear, were opposed to the principle; but, granted that such licensing legislation would come to pass, the council drafted a model law for it. We think this was most unfortunate, for the general impression resulted that Engineering Council favored licensing, which we understand was not the fact. Much more fitting would it have been for Engineering Council to have come out with its view, and stood flat footed on it, for better or worse. Even the Federated American Engineering Societies has taken no position in the matter, and it was important that that body should make its conclusions known. It was announced that the subject would be gone into at the recent Chicago meeting, but nothing came of it.

Of the mining societies, the Mining and Metallurgical Society of America has recently conducted a canvas of opinion among its members, and though the results have not yet been given out, it is reported that the opinion was so overwhelmingly against the principle of licensing as to be almost unanimous. It is to be hoped that the official report will soon appear. It is true that licensing is already an established fact in a number of states, but there are others where it can be defeated, and in those states where it already exists it is possible to repeal an unnecessary, harmful, and obnoxious law. The opinion of prominent mining engineers will have much weight, once it is formulated and unified.

It is unlikely that licensing will so operate as to raise the standard of the practicing engineer, or exclude any who are not thoroughly prepared. Under the law, it will be necessary to be so perfunctory in the granting of licenses that the license will serve rather as a badge of respectability for the unfit than a guarantee of the quality of those who are qualified. Such a condition would make investors still more likely to make mistakes in their selection of engineering assistance than at the present time.

The theory of licensing proceeds from the assumption that engineering is a profession analogous to medicine and the law. On the other hand, it has been acutely pointed out that medicine deals with persons, and must exercise its skill in matters of life and death; and that part of the lawyer's practice is also personal, and also is called for suddenly in critical cases, in matters involving liberty and life. Some sort of quick, even though crude, test must be available to distinguish those who have qualified by study and preparation and those who have not. Yet the test is not successful; and if you pick a doctor or a lawyer blindly, without careful inquiry and investigation, the chances are very good that you will have entrusted your health or your affairs to an ignoramus or a grafter.

The work of an engineer is not with persons but with property, and he is not called upon for quick action involving life or liberty; neither is the investor obliged to call him on a moment's notice. He has time to investigate his man; and he must do so regardless of whether he is licensed or not. He may or may not be interested in his college training—probably not. He will be interested in knowing what he has done, what positions of trust he has held, and how he has acquitted himself. He will want to know about his character. He will not care about whether he has been licensed or not, for he will know, as in the case of doctors and lawyers, that many will get under this particular wire, with whom he will have nothing to do. Engineering is a function of business; and a business man does not need to be licensed or pass an examination before he can practice. So important is this business element that many an engineer whose technical training has been none too long, but whose commercial perceptions are well balanced, is a safer investment and a better guide for the capitalist than some highly learned technical man who is short on common sense.

A Buyers' Market

TURN where you will in the metal and mineral markets, present prices are depressed. They are lower than for a number of years. It is an attractive situation for the user of metals and minerals. Nevertheless, the existing industrial depression is influencing buyers more than it should. Apparently the future, embracing a two or three year period, is not receiving the consideration that it merits. The immediate present is controlling the situation too greatly, in our judgment.

A similar situation exists in the market for mining properties. Owners offer very favorable terms, and are willing to negotiate on a much more reasonable basis than during the flush period when prices for prospects and partly developed properties were inflated. The present is distinctly a buyers' market for mineral properties in the United States, Mexico, and elsewhere.

Depression in mining is widespread, but it's an ill wind that blows nobody good. Astute engineers are cruising about and taking advantage of the existing conditions. It is unlikely that they will continue for a great length of time. Although capital is hard to get, future opportunities for its remunerative employment can be secured on more favorable terms now than later. The wolf may be looking in at the door of the mining engineer in some instances, but it is equally true that opportunity is also looking in at the same time. Faith in the substantial character of American industry and in the mining industry in particular is eminently justified, and will bring its reward to those who have it.

The Awakening

THE PUBLIC seems to be awakening to the fact that George Graham Rice is not in jail after all. It is true that, after a criminal has been sentenced, he rarely is of further interest to reporters. He is soon forgotten and generally remains so. But Rice's recent activity has brought him once more into the limelight. As one reads the facts of his career, with particular attention to those events that have marked it in the last eighteen months, several things astonish. A jury has held Rice to be a crook—a thief—on more than one occasion. On Jan. 29 last year he was sentenced in New York to three years in Sing Sing prison, as we recently recalled in another editorial. But he speedily secured his release upon a certificate of reasonable doubt, and since then has been at liberty pending his appeal. From time to time his lawyer has managed to secure an extension of the time in which he had to prepare his argument, this leniency being shown, it is said, more on the lawyer's behalf than for the client's sake.

What honest man would have business dealings of any sort whatever with a person in such a predicament? The adage of the dog that was licked for being in bad company is familiar. There has been no secrecy about Rice's conviction and sentence nor about his previous career. No one can plead ignorance. Yet the facility with which he has been able to secure acquiescence to his scheming in Reno, San Francisco, and more recently in Salt Lake is simply amazing. When recently the State Securities Commission in Utah granted the Bingham-Galena Mining Co. a stock-selling permit over many protests, made because of Rice's connection with the company, the reason was said to be that a majority of the members of the Salt Lake Stock Exchange favored the granting of the permit. Why? Presumably because Rice is known to be a good manipulator and because stocks with which he is connected, however rotten they may be, usually enjoy for a time a sensational rise. This means money for the brokers and speculators. But it looks pretty bad for the members of the exchange, especially in view of the fact that a warrant has just been issued for Rice's arrest in California.

The argument on appeal from Rice's conviction in New York for grand larceny must be made, it is said, within the next three months. There is a limit to everything. But Rice has undoubtedly made quite a respectable killing since his conviction, enough no doubt to enable him to retire for three years at least, even though it be to Sing Sing in case his sentence is upheld by the higher court. If the court reverses the decision, other indictments are possible. But so are other certificates of reasonable doubt in case of other convictions, to say nothing of other appeals. And so on *ad infinitum*. You can't keep a good swindler down when there is a public that needs trimming. In the public interest this case should be settled without further delay.

The Census Statistics

THE MINING STATISTICS gathered by the Bureau of the Census ten years ago were freely criticized, the *Engineering and Mining Journal* being among those publications which appraised them as being of no particular value. The advance sheets of the present census are beginning to appear. These consist of preliminary statements as to the mining and quarrying enterprises of the various states. The items on which figures have been gathered for 1919, as compared with 1909, are: Number of Enterprises; Number of Mines and Quarries; Persons Engaged (proprietors and firm members total, number performing manual labor in or about the mines and quarries, salaried employees, wage earners average number, wage earners total, above ground and below ground); Power Used; Capital; Principal Expenses (salaries, wages, contract work, supplies and materials, fuel and power, royalties and rents, taxes); Value of Products. Here is a set of figures, certainly; but the point is, what useful purpose do they serve? Of what use is it to know the "total number of mines and quarries" in Connecticut as compared with Minnesota? Is it not like giving us the total number of "woodchucks and Plymouth Rock hens" in these respective states? If we knew how many iron mines, copper mines, marble quarries and similar establishments, the information would be of value. It is difficult to see why money should be wasted on mere figures. Metal mining, coal mining, non-metallic mining and quarrying are all lumped together in these statistics.

The only measure of the quantity of material produced by these mines and quarries is given, not in actual measures of weight or volume, but as "value of products." As the value depends on immensely fluctuating prices, this information conveys no clear idea of the status even of this waste-basket grouping of "Mines and Quarries." For example, the value of Minnesota's products of this type in 1919 was 122 per cent greater than in 1909—a great increase, whether it was in iron or sandstone, or in both combined. But the total number of persons engaged in 1919 was practically the same as in 1909; and the horsepower used was somewhat less in 1919 than in 1909. Which leaves any concrete fact whatever a deep, dark mystery.

Cannot Mr. Hoover break away from the old and discredited tradition of the Census Bureau, and secure separate figures of the separate mining industries, and the products measured in ounces, pounds, or tons? He can also economize by omitting some of the meaningless headings—such as the total of "principal expenses," and how much of this went for "royalties and rents," and how much for "contract work." Will anybody ever use this data, or be interested in it: or is it possible to derive any information from it? The Government spends a lot of money automatically and by precedent and tradition, without much thought as to its utility, where in private business these items of expenditure would be closely scrutinized, and the useless ones eliminated.

WHAT OTHERS THINK

A Defense of Apex Procedure

In reading recent editorials and articles in the mining journals, and particularly in the one published in San Francisco, the query naturally arises whether the authors are inspired chiefly by ignorance, by prejudice, or by downright disingenuousness. The latest outburst is replete with examples of all three. One hardly knows whether to take them seriously or as a joke, but many intelligent people are not so conversant with the details of technical subjects as to be able at a glance to detect sophistry and inaccurate statements, and may thus be infected with the views insidiously and apparently with deliberate purpose instilled into this malicious propaganda.

An extended discussion in a recent issue of the *Mining and Scientific Press* by A. B. Parsons is so full of misstatements and is aimed so directly at me and some of my friends that it demands refutation and reply. I shall discuss some of these statements seriatim.

1. Mr. Parsons starts out by saying that Judge Bollinger, in the recent decision in the Tom Reed-United Eastern case, "declared in no equivocal terms that, though highly interesting and illuminating, the theories advanced in the testimony of a dozen 'eminent geologists and mining engineers' were of negligible value in assisting him to arrive at a conclusion on the issues involved."

A careful perusal of the judge's opinion will show that he said nothing of the sort. His precise language is as follows: "This case must be decided from a practical viewpoint as the miners find conditions in the ground today, *or* it must be decided upon the theories and testimony of geologists in accordance with conditions as they existed many thousands or millions of years ago. If the decision be based upon the theory and testimony of the geologists it seems to me that no mining location in the Oatman district could be secure or valid.
We are reliably informed by geologists that this northwest section of Arizona, including the San Francisco mining district and Oatman, experienced at some time in the past a great upheaval and sank about six thousand feet. *With this in mind*, the court is compelled to view this case from a practical standpoint and adopt the views of the practical miners, and view the conditions as they are today and as they were when the rights of all parties herein were acquired." (The italics are mine.)

The decision thus really follows the arguments and adopts the conclusions of the geologists who described the complex geological history prior to faulting and who themselves pointed out the necessity for a decision of the issues in accordance with the structure as it is today.

2. Mr. Parsons proceeds with the assertion that "His Honor certainly ought to know whereof he speaks; the 'eminent' gentlemen had devoted several weeks exclusively to the task of enlightening him." The fact is that the hearing consumed less than seven days, having begun on Monday, Nov. 8, and finished on Monday, Nov. 15. Within that time there were one Sunday and one half holiday, Armistice Day, when no court was held.

3. Mr. Parsons states that Judge Bollinger "frankly declares that they (the geologists) and their technical theories are no more necessary than the proverbial fifth wheel of a coach." No such language appears in the judge's opinion. Mr. Parsons says that "The reader is not only at liberty, but is urged, to season any statement with as much salt as he wishes." I know of no salt, not even chloride of lime, which could possibly season such an unsavory falsehood.

4. Mr. Parsons displays equal ignorance and prejudice in discussing the Elm Orlu case. His discussion is too long for repetition, but he errs in saying that the Pyle and other so-called branch veins were barren stringers and had never been mined. The fact is that the Pyle vein was discovered by the Butte & Superior Co. branching upward from one of that company's stopes on the Rainbow Vein. It was from ten to sixteen feet wide and was mined upward by Butte & Superior until it was found that its apex would be in the Elm Orlu, when the work was discontinued.

And not content with misrepresenting facts, Mr. Parsons proceeds to state that *on the day before* the "unexpected denouement" of settlement, Judge Bourquin asked a question which one of the attorneys for Senator Clark "was afraid to let develop," and insinuates that thereupon the Clark interests hastily sought and concluded a compromise. The facts are that the compromise was first suggested by attorneys for the Butte & Superior and had many times been under serious consideration, and on the last occasion for more than a week before the denouement.

5. Not content with misrepresenting facts, Mr. Parsons next proceeds to impugn the good faith and cast aspersions on the character of those who act as expert witnesses in apex litigation. "A witness usually knows little of the detailed geology of the mines when he is retained; and (that) although provision is always made for withdrawal from the case in the event that the expert cannot conscientiously support the position taken, no such withdrawals are on record."

Wrong again, and on both counts! A witness is generally selected for the very reason of his familiarity with the mine in question, and many instances of subsequent withdrawal "are on record." Of course, Mr. Parsons may not have the record. We do not all report to the press as faithfully as no doubt they would like; but what difference would that make? Our motives would still be misunderstood and we should in that case probably be accused of having sold out to the opposition.

6. Coming back to [illegible], Mr. Parsons has slipped a little. He says that Judge Bollinger "never had presumed to question the ability of geologists or the soundness of their conclusions; he is convinced that their conclusions are sound." He then goes on to say that the judge "frankly ignored geologic history and based his decision on conditions as the miners find them in the ground today. There was no conflict between the statements of the geologists who testified for both sides in so far as matters of physical fact were concerned."

It has already been shown by the judge's own language that he did not "frankly ignore geologic history."

but understood and accepted it, and for that very reason, and in accord with the views of geologists, rendered his decision. Surely Mr. Parsons was surprised and disappointed to find such harmony in the testimony of opposing geologists, for of a certain subject matter do not six always swear that it is black and six white? It must be so, for it is so written by the editor of this same critical journal.

7. Other insinuations of a derogatory and scurrilous nature abound in the emissions of Mr. Parsons. He says, for example, that "the witnesses for the United Eastern side of the suit may seek to derive some small crumbs of comfort from the fact that the recent decision favored the company on whose payroll they happened to be." The size and sustaining power of these "crumbs of comfort" will be appreciated when it is known that several of the United Eastern witnesses refused to accept retainers from the Tom Reed company, one of them long prior to his engagement by the United Eastern and after an examination of the mines in question.

But perhaps enough has been said to show the existence of some peculiar animus behind the sinister attacks which from time to time appear in "the little volcano of journalism published on the Pacific Coast." Its moving spirit himself frequently remarks that "an editor must be possessed of a demon of criticism," and it appears that in this case the baleful demonic influence has taken possession of the entire force between the editor and the printer's devil, and is now seeking to inspire the readers of the journal.

Really, what is the use of such diatribes? Does anyone think for a moment that they will in the slightest degree alter long-established court procedure? Is human nature to be changed by the homilies or philippics of even the most prosaic or vitriolic copy manufacturer? Suppose Jones, an individual or a mining company, hopes that bodies of ore exploited by another individual or corporation may possibly, with sufficient development or under the proper construction of the mining law, prove to be his property. What is he to do about it? Is he likely to refer the matter to some shift boss or foreman with little knowledge of geologic structure and none whatever of mining law, or shall he employ someone of experience and reputation in those two special lines of study? Apex litigation is admittedly expensive, and Jones will hesitate to incur the expense of underground development and of preparation until he is assured by some person in whom he has confidence that he can probably prevail in legal proceedings. Sometimes Jones is stubborn and unduly optimistic or carried away by cupidity, and rushes into litigation contrary to the recommendation and opinions of his advisers. Sometimes he is misled by the optimism of his attorneys, or by his own engineers. But the prudent man will seek the best advice obtainable and will not go counter thereto.

Now consider Smith, an individual or corporation, who has been mining and extracting ore which he has always looked upon as his property, and whose title nobody has ever questioned. Suddenly he is advised that his neighbor Jones asserts an adverse interest in and to the said ore, and intends not only to take away the right of possession but to compel Smith to pay over the net or gross, or twice or thrice the gross value of the ore already mined. Is Smith now likely to say to the mule skinner or the shift boss or the surveyor or the foreman who has been taking out the ore claimed by Jones, "Go to the mine today, Bill, and find out who owns that ore." Does he seek the opinion of "a few practical miners"? He hurriedly wires some of his mining friends who have passed through apex litigation fevers themselves and asks them to furnish the names of a few of the best counselors in such matters. And when these men come they study the situation with the greatest care, paying the most scrupulous attention to details. The property's history, discovery, location, survey, patent, development, production, geology, and mineralogy are combed for pertinent facts. Information of great importance is frequently developed which had been entirely overlooked by the managers and engineers whose business lies in operation and not in apex litigation. And often the engineer says: "Without development I cannot state positively who owns that ore—and it may be the necessary development will be extensive and require months or years to complete."

If the amount at stake justifies the estimated cost of the investigation, the work is laid out by the consulting engineer. Maps, cross-sections and study models are prepared, and the mines are given additional study. Old levels and raises are opened, old shafts repaired in the search for information which was once readily available, but not recorded or preserved by any competent observer. At length the time arrives when Smith's engineer or geologist can express an opinion. If the work has demonstrated to his satisfaction that Smith is the owner of the orebodies in question, he will recommend preparation for trial, and this work may consume many more months of time and cost additional thousands or tens of thousands of dollars. But he proceeds with the conviction that law and equity are with his employer and that Jones' attack is without legal or geological justification. Of course, he becomes partisan. He has looked into every phase of the matter; he has tested his theories by costly development; he understands the structure and vein systems; he is familiar with the provisions and the meaning of the apex law, and he hopes and expects to make so clear its application to the particular suit in hand that his client's rights will be vindicated.

No witness who, after such a thorough study and analysis of a complex situation, would not strive to uphold his beliefs and conclusions would be honest with himself or his employer, or have a drop of red blood in his veins. It would not matter one iota whether he were the only witness or adviser and had been appointed by the court. The attorneys for the contesting parties would urge their respective theories upon the court and the sole witness would just as manfully adhere to his convictions and conclusions.

Under the provisions of our apex law, litigation will inevitably from time to time arise over the ownership of valuable ore deposits. Both claimants will require the studies and opinions of the ablest engineers and geologists before deciding in their own minds whether to compromise or fight to a finish. The men employed by both sides will pursue their investigations conscientiously in a scientific spirit of research. If they become convinced of the righteousness of their client's cause, they will later espouse it in court with their utmost ability. I repel with indignation the imputation that they are and must of necessity be placed in an "equivocal position" in the matter. Such imputations are gratuitous insults to men of highest moral character and emanate usually from unfair, biased, and uninformed minds, and are an evidence first of ignorance and second of sordid and suspicious natures.

Minneapolis, Minn. HORACE V. WINCHELL.

Concerning the Petroleum Supply

In a recent editorial you were kind enough to credit the U. S. Geological Survey with successful service in informing the country as to the petroleum situation. The purpose of our fact-finding has been to furnish the basis of truth for the guidance of national policy. Possibly, however, the plain statements of the statistics of production, consumption, stocks, and reserves of petroleum or any other mineral fail in part to guide us—because the impressive strings of figures are not readily understood. It is perhaps more easy to talk millions than to think millions.

In a column of Wall Street news recently I noted these words: "The existing surplus of crude in this country would soon be corrected." Irrespective of the context of this reference to stocks of petroleum, the question may be raised, Is there a surplus to correct?

In the latest monthly report of the U. S. Geological Survey, Mr. Richardson stated that the total stocks of crude, both domestic and Mexican, held in this country aggregated 155,000,000 bbl., the greatest stocks on record. But this supply is sufficient for only 115 days at the country's rate of consumption in May—which was abnormally low—so that the real test is whether a 115 days' supply of this most essential raw material affords more than a safe margin. Is there too great a surplus?

Figured in terms of consumption, the total stocks of crude oil in this country outside the refineries on Dec. 31 last amounted to only eighty days' supply at the average daily rate of consumption for the year. By correcting the gross stocks in other years so that they are fairly comparable with the net stocks as now reported, we find that the corresponding measure of crude oil in pipe-line and tank-farm storage at the end of 1915 was 190 days' supply; 1916, 162 days; 1917, 122 days; 1918, 95 days; 1919, 99 days. No more significant commentary on petroleum supply and demand is needed than the fact that the present 115 days' stock slightly exceeds in number of barrels the 190 days' supply on hand Dec. 31, 1915, after the flood of Cushing oil. What was then more than enough for six months is now less than enough for four months.

Washington, D. C. GEORGE OTIS SMITH.

The Tariff Advocate Speaks

The article written for the *Engineering and Mining Journal* by Marc Pawl must have been intended as the creator of this remarkable effusion remarks a "grime pleasantry," for if not so intended then the E and M Journal can not be what it purpohts to be, "A Weekly Journal of the Mining and Mineral Industries" supposedly of the United States of America. This article was written as stated at the heading *for your paper*, therefore expresses the papers policy so far as the Tariff on Minerals is concerned, and as this article is clearly the expression of a "Wilson Free Trade" and tariff for Revenue only Democrat, therefore also pro-English at the countries expense no matter what effect it may have on the United States industries, the readers must come to the conclusion that such is the policy of the *Engineering and Mining Journal*, and if this be true, we of the western states of America will cease to subscribe and read this paper. If this article was intended as a "Joke" it is published at a time that is likely to do infinite harm, for it may fall into the hands of unthinking and very impressionable individuals, who will circulate the misstatements therein contained, and it is my purpose to call your attention to such, and I expect you to publish this letter taking exception to the article, and the privilege given to writers of this man's view point, and from you, an expression as to whether the mining industry producing the very minerals your correspondent calls attention to, as those which should be exempted from tariff protection, express the views of the "Largest Circulation of Any Mining and Metal Journal in the World" that is the *Engineering and Mining Journal.*

The writer of this article makes an untrue statement when he accuses all the "pleaders" that have filed briefs with the committee on tariffs for minerals, ores, and the products from such, as giving "highly colored statements" as to the facts they wish to present, and in so many words your correspondent says that all or practically all such statements are lies, made to deceive the committee. He takes particular pains to plead for the "Americans" living and owning mining property in foreign countries, and especially calls attention to the fact that were the tariff as asked for be put into effect, it would seriously hinder and prevent the sale of their products in our markets. Now the writer of this letter is a producer of "Arsenic White" made from mispickel, and Enargite, both of which ores carry a good value in gold, silver, copper and ARSENIC. It is unnecessary to state here in detail, that it is practically impossible to secure a market for these ores, as mined, therefore we have built at great cost a mill for the purpose of beneficiating such, and have with several others filed a brief asking protection for these mines and industries, and have not lied about the costs or statements we have presented.

It is not at all "difficult for the committee" as stated by your correspondent to arrive at just rates in the new tariff measure, when viewed from the standpoint of American basis of wages and living conditions, for the employees of such mines and metallurgical works, and when the costs for such labor and the materials necessary to carry on these industries are taken into consideration especially at this time, it is a marvel of efficiency for the operators of these mines, and works, and were it not for the high efficiency of the labor we use, and the methods created in our works and at the mines, every mine and works of the kind which are producing the very minerals your Mr. Marc Pawl states should be dumped on our markets duty free, would be closed down. As it is, practically all the copper mines are closed down, as well as the lead mines, and zinc mines and works. Every Tungsten mill and mine is closed down, and in your issue of the 18th, you so state, and call attention to the fact that during the past year there was imported sufficient ore from China to last the countries requirements for the next three years. Of course the men who built the Tungsten mills and opened the mines of the country during the war should have no consideration whatever, they are expected by this pro-English writer (and your paper concurs in the policy,) of no future protection for their investment, and should loose what they put into this industry, for the benefit of the Chinese, who under the Wilson free trade policy, shut down every Antimony mine and works in the entire United States, as will be the case of every other mine and mill of whatever nature, if your policy is adopted. No consideration is given or thought of, other than the "American" owners living abroad, none is given for the millions of men now out of work, or the men who went to Europe to perputate the policy of the English, for free trade for their little island, so as to give the privileged classes there the greatest purchasing power for their money, irrespective of what pauperizing results will follow, for their own working classes, and your paper prints such stuff, expecting to continue the support of the American mining industry, its working men, operators, and supply manufacturers. I had the privilege of operating in the Orient, and have lived under the cross of St. George, and know where of I speak, and it is this. If the same policy were expressed in the "Tight Little Island" that is in operation in every English colony, and in all the territory they have annexed the world over, of protection to the HOME manufacturer, the millions of idle men there would be employed, and this develish war would never have happened, much referred to by your Mr. Marc Pawl. The plea made that by being compelled to purchase the American produced ores and products made from such by the American manufacturer, will add to the cost by the American consumer, all of which is absolutely erroneous, and is not true, for it is a well recognized fact, known to every purchaser of home made products, the raw material for which was never lower than it is now, and we are paying the same prices we paid during the war. Instance any manufactured article made from copper, lead, zinc, and all the metals in the Pawl list, and it is also a well known fact that not only at present is this true, but has been so for years past, due to the fact that there is a low standard figure, higher than any imported article, no matter what the labor costs and material may be. This is rightfully so, and we all expect it, and are able and willing to pay it, and do not want to be compared to the cheap European and Oriental sales prices and costs of manufacture. It look very much as though Mr. Marc Pawl were pleading the cause of the "Americans and All others abroad" for the privilage of the American Market, and the American dollar, the only stable currency in the world to day, and your paper publishes this argument?

Of course we have more concern for the well being of the Chinese, who receive in one year, about what one of our men gets for half a shift. We are expected to subscribe to the argument as published "Tariff on Minerals" by Mr. Marc Pawl, to the same extent in labor, and import this also, so as to allow the home consumer to obtain the metals he has listed, cheap, which would be the case were we to pay what the Chinamen gets, the same for the pauper ridden laborers of Europe, Mexico, South America, and the world over, for our mines are the equal of any of these, and better than most, but were we to pay the same scale of wages, we also could afford to sell at the prices these people are willing to sell for, and get the only real money in the world to day. If this be done, we would be as cheap as they are and as Mr. Marc Paul is. Some months since your paper also printed an article on Antimony, and stated that this country was unable to produce in any sense whatever, the antimony required for home use. Such statements are absolutely untrue, for the state of Nevada, can and will produce all the antimony the industries in our country can possibly use, and still have some left for posterity, which Mr. Marc Pawl is so fearful will be left out in the cold. He also fears there will be another war, and therefore we "Boob" American may be made to keep the resources we have under cover until such time. In all the list given by this gentleman, we produced very little, and it was not thought possible to meet the demands for such, until we were given the chance, and given this we produced all that was required, and it now seems to be feared we will continue to do so, unless we adopt the Wilson pro-English policy, and throw open our markets, ruin our mine owners and laborers, and adopt a free trade policy, so as to benefit Mr. Marc Pawl and his English friends, concurred in by the *Engineering and Mining Journal*. E. H. WEDEKIND, Gen Mgr.,
Toulon Mills Co.

Bx. 758, Lovelock, Nev.

Revision of the Mining Laws Submitted To Congress

Now that the Congressional committees on Mines and Mining have received a suggested draft of a bill for revision of the mining law, prepared by a committee appointed by the Bureau of Mines in 1917 and supposed to embrace amendments conforming to the wishes of the mining industry, it may be advisable to discuss various phases of suggested changes.

It is apparent that there are, apart from the apex law, which has caused much litigation and should be abolished, two distinct points of weakness in the development of mineral claims.

In regard to unpatented mining ground, large areas are held without sufficient work being done to develop prospects, and the same applies to patented mining claims, the holders of which pay the taxes without ever attempting to do any legitimate mining.

Limiting a prospector or owner of unpatented mining claims to a period of five years to make a discovery, and allowing him to hold the ground for a further period, not exceeding five years, by payment of $5 an acre per year in advance, is decidedly an unjust provision, as it has frequently taken fifteen to twenty years or more to make discoveries of actual value, and this only by good fortune and a vast amount of hard work and grief. The owner of unpatented mining ground should file a sworn statement as to the amount of work done annually and a description of that work; in doing so he would protect himself against the jumping of his claim and show his good faith and his intention to develop the property.

Idle patented mining claims in the heart of the Western mineral zones have been the bane of every district. Thousands of acres, patented under too liberal laws or interpretation of the same, are held by defunct mining companies or estates of speculators and investors. Such claims should be returned to the public domain ten years after the issuing of a patent, unless a sworn statement has been filed, proving the extent of legitimate mining and development in this period of time and verified by the state mine inspector.

The provision that one discovery is sufficient to support the holding and patenting of a maximum of 160 acres in contiguous claims, either four full claims or sixteen ten-acre claims, is good. Another provision seems to offset this improvement by requiring an expenditure upon each claim of $20 per acre. If the work is to be done on one discovery and considered valid to patent 160 acres in contiguous claims, the requirement of expending $20 per acre in work or cash before patenting will not coincide with the first provision. The provision in the new laws as proposed, that final entry and payment for all mining claims shall be made within seven years from the date of the original location, except in the case of extension of the exploring right, when twelve years is allowed, should be eliminated, as few owners of unpatented mining ground are able to pay for the expense of patenting, and should not lose seven or more years of endeavor because they have not sufficient funds to acquire title.

The proposition of establishing a special fund known as the mineral development fund is good, and a levy of $1 annually per claim from owners of patented and unpatented mining property for experimental purposes, for instance, would not cause any hardship and would be of value to the mining industry. A. T. ROOS.

Deadwood, S. D.

Foreign vs. Domestic Business

In *Engineering and Mining Journal* of Feb. 12, 1921, there appeared an editorial under the heading "Could Brass Prices Be Reduced?" In the same issue appears a communication by Mark R. Lamb on "Credit Conditions." Since then we have noted the formation of a $40,000,000 corporation to finance "credit conditions" for the shipment of cheap American copper to Europe, and, in the current daily press, "Western Bankers Oppose Eastern Bankers," in the policy of the latter in financing Europe vs. America along many other lines. In the meantime, and at present, American industry is at a standstill, factories and operatives are idle, mines are shut down, and no money is available (in these United States) with which to "start something."

An anomalous situation exists in the face of the facts. More money in the United States than in any other country; more coming in all the time; unconscionable reserves in the Federal Reserve banks and raw materials down to bedrock prices. In the face of these conditions, philanthropic (?) financial interests are breaking their necks to shuffle off our low-priced raw materials on foreign countries—to come back in cheaply manufactured form, in competition—to the impoverishment of the American producer, loss to direct labor, and, incident to this last, loss to manufacturers and producers of ordinary necessities, to say nothing of semi-luxuries.

The attitude of the Western bankers is well taken in their opposition to Eastern activities to do *everything* for the foreign manufacturer. Mr. Lamb points out the blind subserviency to foreign interests. Between his lines there is a world of inference as to the domestic customer.

This is a democratic government, in name at least. Mr. Lamb says, "The United States Government will not grant further credits to foreign governments." Will the United States Government, through the operations of the Federal Reserve banks, and reasonable discount rates, grant credits to domestic business? A democratic form of government? Recently we have seen the "Protective Association of Tenants" organized to protect themselves from the greed of the landlords, building trades, labor organizations and whatnot; Western bankers in organized opposition to exploiting American industries for the benefit of the foreign manufacturer and selfish ends of so-called American interests.

Take the copper situation. For a generation the foreign manufacturer has profited when American copper sold for less than it cost to produce it, and now, patriotic, American (?) financial interests organize to aid in the looting of American mines and American stockholders of American copper mines. Where is the "democratic government" under such conditions? Rushing to a government of co-operative organizations and protective associations.

Why should tenants be forced to organize, tax themselves, employ counsel, and assume the burden of exposing and breaking down criminal combinations? Where in natural sequence is an organization of American copper consumers for the protection of their industry against the American-financed foreign copper manufacturing industry? Are there no forces in the United States Government to offset these conditions? Or, are the inherent forces subserviently controlled under the subtle "prevention of unbridled speculation"?

The summer is passing; winter looms before the idle laborer and operative. On what are we waiting? Adjustment of European conditions? A pipe dream! There is plenty waiting the doing here at home if we but turn our eyes toward the United States, loosen up the money for domestic use, at reasonable rates, and get to work. The housing industry alone is no small item. Get off Europe and Europe's affairs. They can be taken care of without concentration to the exclusion of home affairs.

With the wheels of home industry turning, cheap copper manufactured at home and supplying the home market, and other raw products the same, there will be less time to worry over foreign exchange and foreign markets. Time, and time only, will take care of that situation. "A watched pot never boils." Let us turn our backs to the Atlantic and "keep the home fires burning." Then we will be better able to aid Europe, and with better grace. L. S. ROPES.

Helena, Mont.

The Cottrell Process for Phosphoric-Acid Recovery

In a recent article on the Cottrell process, by Strauss L. Lloyd, in *Engineering and Mining Journal* of April 23, reference is made to the use of the Cottrell electrical precipitation processes in connection with the electric furnace reduction of phosphate rock.

The data given on the Cottrell processes apply to a dust and fume problem in a large metallurgical plant. Inasmuch as the Cottrell installation at this plant was one of the earliest, the data given hardly apply to any recent commercial applications, particularly for the recovery of phosphoric acid.

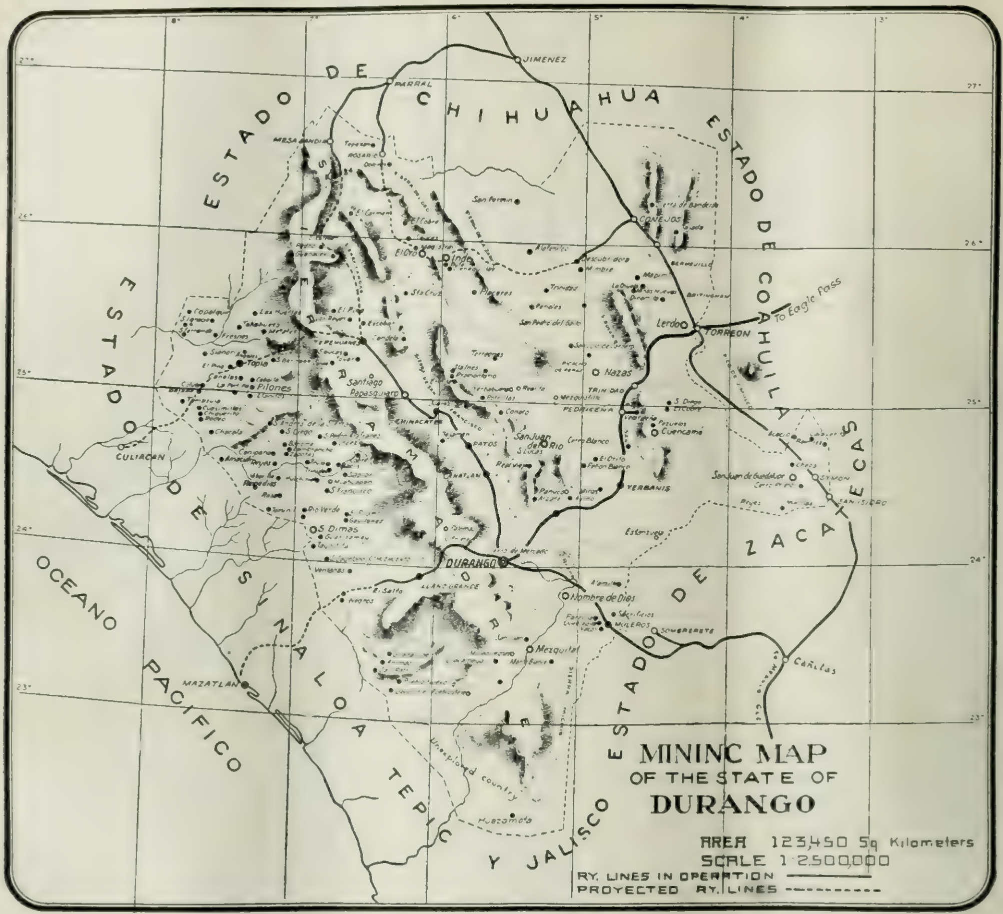
For phosphoric-acid recovery a precipitator of the pipe type must be used, and it must be constructed of acid-proof materials. The pipes are usually of stoneware or tile, and the connecting chambers are constructed of acid-proof brick. The high-tension electrodes are made of special metal alloys to withstand the action of phosphoric acid.

The dust precipitator described by Mr. Lloyd is no longer in operation. It was installed over ten years ago, and the plant in which it was used has been shut down for almost ten years. The design described is entirely obsolete. Modern installations are operated at 50,000 to 100,000 volts. The cost figures given are incomplete, and are not indicative of present conditions.

New York, N. Y. P. E. LANDOLT,

Manager, Commercial Dept., Research Corporation.

[Note: Mr. Lloyd published a correction in the *Engineering and Mining Journal* of July 16.—EDITOR.]



Mineral Resources of Durango

State Regarded as One of Richest in Mexico—Silver, Gold, Lead, And Copper Abundant—Quicksilver, Antimony, Tin, Sulphur, Iron Ore and Construction Materials Also Found in Quantity

By Manuel Rangel and Alberto Terrones

Written for Engineering and Mining Journal

DURANGO has long been considered one of the richest mining states of Mexico. Mines have been operated in all the thirteen districts in which the state was politically divided. Most of these mines have been in operation until a comparatively recent date, and in olden times some were famous for their abundant production and rich ores. The following are instances of famous old mines: Socavón, or Mina Grande de Avino, in San Juan del Rio district. Its owner, Francisco de Ibarra, was the founder of the city of Durango. This remarkable mine has been a constant producer since 1563. Its ores in the upper zones were amenable to amalgamation, but at present the abundance in depth of galena and copper sulphides has rendered them unsuitable for such treatment. In the Indé district are the Agua and Gran Lucero *antiguas*.

The first mines discovered in the Mapimí district were La Guadalupana, La Colorada, and Animas. The Terneras mine, in the Cuencamé district, now operated by the American Smelting & Refining Co., is famous for its uninterrupted output of uniform ores. In Topia, Tamazula, and Otaez, a great number of veins were discovered long before the city of Durango was founded, 400 years ago. Late in the eighteenth century the San Dimas, La Puerta, and Guarisamey mines were discovered. In Guarisamey the Tecolota mine made its owner, Juan José Zambrano, the richest man of his day. After San Dimas and Guarisamey, the Gavilanes mines were discovered, which were as rich as those at Guarisamey. These mines are remarkable on account of their ores consisting of native silver and argentite in a quartz gangue, and they have been producing since 1786. Finally, the Vacas mine, in the Parilla camp in the Nombre de Dios district, caved and abandoned for a number of years, was afterward worked with success until about thirty years ago. This mine has not been bottomed yet.

The lack of modern machinery, principally for pumping, has been the main reason why most of the old mines have had to shut down, even when in *bonanza*. Very old caved workings with high-grade ores are of common occurrence in the district. Also, the old "Castilian" furnace and amalgamation were the only treatment processes known in the early day in Mexico, and as it generally happened that the mineralization changed with depth, as the oxidation zone was bottomed, such treatment became unsuitable. The mines were therefore abandoned, even if possessing very rich ores.

The operation of mines hitherto unprofitable is now made possible by the present transportation facilities; the use of modern labor-saving machinery; the use of the latest explosives; and the recent development of ore-treatment processes. Two factors may further encourage mining in the state; namely, the construction of railroads to the principal mining districts and the erection of modern mills.

Huge Tonnage of Iron Ore in Cerro del Mercado—Wolframite and Manganese

In the following paragraphs we have endeavored to give a general description of the mineral resources of Durango:

About two kilometers north of the city of Durango, there is a remarkable iron deposit called Cerro del Mercado. This consists of hematite in compact granular masses, with fractures caused by contraction. In several parts beautiful martite octahedrons can be seen. Hematite is found in small quantities in the northern part of the mountain in a place called Cueva del Iman (Magnet Cave). Specular iron and the variety called micaceus oligist are found in Cueva de la Marmaja. Limonite seldom occurs.

The massive hematite is cut in several directions by chalcedony stringers, and at the foot of Picacho de la Cruz some fine stringers of altered amphibolite are seen. Apatite, or rather its variety known as "asparagus stone," is disseminated in the mountain, specially in the cave called Cueva de los Biriles. It appears in hexagonal crystals of a yellow or a yellow greenish color, and has been improperly called *biril*, a corruption of beryl.

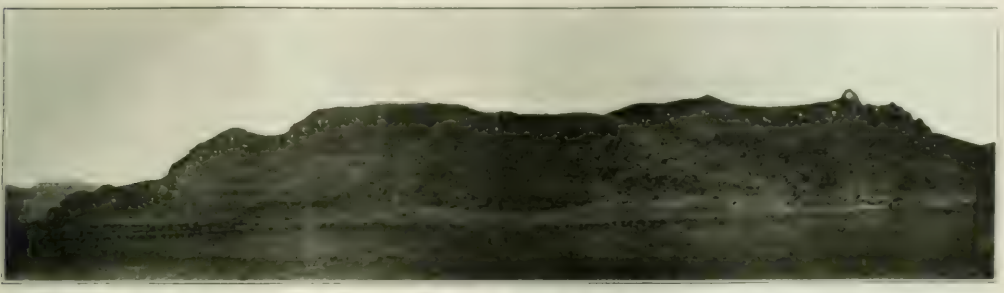
The continuation of the iron deposit is marked on the country rock (rhyolite) by wide impregnation zones of a deep red color and by numerous red and crimson veins of ocher and argillaceous hematite, locally used in painting (*almagre*). Some other places in the state are noted for the existence of well-defined iron veins; for instance, near Sierra de Yerbanis, at a point called Minillas, where hematite and magnetite occur. Hematite is again found in veins at La Fortuna mine, in the Mezquital district; at San Francisco, in El Oro district, and at Sierra de Cacaria, where it is associated with cassiterite.

Generally, it is common to find iron oxides mixed with the quartz gangue (gossan) in the outcrops and in the oxidation zone of nearly all the veins. In the Viva Juárez vein, at San Bernardo, in El Oro district, the gangue is practically hematite. At the Canelas mines, in the Tamazula district, there are veins in which oligist presents itself. At Ascobar, near Tepehuanes, the veins, running high in silver, abound in hematite and limonite. Magnetite occurs in El Prospecto mine, in the Indé district. At some mines of the Mapimí district not only iron oxides but also sulphides and sulpharsenites are present in the veins. Turgite is found at Ojuela. Frequently, iron oxides are associated with manganese oxide in the outcrops or in the oxidation zones of the veins, thus forming what is commonly called *colorados*, *negros*, *quemazones*, or other native designation, sometimes rich in silver and gold. They are used as flux.

Wolframite is found in the Tungsteno mine, near Peñon Blanco, in the Cuencamé district, where it is associated with gold; and it also occurs in Sierra de San Francisco, at the Coneto mines, especially in the San Juan del Rio district.

As already stated, manganese is commonly associated with iron in the outcrops of the veins and in their oxidation zones. Some deposits are found, however, in which manganese appears in the form of pyrolusite veins like that of Cerro Santiago, near Juan Pérez, in the Cuencamé district, and that of Mesa de Zavala, near Purisima, in the same district. In both instances the pyrolusite is associated with calcite and barite.

Rhodonite and rhodochrosite are often found in veins of silver and gold where the gangue is quartz, like the



CERRO DEL MERCADO, A MOUNTAIN OF IRON ORE NEAR DURANGO CITY, DURANGO

Predilecta and Santa Cruz veins at Guanaceví, and the Santa Cruz vein, near Otaez.

Tin Deposits of Varying Importance Scattered

Although it has no industrial importance, we record the occurrence of the cassiterite deposit of Cerro de los Remedios, west of the city of Durango, extending half a mile to the south as far as Analco. This cassiterite is distributed in small stringers that resulted from the filling of contraction fissures occasioned by the cooling of rhyolite, the country rock. It also presents itself in kidney-shaped masses forming small pockets. Often it is covered by isomorphic octahedrons of cassiterite and hematite, the latter, as a rule, being associated with tin deposits in the state. So far, it has not paid to work these deposits. For a number of years they were operated on a small scale, but the output did not suffice for the local consumption, and as water was struck with depth, the mines were abandoned.

IN THE FOOTHILLS OF THE SIERRA MADRE, DURANGO

Tin deposits are also found in the Potrillos mines, Sierra de San Francisco, in the Coneto district, San Juan del Rio. The bodies are fissure veins originated by fracture in some occurrences and by contraction in others. The fillings consist of reniform masses of cassiterite, frequently associated with argillaceous hematite and with pycnite, the latter in hemihedral rhombic crystals of the general type.

Some of the tin deposits are noted for the presence of a curious mineral specimen, durangite, classed as a fluo-arsenite of sodium and aluminum. It appears in monoclinic translucent pyramidal crystals of an orange color. According to Dana, durangite was found at the Barranca tin mine, eighteen miles northeast of Coneto, not with the stream tin, but in a vein four to six inches wide, sometimes attached to the walls of the vein (here the large, light-orange colored variety), and sometimes with cassiterite in the white pulvurulent matter which fills the veins (small dark-colored variety). Its presence has also been noted in the Refugio mine, of Coneto.

The Potrillos mine was worked about twenty years ago by the Pittsburgh & Mexico Tin Mining Co., the failure of which company was due to mismanagement, according to reliable information. It spent more than $200,000, United States currency, with a gross production of 1,000 tons of ore, of which one carload was shipped to the United States with good results. La Reina, Dos Señores, Donato Guerra and La Sorpresa mines of this district were afterward worked by Manuel Enriquez.

Important cassiterite deposits associated with iron oxides are also found in Cienega de Batres, Potrero de Laysola, and Santa Isabel mines, in the Cacaria Mountains. The Providencia, Maria, El Diablo, and Ampliación del Diablo mines are also situated in Cacaria.

Cassiterite deposits are disseminated in some other parts of the state, always associated with hematite, the country rock being rhyolite. These are the Cerro Blanco and Hornitos mines, in the Mezquital district; the Sacrificio mine, in Nombre de Dios; Tinaja Creek, in Sierra de Gamón, and the Guadalupe mine, in the San Juan del Rio district, where stannite also occurs.

Alluvial deposits of cassiterite are commonly found, resulting from the desintegrated mineral that has been washed down by the streams, thus being subject to a kind of concentration. These occur principally at Cacaria, Sierra de Gamón, and Los Hornitos, the latter in the Mezquital district.

Antimony, Quicksilver and Sulphur Abundant

Antimony ores are abundant. Besides being frequently associated with lead-silver ores, they are found in deposits composed almost exclusively of sulphides (stibnite) and oxides (senarmontite and valentinite). In these antimony deposits the lead ores are of common occurrence in depth. Antimony ores are found at Cañon de Jerez, near San Juan Bautista, where stibnite predominates. Stibnite is also found in small stringers crossing the hills south of Juana Guerra, in the Nombre de Dios district. In the Cerro de la Pitarrilla are some antimony deposits, where the stibnite is associated with the oxides, the latter resulting from an alteration of the former, due to weathering. The same condition is observed at El Carmen mine, in the El Oro district, and in the neighborhood of Avino and Tapona. In the Casualidad mine, near Panuco de Coronado, cervantite has been found, and in the Ojuela mine, in the Mapimí district, valentinite is present.

The best specimens of antimony ores have been brought from the Nazas district, where they abound. They have been taken from the Bonifacio Escobar and the Concreción de Dios mines, belonging to Jesús Ruelas, and situated in San Pedro del Gallo, in the same Nazas district.

As antimony oxides have been originated by the decomposition of the sulphides, the ores in the outcrops and in the oxidation zones occur in heterogeneous masses. Part of them are of a yellowish-white color, with a resinous luster that reveals the presence of senarmontite. In some other parts long crystals of rhombic appearance and a reddish yellow color are observed, disclosing the presence of valentinite and carvantite. As to the pulvurulent yellow-colored substance coating stibnite like a thin smear, drops of moisture condense in the upper part of the testing tube, for which reason we believe it to be stibiconite.

Operators of antimony mines have reported that there is a better market for antimony oxides than for the sulphides, and that they could market only ores containing not less than 50 per cent of metallic antimony, determined by crucible assays. As this method of assaying entails great losses, nothing but the richest antimony could be marketed, and so operations were in consequence discontinued.

Although treatment by lixiviation, cyanidation, and very recently, by flotation, has eliminated the old *patio* process and cut down the demand for quicksilver (*azogue*), we should, as a matter of record, mention the existence of the most important cinnabar deposits in the state. The well-known deposits of Palomas, near Otinapa, not far west of the city of Durango and in the mountains, were successfully worked until about twenty years ago. They are abandoned at present, but as the railroad to Mazatlan passes near them, it would be profitable to resume operations. In the Indé district there is a mine called Tenoxtitlán, where cinnabar occurs in deposits imbedded in the rhyolite like those of Otinapa. At Los Remedios and Cucuyame mines, in the Tamazula district, there are some rich cinnabar deposits, but the location is far from rail. Some samples of cinnabar have come from Aviles, in the Mapimí district, and from Suchil and Muleros, in the Nombre de Dios district, but the deposits have not been explored. Cinnabar has also been found in El Oro, San Juan del Rio, and Santiago Papasquiaro districts, and recently in Minas Nuevas not far from Topia. In San Dimas there is a mine called Cinabrio, where cinnabar occurs incidentally.

Although confined to the Mapimí district, sulphur occurs abundantly in the state, principally at Sierra de Banderas, where some important deposits have been worked for a long time. Juan de Dios Villarelo, a geologist, has written interesting reports about these deposits.

The natives of Tuitán, in the Nombre de Dios district, used to make fireworks of peculiar characteristics, and their ingredients for powder were sulphur, saltpeter, and charcoal. The sulphur came from Cerro de Maika, on the boundary line between the Ojo and Ochoa farms. This Cerro de Maika is one of the dead craters through which, in a recent geologic period, enormous flows of basaltic lava took place, originating the volcanic country now known as *breña* and *malpais*. The sulphur is of a solfataric origin and was produced during the solfatara stage of the last eruption, as the lava flows were cooling. It is found sparingly and is not very pure.

As to saltpeter, we may incidentally add that the Tuitán natives obtained it through efflorescence, by dampening certain red clay from Chorro, where it is found in caves in the basaltic lava. Saltpeter has been found, also, in small quantities at San Esteban, in the Nombre de Dios district, where it is associated with *tequezquite*, or sesquicarbonate of soda (trona). This is used only by cattlemen. In the vicinity of Ojo Caliente, near Estanzuela, in the Cuencamé district, the saltpeter occurs in larger quantities, and has been exploited by the natives. Not long ago a place was discovered near Avilez, Mapimí district, where the rock is said to contain 15 per cent of saltpeter.

ZINC USUALLY ASSOCIATED WITH LEAD AND SILVER

To date we have not heard of the existence of deposits composed exclusively of zinc ores, although blende, or sphalerite, is commonly associated with galena and iron pyrite in the lead-silver ores occurring at Tovar, near Tepehuanes, at Tejamen, and in the most of the mining camps where silver is produced. Sometimes the blende appears separated from the galena, forming pockets of different sizes, as in the [illegible], Parrilla, and in Guanaceví, Topia, Otaez, Huahuapan, and San Dimas mines.

Where lead appears in the form of carbonate or sulphate (cerussite and anglesite), zinc occurs frequently in its carbonate and silicate combinations (smithsonite and calamine), resulting from the decomposition of sulphides in the upper zones of the deposits. As typical instances we mention the Ojuela and Mapimí mines. Zinc ores have been reported in the San Juan de Guadalupe district.

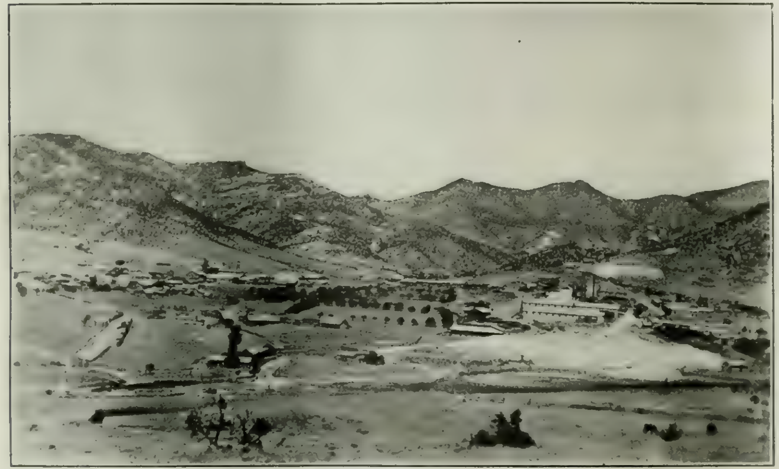
SILVER ORES WIDELY DISTRIBUTED

Silver ores are distributed all over the state, either alone or associated with lead, copper, and gold. Rhyolites, tufas, and conglomerates predominate in the higher regions of the Sierra Madre, surmounting the andesitic and dioritic flows, where the mineralized zones appear. Sometimes basaltic dikes cross the andesite and diorite formations. The ore deposits, veins, and beds occur principally in the contact zones. This is the general geologic characteristic in the following silver mining camps in the Sierra Madre of western Durango: El Carmen, Guanaceví, San Pedro, [illegible], Tahuahueto, Norotal, San Fernando, Sianori, Metatitos, Topia, La Portilla, [illegible], [illegible], San Andrés de la Sierra, Llanitos, Tamazula, Tominil, Amaculí, Otaez, Basis, Huahuapan, San Dimas, Guarisamey, Gavilanes, Tayoltita, Ventanas, [illegible], Chavarría, Guadalupe, Animas, San Nicolás, Las [illegible], San Patricio and many others. Although these mining camps are all situated at a long distance from the railroad lines, with few if any roads leading to most of them, and therefore having to pay excessively high freight rates, they have been producing ores profitably for centuries. Some [illegible] and old-fashioned treatment plants were built long ago, but modern mills have been installed in some

SANTA CRUZ MINE, [illegible]

camps. Railroad building is proceeding most satisfactorily, existing conditions considered.

The construction and extension of railroads will be a decisive factor in the development of the mining country just described. The Durango and Mazatlán line is now being constructed. The Mexican National Railway Co. has already built about 100 miles west of Durango, and has reached the divide. Orders have been given to start construction work from Mazatlán. The extension of the Tepehuanes branch to Guanaceví and thence to El Oro and Rosario will connect the city of Durango with the northern part of the state and with the State of Chihuahua. Preliminary locations were made by the Mexico Western Ry. Co. (formerly Nazas Valley & Pacific R.R. Co.) on the line from Santiago Papasquiaro along the Nazas River to La Laguna district, and from Ciénega (the divide of the Tepehuanes-Guanaceví extension), crossing the Tamazula mining and timber sections, to Altata, on the Pacific Coast. Plans have recently been considered for the construction of the Parral & Durango narrow-gage railroad as far as San Pedro and Guanaceví mining camps. The Durango Central, starting from Conejos station, south of Jiménez, branches out from the main central line to the El Oro and Indé camps, and has been built as far as Descubridora.


SOTO MINES, SAN PEDRO, GUANACEVÍ, DURANGO

Considering the argentiferous ore deposits in the Sierra Madre, it is found that their mineralization is composed of argentite, argentopyrite, the complex silver-sulphides like polybasite and stephanite, ruby-silver, pyrargyrite, proustite and myargyrite, and also native silver. Very rarely the haloid silver compounds are found in the outcrops, but the association of iron pyrites with silver ores is of frequent occurrence. Fissure veins are formed by the minerals above mentioned in a quartz or calcite gangue, and the ore shoots often constitute more or less large pockets.

It is well to remark that the silver ores, as already described, are associated in nearly all the mines with lead and copper ores, as follows: galena accompanied by blende; malachite, azurite, cuprite and chrysocolla in the oxidation zone; in depth the sulphides like chalcopyrite, chalcocite, erubescite (bornite) and gray copper (tetrahedrite and panabase). In San Andrés de la Sierra the complex copper sulphides (*fahlerz*) and galena are abundant, the latter predominating in Topia. Lime formations seem to have a bearing on the presence of lead and copper deposits, and this fact deserves a more careful investigation.

In general, wherever silver ore deposits occur associated with copper-lead deposits, either they have not the same strike, which frequently is the condition, or they are parallel, as happens in the Guanaceví mining camp, where, from the Barradon vein to the west, all the veins are argentiferous, and to the east only lead-argentiferous and cupro-argentiferous ore deposits are formed. In both occurrences it is apparent that the veins are of different age, and it is remarkable that galena and copper sulphides appear in large proportions in depth. In San Andrés de la Sierra the country seems to have been broken up after mineralization; the fractures are not mineralized and constitute numerous faults of large displacement. In other places the veins are devoid of minerals having strong chemical action. The walls have been scarcely altered, and the presence of primary sulphides right under the surface shows that there has been no migration of values. This type of argentiferous, cupro-argentiferous, and lead-argentiferous ore deposits seems to predominate in the Promontorio, Coneto, El Refugio, Avino, Panuco de Coronado, Arzate, Yerbanis and other mines in an eruptive intrusion running more or less parallel to the Sierra Madre in central Durango.

GOLD, LEAD, COPPER, NICKEL, COBALT AND BISMUTH

Gold is also abundant in the state. Most of the lead-copper-silver ore deposits in the Sierra Madre contain a large proportion of gold, and in such mines as Ventanas, Copalquin, Bacis, Animas, San Patricio, and others the gold values are frequently higher than those of silver. Rich gold quartz veins containing considerable iron have been worked in the Purisima mine, situated in El Carmen camp, in the El Oro district; in the Guadalupe mine, at Cieneguillas, near Indé; in Los Reyes, at San Juan de Guadalupe; in El Orito, of the Cuencamé district, and in the Tungsteno mine. A fabulous gold mine is supposed to be hidden somewhere in Sierra del Oso, in the El Oro district. High-grade gold ores have been found in the Arzate, Refugio, and Cañon de Juárez mines, in the San Juan del Río district; but, as with the Arzate and Refugio mines, these are silver-gold veins, the upper zones of which have been intensively leached, thus forming a gold concentration in the outcrops. In other occurrences no such leaching has taken place, and the gold presents itself finely disseminated in a compact quartz gangue. The southern part of the state, the Mezquital district, being in a mountainous and rough country, has not been much explored. From what is known, it seems to be exclusively a gold country, which is shown by the mines called Minas Negras, Temoaya, Pueblo Viejo, Guacamaya, Santa María de Ocotán, and Huasamota. Animas, San Patricio, Guadalupe, Jocuixtle, and Coaborita are all gold mines, and belong to the Durango district.

The richest lead and copper deposits are found in the eastern part of the state, and some big mining companies are working them in Mapimí, Velardeña, Asarco, and El Cobra, where smelting plants of large capacity have been erected. Two formations, eruptive and sedimentary, are observed in the eastern part. The ore deposits occur either in the sedimentary formation or along the contact between the two, lead deposits belonging to the first class and copper deposits to the second. Sometimes the contact mineralization goes very deep into the eruptive rocks, as at Indé, where the mineralized bodies branch out into the rhyolite. The limestones have been re-crystallized to marble in nearly all the lead deposits. It is not unusual to find the copper ores associated with wollastonite and grossularite, as in the Sacrificio and Parrilla mines of the Nombre de Dios district.

The lead deposits are generally composed of galena (frequently accompanied by blende and by antimony sulphides). They are often altered to oxides, carbonates, and sulphides in a gangue of calcite or of quartz-calcite and not infrequently undergo secondary enrichment. The migration of values does not seem to have taken place frequently in the copper deposits, although in the zone of oxidation the silicates, the carbonates, and cuprite are found associated with iron ores, and the primary sulphides appear next, the gangue being quartz and calcite.

The primary ores contain enough lead and copper to make the deposits of economic value. Lead averages from 10 to 30 per cent. The silver grades are high in this part of the country, where the ores run 1 kg. of silver per ton. Copper contents average from 10 to 25 per cent, with little silver, and the gold runs from 6 to 10 g. per ton. In the lead-copper-silver ore deposits of the Sierra Madre the silver and gold are notably higher.

Bismuth ores are said to be found in the Carmen mine of the Indé district. Nickel and cobalt ores are reported in the Tamazula district, but their occurrence has not been verified.

Clays, Lime, Gypsum, and Other Construction Material Found in Quantity

Kaolinite results from the decomposition of the aluminous minerals, especially the feldspars, of granite and gneissoid rocks and porphyries. As rhyolites are common in Durango, kaolin is often found in places where the rock has been altered. Kaolin deposits of some importance occur on Calvario Hill and on Morga Ranch, both in the outskirts of the city of Durango. The existence of kaolin has also been demonstrated in Amaculi and Saporis, in the Tamazula district, and in the vicinity of Santiago Papasquiaro in a place called Herviderosp. Common clays used in the manufacture of earthenware, bricks, and other paving materials occur in all alluvial deposits.

As already stated, the cretaceous limestone formations are abundant in Durango, so that lime is easily obtained everywhere, except in a few places of the Sierra Madre. When the Mercedes dam was being built near Pasaje station on the International railroad, an American was sent to locate the best limes, with the necessary equipment to test the material *in situ*. He found that the best grades could be obtained at the bottom of the Yerbanis hills, in the Cuencamé district. Here the limestone beds overlie the shale formations.

As to gypsum, it occurs abundantly in the cretaceous formation of Banderas, Campana, and Sierrita Hills of the Mapimí district; and it is also found in the Cuencamé and San Juan de Guadalupe districts. What is called "gypsum" (*yeso*) in Tejámen, Avilez, San José de Cañas, Mezquital and other places is nothing but lime carbonate having the appearance of limy alabaster.

GUANACEVI MINING CAMP, DURANGO, MEXICO

Durango City is situated at the foot of the Sierra Madre. The Calvario, Remedios, Analco and Guadalupe hills, surrounding it, are but the first counterforts of the Sierra, in the formation of which the rhyolite tuffs had an important part. These tuffs constitute the best construction material, especially those found near the city of Durango. The latter are famous for their abundance, their variegated colors and uniform texture, and for the facility with which they can be dressed. The material from the quarries is remarkable for its color, varying from dark or light gray and pink to plain white, and for its texture, which is classified as hard, medium, and soft.

In Sombreretillos, near Cuencamé, there are some tuffs similar to those described, but they have different shades, like wood, which characteristic makes them appear more beautiful.

As ornamental material the State of Durango possesses the *tecalis* and marbles of superior class and variegated colors which are found in the Sierra de Jimulco, of the San Juan de Guadalupe district, and in some places in the Mapimí district, such as Cerro de la Tinaja and Sarnoso, not far from Noé.

The siliceous sandstones of San Pedro del Gallo, in the Nazas district, are well known, and from these the best grindstones are made. They are also very refractory. The quartzites appearing north of the Cerro Mercado are remarkable for their hardness and may easily compete with the Danish flints used for grinding ores in tube mills.

Coal has been found at great depths in San Pedro del Gallo, in the Nazas district, and in several places of the Bolson de Mapimí and in San Juan de Guadalupe and San Juan del Rio districts. No formal explorations have been undertaken. Petroleum has been located near Conejos, in the Mapimí district, and in San Juan de Guadalupe, but the quantities found were not large enough to encourage further investigations. It is our opinion that a systematic exploration should be undertaken in eastern Durango for the purpose of verifying the existence of coal and petroleum in the state. So far, no reliable information on which to base an opinion in regard to this subject is available.

A Method of Determining Nickel In Silverhorn Ores

By E. C. D. Marriage

Written for Engineering and Mining Journal

THE PRESENCE of nickel in the ores of the recently discovered Silverhorn district, near Pioche, Nev., lends interest to the following method for the determination of nickel:

An alkaline solution of potassium cyanide to which a few drops of potassium iodide have been added as an indicator may be assayed for its strength by titration with silver nitrate, as commonly practiced. Nickel interferes with this assay doing the work of its equivalent in silver, and the quantity present may be calculated from the amount of interference. It is on these facts that this method of nickel determination is based. The method, being indirect, has the disadvantage of requiring two standard solutions, one of potassium cyanide and one of silver nitrate, but the ease of manipulation, the rapidity of the process, and the reasonably consistent results obtained entirely offset any such disadvantage.

Composition of Standard Solution

The standard silver nitrate solution is made by dissolving 14.48 g. of c.p. recrystallized silver nitrate in distilled water and making up to 1,000 c.c. This solution should be made exact and, if so, 1 c.c. will be equivalent to 0.0025 g. of nickel. If the silver nitrate used is pure, and the resultant solution perfectly clear, there will be little need of standardization, as the methods most used in standardizing silver solutions will show a greater error than will be noted in the making up of the solution.

The standard cyanide solution should be made so as to be exactly equal to the silver nitrate solution in strength. This may be done as follows: Weigh up 12 g. of 95-per cent potassium cyanide or 11.6 g. of 99-per cent, dissolve in water, and dilute to 1,000 c.c. Fill one burette with solution and another with the silver nitrate solution. Run 50 c.c. of the cyanide solution into a large beaker, add 10 drops of a 5-per cent solution of potassium iodide, 10 c.c. of ammonia, dilute to about 200 c.c., and titrate with the silver nitrate solution until a distinct, but not too deep, yellowish cloud of silver iodide is formed, indicating that the end point has been reached. The cyanide will be found to be slightly stronger than the silver nitrate. For example, 51.3 c.c. of the silver nitrate solution may have been required to neutralize 50 c.c. of the cyanide solution; in which case add 1.3 c.c. of water to each remaining 50 c.c. of the cyanide. Another trial should demonstrate the two solutions to be of equal strength.

To make a determination, weigh 0.5 g. of the ore in a 6-oz. flask, add 15 c.c. of nitric acid, heat till red fumes have ceased to come off, add 5 g. of potassium chlorate, and take to complete dryness but avoid baking. When cool, add 10 c.c. of hydrochloric acid and take to dryness as before. Allow to cool and take up with 10 c.c. of hydrochloric acid and 40 c.c. of water. Heat gently until all soluble matter has gone into solution, filter, and wash thoroughly with successive small amounts of hot water. Make the filtrate alkaline with ammonia, add 10 c.c. of bromine water, and boil off the excess bromine; filter, redissolve the residue with hydrochloric acid and reprecipitate to recover any occluded values, and filter through the same filter, acidify the filtrate with hydrochloric acid, and add 10 c.c. excess. If manganese is known to be absent, the ammoniacal precipitation should be omitted, in which circumstance the filtrate from the flask is ready for the next step. In either case the hydrochloric acid solution obtains, through which hydrogen sulphide is passed until no further precipitation takes place. Filter, wash thoroughly with hot water, and boil off the excess hydrogen sulphide from the filtrate, and if the solution exceeds 150 c.c. in volume, reduce by evaporation. Add 15 c.c. of bromine water to oxidize the solution thoroughly, and boil off the excess bromine. Cool to approximately 60 deg., add 15 c.c. of a 10-per cent solution of citric acid, after which neutralize with ammonia, and add 10 c.c. in excess. If there is any nickel present the solution will have a distinct blue color, nickel being similar to copper in this respect. The solution is now ready for titration and should be about 200 c.c. in volume.

Method of Titration

In titration, add the standard cyanide solution until the blue color has disappeared and add 5 to 10 c.c. in excess. It is well to add a round number of cubic centimeters in order that the calculation may be simplified. Add about 10 drops of potassium iodide indicator and titrate until the yellowish cloud appears. If there is any doubt as to the exactness of the end point, add an additional 5 c.c. of the cyanide and finish with the silver nitrate solution. The results should coincide; that is, if 30 c.c. of the cyanide solution had been used, and the silver nitrate burette showed a reading of 20 c.c., then if the titration is correct, 35 c.c. of the cyanide should take 25 c.c. of the silver nitrate, the difference in both instances being 10 c.c. It is this difference between the readings of the two burettes that measures the quantity of nickel present, each cubic centimeter of this difference being equivalent to 0.0025 g. of nickel. In the example quoted the difference is 10 c.c., which is equivalent to 5 per cent of nickel, the weight of ore taken being 0.5 g.

If the cyanide solution is not exactly equal in strength to the silver nitrate solution, the quantity of cyanide used must be calculated to its equivalent in silver nitrate before the subtraction is made.

There are few elements that interfere in this determination, manganese, copper, lead, silver, arsenic, and antimony being eliminated in the two precipitations described. Cobalt, when present, counts as so much nickel. Zinc, when present in any quantity, seems to have no effect whatever. The method, as described, gives accurate results on the ores of the Silverhorn district.

The Effect of Sizing a Copper Blast-Furnace Charge

Exceedingly Large Chunks Undesirable, and Better Work Indicated by Segregating Various Sizes And Charging Separately

BY JULIUS H. GILLIS

Written for Engineering and Mining Journal

THE SIZE of the material making up the charge of a copper blast furnace is generally determined by other considerations than its possible effect on the operation of the furnace, and does not always receive the attention that it should. Probably in most cases the furnace man's greatest concern in regard to the mechanical condition of the charge is to handle the large amount of fines which are forced on him by the mine or mill. Without careful analysis, the natural conclusion would be that if the crusher could be operated with a little larger opening, or if some large chunks could be mixed with the ore and the general average size made larger, the charge would be loosened up a corresponding amount. This is not necessarily true.

In the operation of a smelter with which I was recently connected it was the practice to set the primary crusher, which took a hand-sorted feed, to about an 8-in. opening. The ore was then crushed again to pass a 4-in. grizzly and sorted a second time.

In the first crushing, slabs 18 in. long and 12 in. wide were common, and a large percentage of the ore would not pass an 8-in. ring. It was found that sufficient sorting could be done on the first set of sorting belts and that the fines were giving considerable trouble on the charge. In addition, the rockhouse could be simplified mechanically by omitting the second crushing, so this system was adopted. There was an almost immediate increase of about 20 per cent in the ratio of coke to ore in the blast furnace, and some other conditions developed which made operation more difficult. As this change was made at the same time that some other changes in the process were being tried out, the difficulties were not at first considered in connection with the change in the size of the ore. By eliminating every other factor as the cause of the trouble, I decided that the size of the ore must be the reason, and obtained permission to make another trial of the second crushing.

The advantage of the smaller size was evident as soon as the large chunks were eliminated from the system. The ratio of coke to ore dropped about 20 per cent, and other advantages were secured, such as increased oxidation of sulphur and iron, freedom from accretions and crusts in the furnace, and increased capacity. The increased concentration gave a higher grade of matte and less work for the converting department. The furnace operators also found that the mechanical handling of the ore through the bins and cars was greatly improved. Altogether, the difference in cost for the entire smelter between the period in which the large sizes were charged and that following was about 20 per cent in favor of the smaller size. The plant was shut down before any systematic tests could be made to find if further savings would result.

Investigations might be made along the lines followed in producing a correct mixture for concrete, but, of course, with the opposite end in view. For concrete, a mixture is desired without voids and with the least possible area of surfaces in the aggregate; on the other hand, the ore mixture should contain the maximum, or, rather, the correct percentage, of voids, with the greatest possible area of surfaces exposed. The voids would make a loose charge and allow free flow of the gases, and the large area exposed would make for rapid operation of the furnace.

Round balls of a uniform size when placed in a bin will contain a definite percentage of voids. This percentage is practically the same for all sizes, and this rule is approximately true also for irregular pieces of a uniform size. Although the voids are the same with the smaller sizes, the surface exposed to the action of the gases and fluxes is greatly increased. If two sizes, one considerably smaller than the other, and with the same percentage of voids in each, were mixed together, a certain definite quantity of the smaller size could be entirely contained in the voids of the larger size and the bulk of the mixture remain the same as the original bulk of the larger size. The percentage of voids in the mixture, however, would be much less and for blast furnace purposes the charge would be much "tighter." The addition of other sizes could be made until a minimum of voids and a "tight charge" would be secured.

The next worse thing for a blast-furnace charge than a uniformly graded mixture would be large pieces mixed with the fines and smaller pieces. These large pieces would contain no openings and would have the effect of reducing the capacity of the furnace in somewhat the same proportion as the ratio of their area at any level to the total area of the furnace. These solid pieces in the shaft would shut off the passage of the gases as effectually as though the shaft were reduced in size an equivalent amount.

A good illustration of the relation of voids to the mixture of various sizes of ore came to my attention a few years ago when I had some determinations made of the weight per cubic foot of a certain ore for the purpose of designing an ore bin. Several sizes were to be handled, and the weight of each size was to be determined. Some ore of each size was carefully screened, and it was found that the weights were nearly the same for all sizes except the fines, which were in every case the heavier. This held good whether the maximum size of the fines was ½ in. or 2½ in. and the size from ½ in. to 1 in. was practically the same weight as the size from 4 in. to 8 in. All sizes, ½ in. to 8 in., mixed together were much heavier, and therefore contained less voids, than any individual sizes.

Some conclusions may be drawn, subject to modification in the light of more definite data:

1. Large pieces of ore or flux in the charge do not loosen the charge or permit the use of a larger percentage of fines, but rather the contrary. The actual dividing line between a piece which could be considered as solid rock and one that would be a part of a permeable mixture might be hard to determine, but the [illegible] generally specified in concrete mixtures after years of investigation might provide a suggestion for want of more definite data.

2. The efforts which are generally made thoroughly to mix the various sizes of ore before charging to the furnace may be in the wrong direction and a more open charge might result if the ore were screened and different sizes charged in layers or batches. Only the fines, which would cause trouble from dusting, would have to be taken out. The smaller sizes should be kept separated and should be large enough to be granular.

A Mining Odyssey

In Which the Mining Engineer Is Moved To Discuss His Work and the Criticisms Directed Against His Profession

BY EDWIN C. HOLDEN

Written for *Engineering and Mining Journal*

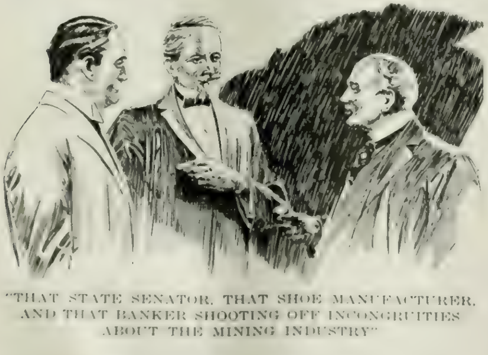
BEING STIMULATED by counterirritants, I hasten to react while they still tingle; otherwise, I shall probably calm down again into the somnolence of my confrères. As a more or less prideful professional, I have been fond of thinking that the prerequisites to make a competent mining engineer class him in a learned profession, but for a long time, I must shamefacedly confess, I have suffered uneasy qualms regarding a certain uncertainty in the prestige of my profession and its personnel. Time and again I have surreptitiously poked the thought away as disloyal, but sooner or later some unfortunate occurrence, or lack of occurrence, has brought it back again like the Cheshire cat, to grin down upon me.

"BROUGHT IT BACK AGAIN, LIKE THE CHESHIRE CAT, TO GRIN DOWN UPON ME"

THE AUTHOR STARTS SOMETHING

At last, after an evening discussion of mineral developments had been monopolized by laymen while the aggregation of mining engineers present had preserved a baleful silence, in an unguarded access of plutonism I erupted at an associate:

"What is the matter with us? Why are we so inarticulate? Why did we sit like reverent frogs while that state senator, that shoe manufacturer and that banker were shooting off incongruities on our own subject?"



"THAT STATE SENATOR, THAT SHOE MANUFACTURER, AND THAT BANKER SHOOTING OFF INCONGRUITIES ABOUT THE MINING INDUSTRY"

As he glared at me I suddenly realized I had turned loose a whole batholith.

"Oh, so you're thinking along that line too! Why?" he repeated. "Because we're trammeled by facts; because we're long on science and short on human interest; because we're a crowd of dubs who have let our technique atrophy our imagination; because we're deadly prosaic and uninteresting and we know it ourselves."

The perverse kink in human nature that makes one talk Republican in Alabama and "wet" in a Methodist rally then asserted itself, so I protested:

"Don't deride our profession; Agricola recognized its dignity even in his day."

"His eulogy would have more unction if we didn't have to delve so deep in the vaults of time for it," he replied tartly. "A layman told me today that the mining engineer is passé; that, whereas in the days of Mark Twain's miner, and until quite recently, the mining engineer had to be an all-round engineer, metallurgist, geologist, and executive, those were also the days when a professor occupied a settee instead of a chair. The professor of history was responsible for the doings of the human race from glacial times to next year. He had some breadth and perspective. He was human, livable, lovable. Now you can take a major course on the Edict of Nantes or on the High Cost of Living, all based on an efficient card-index system, with a card-index personality back of it. The old professor of chemistry and physics whose hobby was philosophy has given way to a myriad of ists and ologists who can give you a four-year course on Why Hair Turns Gray, and a three-year post-graduate under the professor of applied psychology on Why It Sometimes Doesn't. That's modern specialization, that's Progress.

THE PRESENT AN AGE OF SPECIALIZATION

"This layman went on to disclose that we no longer need the jack-of-all-trades mining engineer except at small mines on the outskirts of civilization like Central Africa, the east slope of the Andes or Bolshevik Siberia. A modern mine needs an underground foreman, a mechanical or electrical engineer or both, a surveyor, a mining geologist, a metallurgist or chemist, and a manager who may be any one of these, or not a technical man at all, merely an executive to correlate the work of this staff. Exit the mining engineer.

"If there is any hiatus to be filled, Mark Twain's miner has a worthy successor in the 'mining man,' who is so largely with us, and you must admit," added my friend bitterly, "he averages up a shining social and intellectual asset to us."

"Have you any further indictment?" I gasped.

"Yes, we aid and abet our own disesteem by remaining an inglorious submerged tenth while the Philistine swarms through our gates. Do you know"—and here his forefinger menaced me—"that the Geological Survey and even the Bureau of Mines have never had an actual mining engineer as director? I admit it isn't our fault, for we don't make the appointments, but it is a matter of standards whether as many as 80 per cent of the presidents of the Institute of Mining Engineers have been undeniable mining engineers. The others were of course exceptional men, but when does the Bar Association, for example, ever give a testimonial presidency to an eminent client, sheriff, or convict instead of to a lawyer? Even when you come to our holy of holies, the Mining and Metallurgical Society, where membership requires that if you weren't born underground, you at least must have been nursed from a carbide lamp or teethed on drill points—even here, in the Mining House of Lords, you must rummage on the back seats to find the real miners."

"Well, at least you don't have to rummage to find a miner in the Department of Commerce," I retorted. "And that miner banishes my professional blues."

"That's true," he admitted, "but you must remember he succeeded not because he is a mining engineer but despite that fact. His technical efficiency and world experience are exactly what our Washington machinists object to."

"Well, since there's no place left for mining engineers, we'd better turn geologists," I suggested.

"Geology is a delightful philosophical pastime," he mused, "an unlimited field for imaginative speculation and exposition; a veritable Mecca for poetic scientists and scientific poets if ever the twain may meet. So, under her banner gathers a collection of choice souls, gifted with social volubility and with inclinations toward not only the quiet retreats of academic life, but also toward the confusion of apex judges, the general direction of the mineral industry and the conservation of most everything. In all of these occupations disquisition is capitalized."

"You'd better not slam geologists. My friend Haultain did years ago', and I believe he still wears the bandages of their scandalized indignation. Besides I really have a sneaking respect for some of them, a few I revere, and one or two, I must confess, I love.

"But there are also others," he said uncompromisingly, "and when I finish a successful diamond-drill campaign or devote less than 60 per cent of a mine valuation report to its historical geology, I am liable to become peevish when a geologist criticizes because I did not retain his master mind in order to increase my barren footage, or elongate my report and enlarge my overhead. I turn peevish, but I humbly turn the other cheek and help elect a couple of geologists to office in the Mining Institute."

[illegible]

"Why don't you go on record in one of the mining journals and rouse the craft against their submergence?"

"Nothing doing with that mixed metaphor," he jeered. "Closed shop. The editors of both mining journals hold geological union cards."

"I'm still cogitating over this superman who merely correlates the staff. What is he really?"

"Oh, probably a pseudomorphic statistical geologist who owns a copy of the Mining Handbook, so he can follow the vocabulary of the staff. Thus he just correlates men instead of strata; it's very simple," and my friend went away wiping his eyes.

I [illegible] a cheering thought revived me.

I am expecting a mining man to sell me some oil stock tonight. They own the rights for most of the state of New Mexico and are drilling a well bang in the middle of it. He says they are sure to strike a vein because it's in the same [illegible] formation that they have in Pennsylvania. Being a mining engineer, I appreciate the full significance of striking a crustaceous oil vein, and I am already planning to get a Ford and a Brunton with the dividends and go prospecting on the headwaters of the River of Doubt, where, I believe, the mining engineer, permanganate, and quinine are still à la mud.

PROSPECTING ON THE HEADWATERS OF THE RIVER OF DOUBT

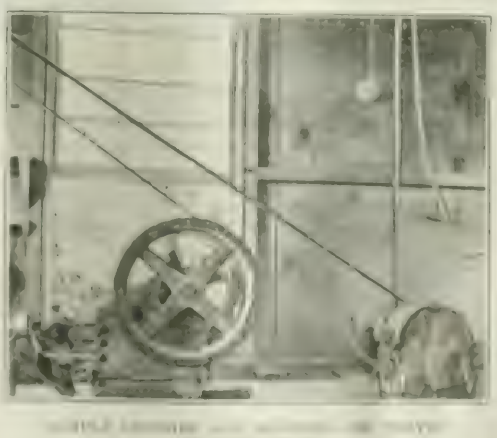
Meanwhile won't somebody behead the grin of that darn cat? It's there yet.

[illegible] *Bulletin*, Vol. 16, p. [illegible]

Driving Laboratory Crushers

Written for Engineering and Mining Journal

A convenient method of driving a small laboratory crusher and sample grinder is shown in the accompanying illustration. The two machines are bolted in line upon the work bench. An idler pulley supported upon an iron arm fastened by a bolt to the underframe of the table in such a way as to swing in an arc is placed in line with the two driving pulleys of the respective machines. To keep the idler pulley in place, and also to tighten the belt, a bolt with a U-shaped extension is attached to the bearings of the idler pulley, and the pull is taken up by the nut and a plate bearing against a wooden frame. The [illegible] above the table. The arrangement is in use at the [illegible] Mining Co., [illegible] Cal.


[illegible]

Metallurgical Engineers of Note

Arthur Smith Dwight

KNOWN as well for his attractive personality as for his ability, Colonel Dwight is, from almost any standpoint, one of the real leaders among American metallurgical engineers. Neither is his military title purely an honorary one; he is not a "Kentucky colonel," but a lieutenant colonel of engineers, U. S. Reserve, and received the D. S. O. from the British authorities as well as a citation from General Pershing. Colonel Dwight was born in Taunton, Mass., on March 18, 1864. He was educated at the Polytechnic Institute of Brooklyn, N. Y., graduating in 1882, and three years later was graduated from Columbia University with the degree of Engineer of Mines. He received an honorary degree from that institution in 1914 as Master of Science. On leaving Columbia in 1885, he went to Pueblo, Col., and for thirteen years was associated with the Colorado Smelting Co. Beginning as assayer, he rose to be general superintendent. When he gave up the latter position he became connected with several large companies in the mining and smelting of lead, copper, and the precious metals in the Rocky Mountain region. This work occupied him from 1897 to 1906, and six years of that time were spent in Mexico. Mr. Dwight was general manager of the Greene Consolidated Copper Co. at Cananea in 1906, when trouble first developed against the régime of Diaz. A general uprising was planned to seize the mines, and, with the money so obtained, carry the revolt through the interior. Mr. Dwight turned his industrial organization into a military unit almost overnight, stemmed the tide of revolution, and had the situation well in hand before the arrival of troops. In the fall of 1906 he returned to New York and began practice as a consulting mining and metallurgical engineer. He next developed important metallurgical patents for the roasting agglomeration of fine ores, known as Dwight & Lloyd sintering process, now extensively used all over the world. When the World War broke, Mr. Dwight became convinced that the United States must eventually enter the fight, and he took an active part in preparedness work, particularly in his own profession. He was a member of an engineering committee which co-operated with the War Department in creating the Engineer Officers' Reserve Corps, which resulted in a large number of engineers being available when the United States entered the war.

ARTHUR S. DWIGHT

Mr. Dwight was one of the first civilians to be commissioned in the Reserve and to enter active service. As Major of the First Reserve Engineer Regiment he had an important part in recruiting and training that body, which sailed for France on July 14, 1917, as the Eleventh Engineers. They were the first unit of the A. E. F. in action. Their behavior at Cambrai on Nov. 30, 1917, when they fought the Germans with no weapons but pick and shovel, thrilled all America. Colonel Dwight served in France for more than twenty-two months, nine of which were spent on the British front. At the request of the French government he was assigned as special metallurgical adviser to French companies engaged in war work. He was next appointed Engineer Salvage Officer, A. E. F., to organize a reclamation service for the great quantities of war material that was being wasted upon the battlefields.

Colonel Dwight's wife, Jane Reed Dwight, was also prominent in war work, and in January, 1918, became Regional Directress of the women workers with the Y. M. C. A. at the American front. She was decorated for bravery by the French government with the Croix de Guerre, also receiving other citations.

Besides being a life member and first vice-president of the A. I. M. E., Colonel Dwight is also vice-president of the New York Post of the Society of Military Engineers; member of the Executive Board of the American Engineering Council; member of the Mining and Metallurgical Society of America, of which he has just been appointed chairman of the Committee on Ethics; member of the Institution of Mining and Metallurgy, London; Military Order of the World War, Engineers', University, and Columbia University clubs, New York, and the Engineers' Country Club. He is attending the meeting of the Institution of Civil Engineers of Great Britain this summer.

CONSULTATION

Cadmium, Alunite, and Aluminite

"Will you kindly give me data on cadmium ores, their market value, what and where the market is and where such ores are found, and their analysis. I also desire to know the difference between alunite and aluminite. Is alunite a source of aluminum or of potash and does not the aluminum remain in the slag? If so will you explain why? Is not aluminite in large deposits more desirable for aluminum purposes than bauxite and as easily separated or more so? With its low aluminum content, would it be of commercial value if found in a large deposit? Where are the two mined, what is the consumption in this country, and who are some of the leading consumers?"

Cadmium ores are of comparatively rare occurrence in nature, and we do not recall the name of any one mine operating primarily, or exclusively, for the production of cadmium ores and the recovery of the metal itself. Commercial cadmium is recovered as a byproduct in lead and zinc smelting and refining, and the production from this source has been sufficient to meet all demands. According to the U. S. Geological Survey, the cadmium occurs in a ratio of about one part of cadmium to 200 of zinc. The only cadmium mineral of importance is greenockite, the sulphide of cadmium, but the metal is not obtained directly from this mineral.

As cadmium ores are not regularly bought and sold, and if they have any market it must be an exceedingly small one, *Engineering and Mining Journal* does not quote cadmium ores. It may be that by communicating with some of the custom smelting companies producing zinc and lead ores, cadium ores can be sold. The position of the individual smelter will influence the probability of making cadmium purchases. It may be treated as an impurity and be undesirable by some, and others perhaps are in a position to consume a specified amount without handicap to their operations. Cadmium metal is selling for $1 to $1.10 per lb. The entire domestic cadmium production for 1920 was about 65 tons.

Alunite is a hydrous sulphate of aluminum and potassium and has the formula $K_2O\ 3Al_2O_3\ 4SO_3\ 6H_2O$, whereas aluminite is a hydrous sulphate of aluminum with the formula, $Al_2O_3\ SO_3\ 9H_2O$. Alunite is primarily a source of potash and is being mined in Utah for the recovery of its potash content. The aluminum contained in the mineral, according to the plans of the producers, is to be recovered as a byproduct.

The alunite deposits of Utah are situated near Marysvale in the Tushar Mountains. Briefly outlined, the practice followed in treating alunite relies on the decomposition of the mineral under a red heat, making the potash soluble and the aluminum insoluble. The alunite is then leached with water, and potassium sulphate recovered by evaporation. The U. S. Bureau of Mines reports that the mineral, as received from the mine, is crushed in a gyratory crusher and a set of rolls, and sent to storage bins. From the storage bins it is sent to a cement kiln furnace fired by pulverized coal. The calcine from the furnace is elevated to storage bins and sent to digesters. Then the digester is agitated with water and steam under pressure until the potassium sulphate has dissolved, after which the solution and residue are sent to tanks. From these tanks the whole is pumped into filter presses, and the solids are separated from the solution. The filter cake is stored on a dump for possible treatment later for the recovery of the aluminum. The filtrate is discharged to multiple-effect evaporators, where the potassium sulphate is recovered. The potassium sulphate crystals are dried, pulverized, screened, and sacked for shipment. From this description it is apparent that no slag, in the common sense of the word, is formed. The aluminum remains in the residue, and as the mineral alunite has only been heated to a red heat, no slag is formed. Alunite when pure contains about 37 per cent of alumina and 11.4 per cent of potash.

Aluminite is rarely found in nature and is not an unimportant source of aluminum. Bauxite is a commoner aluminum mineral, and also contains a greater amount of the metal; hence the almost exclusive use of bauxite for the recovery of metallic aluminum. The only locality known to *Engineering and Mining Journal* where aluminite has been found is at Halle, Germany, Brighton, England, and in localities in France and Bohemia. No doubt, minor mineralogical discoveries of aluminite have been made in the United States.

Bauxite is produced by about five nations. In 1913 the last year for which complete figures are available, France produced over 57 per cent of the world's supply, United States slightly less than 40 per cent and Great Britain, Italy and India the remainder. Most of the United States production comes from the Arkansas deposits, which in 1918 yielded 93 per cent of all the domestic bauxite mined. The bulk of this production is derived from Saline County, where are the chief mines of the American Bauxite Co., the mining subsidiary of the Aluminum Co. of America. The remainder of the domestic production comes from the Georgia, Alabama, and Tennessee fields, with its center near the point where these three states corner. Deposits of bauxite, said to be large, have been developed for the last three or four years in British and Dutch Guiana.

The bauxite produced in the United States during 1920 amounted to 521,308 long tons. The apparent domestic consumption for the same period is given by the U. S. Geological Survey as 541,946 tons. The production of bauxite in the United States is in the hands of practically one company, the Aluminum Co. of America, which produces the ore and metal.

The Most Important Sulphur Producer

In reply to an inquiry relating to the most important sulphur mines in the United States, in our issue of July 16, 1921, we stated that the Union Sulphur Co. and the Freeport Sulphur Co. furnished 90 per cent of the sulphur produced in the United States. Although this statement was probably true prior to 1919 we find that the Texas Gulf Sulphur Co. started production in March, 1919, and that in 1920 this company produced approximately 1,000,000 tons, which is probably a greater tonnage than the combined production of Union Sulphur Co., Freeport Sulphur Co., and Sicilian mines

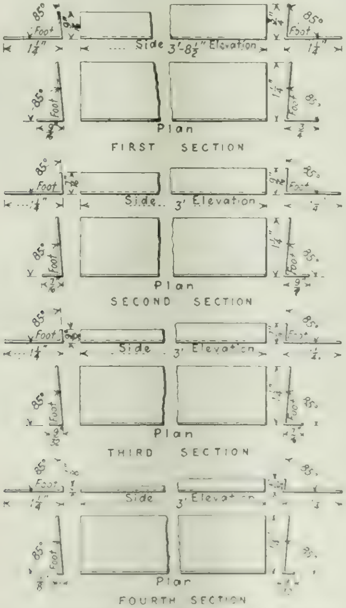
HANDY KNOWLEDGE

The Kirtley Iron Riffle

By W. R. CANTON

Written for *Engineering and Mining Journal*

Excessive wear and short life of wooden riffles made of soft pine led to the search for a more serviceable riffle at the mill of the Replogle Steel Co., near Wharton, N. J. The first suggestion was to try riffles made from harder and tougher woods. At this point L. L. Kirtley[1] advocated the use of iron riffles. At some plants this would not be practicable, but the ore treated at this plant has no objectionable characteristics such as acid and the like. An effort was made to get some data on the use of this type of riffle at some other plant. Inquiry was addressed to the leading manufacturers of mining supplies, but with no results.



DIMENSIONS OF KIRTLEY IRON RIFFLE

Sketches were then drawn up, and the riffles were made in 3-ft. sections in a local tin shop. No. 18-gage galvanized iron was used. They were put on the table deck, and at once a great advantage was apparent. With the same spacing as the wooden riffles the effective table area was increased 25 per cent.

Operation bore this out, for it was possible to handle 12.6 tons per hour with a Wilfley No. 9 rougher table equipped with iron riffles, though with the same type of table equipped with wooden riffles one could get satisfactory results only when feeding not more than 10 tons per hour.

After the table had handled 5,000 tons of ore (which amount would wear out a set of soft pine riffles), it was examined, and the riffles and linoleum were found still to be in good condition. This inspection led to a further improvement that had for its object the saving of the linoleum covering. It was decided to lengthen the foot so as to cover the entire surface. This it was hoped would prolong the life of the linoleum through two sets and possibly three sets of iron riffles, which would materially cut the costs both as to the linoleum and the labor of renewing the deck. It was also decided to make the next iron riffles out of heavier material, so the new ones are made of No. 16-gage soft black iron, in four sections, as per sketch.

In the attached table of costs no mention is made of the cost of laying the deck materials, as the soft pine riffles came with the tables from the factory. However, it has been my experience that the cost of laying the iron riffles has been about 20 per cent less than that of laying wooden riffles.

COST OF WOODEN AND IRON RIFFLES COMPARED

	Soft Pine Riffles		Iron Riffles
	Set No. 1	Set No. 2	Set No. 1
Hours run	655	558	997
Tons treated	5,496	4,708	10,564
Riffle costs per ton	$0.0069	$0.0080	$0.00306
Linoleum costs per ton	$0.0080	$0.0092	(a)$0.00541
Total costs per ton of deck materials. In the case of iron riffles this includes nails	$0.0149	$0.0172	$0.00847

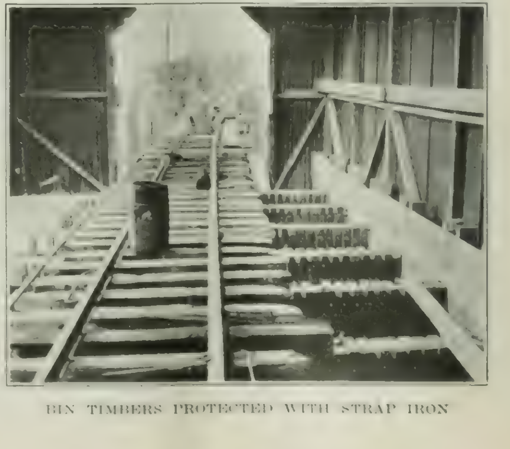
(a) Includes nails.

Comparing these figures, note that iron riffles cost less than half as much as pine riffles, and that the linoleum cost alone, when pine riffles are used, amounts to almost as much as the total cost when using iron riffles. New riffles made according to the accompanying sketch are justifying every hope and are highly satisfactory.

Protecting Mill Bin Timbers

Written for *Engineering and Mining Journal*

In certain types of wooden ore bins stringers are placed across the ore bin to support the unloading tracks. When run-of-mine size is dumped directly into



BIN TIMBERS PROTECTED WITH STRAP IRON

---

[1] Assistant superintendent, Replogle [illegible] Steel Co., [illegible]

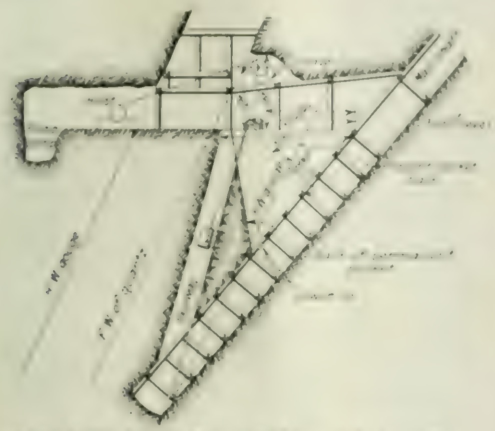
the bins these timbers are cut out rapidly. On the rock crusher bins at the mill of the Calaveras Copper Co., Copperopolis, Cal., protection of the timbers is secured by bending short lengths of strap iron and slipping them over the timbers and spiking them into place, as shown in the cut. Waste iron is used for this purpose. The iron straps are replaced from time to time as they wear out.

Sinking Rig for Inclined Shaft

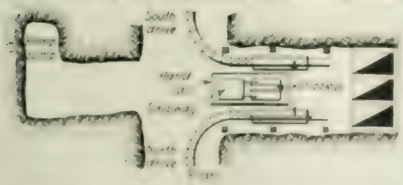
Written for Engineering and Mining Journal

When an operating shaft is being deepened handling of the broken rock on the station level from which sinking operations are conducted usually requires a disproportionate amount of work at the station. At the Plymouth mine, Plymouth, Cal., an interesting sinking arrangement has been devised. An auxiliary skipway was sunk from the floor of the 3,050 level to the shaft, intersecting the roof wall of the shaft ten sets below the station. The angle of the skipway, as shown in the cut, is greater than that of the shaft. The skipway is equipped with a single track and small skip, which discharges into the shaft pocket at the station.

At the point where the skipway cuts into the shaft a pair of hinged rails is so placed that it may be raised or lowered by the hoistman. By this arrangement the hoisting compartments of the shaft can be used whenever necessary to lower timbers or to hoist from the station below. All of the excavated rock from the shaft can be handled by one top man, who operates the auxiliary hoist, and at the same time the shaft station is left comparatively free from interference with its normal functions. The design was made by Stanley I. Arnot, superintendent of the mine.



Section Showing Location of Skipway With Reference to Vein [illegible]

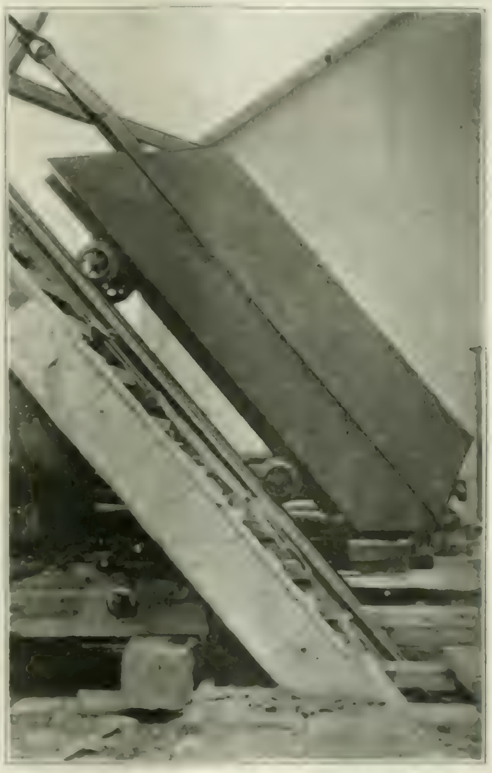


LAYOUT FOR DEEPENING SHAFT AT PLYMOUTH MINE

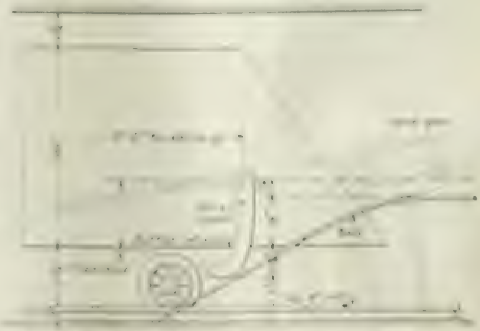
Fremont Mines Water Skip

Written for Engineering and Mining Journal

At the Fremont Mines, Amador City, Cal., an automatic water skip has been devised by Edwin Higgins and has given excellent service in the unwatering of the mine. It is not claimed that the design is entirely original. The bottom plates of the water skip are inclined to the axis of the skip. Two valves of the flap type are placed in the bottom of the skip. The lower valve is connected to a rod which is attached to a rocker arm and shaft used as a discharging device.



WATER SKIP USED AT FREMONT MINES



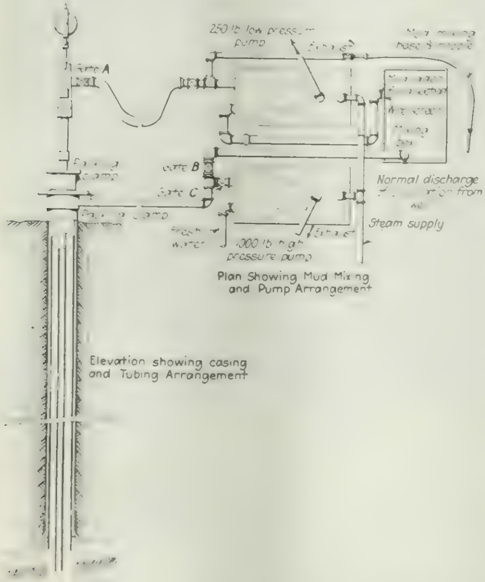
DETAIL OF DISCHARGING DEVICE ON WATER SKIP

THE PETROLEUM INDUSTRY

Introducing Mud-Laden Fluid Under High Pressures Into Porous Formations

By H. J. Steiny*

It is often desirable to introduce mud-laden fluid, under pressures up to 1,000 lb. per sq.in. at the surface, into sandy formations for the purpose of preventing intercommunication between the individual sands. The usual method of accomplishing this is to pump the mud fluid through tubing to bottom of hole, allowing same to return to surface after circulating past walls of hole; place packing head between tubing and water string at surface, and either pump mud fluid with a high pressure pump, or follow the mud fluid already in the tubing with clear water through the high pressure pump, thereby exerting the desired pressure on the walls of the hole.


250 lb low pressure pump
Gate A
Gate B
Gate C
Normal discharge
Steam supply
1000 lb high pressure pump
Plan Showing Mud Mixing and Pump Arrangement
Elevation showing casing and Tubing Arrangement

ARRANGEMENT FOR INTRODUCING MUD-LADEN FLUID UNDER HIGH PRESSURE INTO SANDS

The method in which the high-pressure pump handles the mud fluid is objectionable because the liners and packing are quickly worn out. The method in which clear water is pumped on top of the mud fluid is open to the objection that the water thins the mud and washes the walls of the hole clean, thereby defeating the purpose of the work.

C. L. Giboney, superintendent of the Associated Oil Co., in the Lost Hills field, Kern County, Cal., has devised a scheme shown in the accompanying sketch, to eliminate these two difficulties. Equipment consists of a 250 lb. per sq.in. low-pressure pump, a 1,000 lb. per sq.in. high-pressure pump, a mixing box to mix the mud fluid, and miscellaneous fittings.

Circulation takes place through the low-pressure pump drawing mud fluid from the supply in the lower side of the mixing box. It is pumped down the tubing, against the sands, returning inside of the water string into the upper side of the mixing box. Here it flows across fresh shale, clay or clean rotary mud, to increase its density, then through the screen where the fluid suitable only for penetration into the sands is allowed to pass, and is again drawn into the low-pressure pump from the lower side of the mixing box.

When it is desired to increase the pressure to force the mud into the sand, gates *A* at the tubing head and *B* at the discharge are closed, and gate *C* at the high-pressure pump is opened. The high-pressure pump is then started, drawing fresh water and pumping it back on to the column of mud fluid between the tubing and the casing. This will allow considerable clean water to be pumped in before it reaches the sands, and the pressure exerted will force the mud out into the porous formations.

When it is desired to re-establish circulation, gate *C* is closed and gates *A* and *B* are opened. The low-pressure pump is started, and the clean water is circulated out of the hole without coming in contact with the walls which were to be mudded.

As may be seen, no wearing action is exerted on the liners and packing of the high-pressure pump, and the mud fluid is not thinned, nor the walls of the hole washed with clear water, as the clear water is circulated out with the establishment of normal circulation.

The Prospective Output of Oil in Mexico*

According to statistics given to the press of Mexico City by the Mexican Secretary of Industry and Commerce, the production of petroleum from 1901 to 1920 was 563,523,752 bbl. of 42 gal. each. The quantity increased yearly from 10,345 bbl. in 1901 to 163,540,000 bbl. in 1920. It has been estimated that in January, 1921, the supply of oil in the Tampico-Tuxpam fields was 450,000,000 bbl. This would last two and one-half years at the rate of production in 1920. But the rate of production is increasing, being now about 180,000,000 bbl. a year. Old wells are giving out, but there is no compiled information showing how much the supply from old sources is diminishing. It appears, however, from the statements of men who are conversant with actual conditions and who represent important oil concerns, that there is no ground for anxiety about the future oil supply, though there is some difference of opinion on the subject.

The division of special taxes of the department of finance gave out figures, which were published June 16, 1921, in the *Financial and Mining Bulletin of Mexico*, showing that on Jan. 1, 1921, there were 359

---

*From an article appearing in *Summary of Operations, California Oil Fields*.

*Commerce Reports, July 11, 1921

petroleum wells in Mexico, with a daily production of 3,117,896 bbl. From Jan. 1 to May 1, there was registered an increase of forty-two wells, with a daily output of 828,728 bbl.

According to figures furnished by this department, the monthly production of petroleum from January to May, 1921, was as follows: January, 16,240,623 bbl.; February, 15,063,864 bbl.; March, 17,841,887 bbl.; April, 18,614,790; May (estimate) 19,000,000 bbl.

In the Amatlan district of the Tampico-Tuxpam fields three or four wells have been opened since Jan. 1, 1921, yielding an aggregate of 377,000 bbl. a day. The well-determined oil fields of Mexico extend along the Gulf of Mexico from a district north of Tampico to the Isthmus of Tehuantepec and Tabasco. The well-exploited portion is comparatively small. Even in the exploited portion new wells are continually being opened. Exploitation is now extending into the districts of Lacalulu and Cobus. The Lacalulu district is in an oil-bearing formation situated in the extreme southeastern corner of the State of San Luis Potosi, about fifty miles southwest of Tampico. A well was recently opened in this district, yielding from 40,000 to 60,000 bbl. of oil daily. The Cobus district begins at Cobus, directly across the Rio Gonzales from Tuxpam, and extends southwesterly about fifty miles. It is regarded by experts as a determined oil field and definite exploitation is progressing.

Exploration work is being carried on in all parts of Mexico, including Lower California. So far nothing definite has resulted, but there are sufficient prospects in the southern part of Oaxaca to have led to the investment of capital and the sinking of a well, which requires $100,000. Exploration is especially active on the Isthmus of Tehuantepec and in the region immediately south of Vera Cruz. The Tabasco district is the oldest oil field in Mexico, and the refinery at Minatitlan, near Puerto Mexico, is the largest in Mexico. Much oil is taken from the Tampico fields to this refinery, but little oil is now produced in the Tabasco district, and there are no definite prospects for the future.

Eastern Washington Oil Possibilities

SPECIAL CORRESPONDENCE

Interest in the possibility of discovering oil in commercial quantities in the vicinity of Spokane, Wash., has been aroused by a definite determination that a seepage of oil discovered in the cellar of a house in Spokane is not a fake seepage, but a genuine oil flow. As a result of investigations made recently, T. A. Bonser, a geologist and a professor of biology and geology at one of the Spokane high schools, informed a meeting of the Northwest Mining Association that he had revised his opinion in regard to the local possibility of oil discovery. He had previously held that oil did not exist in commercial quantities in the Spokane Valley.

Circumstances surrounding the discovery of the oil seepage are peculiar. It is estimated that about [illegible] gal. of the oil has been taken out of a small hole in the cellar of the residence of A. L'Ecuyer, at 1029 Southwest Boulevard, Spokane. The oil is yellowish in color, and is said to have fine medicinal qualities. For some time the people residing there were troubled with an unpleasant odor in the cellar, and made numerous efforts to get rid of it, but without success. Following a sharp earthquake shock early last spring, a liquid made its appearance in the cellar, which, upon analysis, proved to be oil. Most of the people who heard of the seepage were inclined to class it as a practical joke, but it has definitely been determined that a genuine oil seepage is there. A local company has been formed, and sufficient capital has been subscribed to make it appear likely that development can be undertaken on a scale ample enough to determine the actual possibilities.

Existence of oil in eastern Washington has been generally doubted because of basalt, which is plentifully in evidence. Some geologists, however, have been willing to admit the likelihood of oil, and, acting upon their recommendations, extensive plans have been made by a local concern for a thorough testing of an area at Clayton, just north of Spokane.

Status of Oil-Shale Industry in the United States

The following summary of conditions in the oil-shale industry appears in a paper, "Notes on the Oil-Shale Industry, With Particular Reference to the Rocky Mountain District," included in the U. S. Bureau of Mines *Reports of Investigations* for June 1921:

> There are no commercial oil-shale plants operating in this country at the present time (March, 1921), although there is a well-established industry in Scotland.
>
> Many American shale deposits are richer in recoverable oil than Scotch shales now being worked, and probably nearly equal in nitrogen content, which is a measure of recoverable ammonia.
>
> Market conditions for shale products are less favorable in this country than in Scotland.
>
> Great quantities of American shales are of greater thickness and better suited for mining than Scotch shales.
>
> As yet no process for obtaining oil from oil shale has been used in actual commercial practice in this country.
>
> Indications are that the United States cannot continue long to depend on domestic petroleum production to supply completely the demand for petroleum products, and that sooner or later our oil shales will have to be used to help supply the deficit.
>
> The shale-oil industry cannot hope to supplant the petroleum industry in a large way for many years, but will probably grow from local industries in favorable places.
>
> Costs of oil-shale operations cannot be reliably estimated until commercial practice in this country furnishes the necessary basic data.
>
> The quantity, quality, and value of products and by-products to be obtained from oil shale in this country are not known with any degree of certainty.
>
> The oil-shale industry is a large-scale, low-grade raw-materials manufacturing enterprise requiring large capital, high technical and business ability, and probably making a low return on the investment. Once economic conditions become favorable for the development of the oil-shale industry, and satisfactory mining, retorting and refining processes are worked out and markets established, there should be only ordinary business risks connected with the industry.

Corporation To Exploit Oil Properties in Venezuela, Colombia, and Equador

The Andes Corporation has been formed with an authorized capital of 2,000,000 shares of no par value to take over the prospective oil properties of the [illegible] and Exploration Co. and [illegible] & Co. The properties include about [illegible] acres in Venezuela, 2,100,000 in Colombia, and 6,500,000 in Ecuador.

Directors are J. A. Bell, [illegible], Rufus C. Dawes, J. W. [illegible], [illegible], H. E. [illegible], John W. Leonard, Robert [illegible], Fred C. [illegible], Pedro Mendes de Leon, [illegible], and John S. [illegible]

Technical Papers

Mackenzie River Oil—The May number of *Mining and Engineering Record* (25c., Vancouver, B. C.) is devoted entirely to the recently discovered petroleum area in the Mackenzie River basin. Sketch maps are included.

1920 Copper Production—An advance statement of copper production statistics for 1920 and preceding years (seven pages) is now obtainable from the Director of the U. S. Geological Survey, Washington, D. C.

Wyoming Mining Laws — Bulletin No. 18 of the Office of State Geologist, Cheyenne, Wyo., seventy-three pages, contains the state mining laws and the Federal mining laws applicable to Wyoming. It may be obtained on request.

Northern Ontario Gold—The July 15 issue of the *Canadian Mining Journal* (Gardenvale, Que., price, 15c.) contains several informative articles on past and present conditions in the Porcupine, Kirkland Lake, and other gold-producing districts of Ontario.

Mining in Mexico—In the *Mining and Scientific Press* of July 2 (San Francisco, Cal., price 15c.) is the first of a series of articles by R. G. Cleland entitled "The Mining Industry of Mexico: A Historical Sketch." The article is written in an attractive manner and is well illustrated.

Oil Shale—"Notes on the Oil Shale Industry, With Particular Reference to the Rocky Mountain District," by M. J. Gavin, H. H. Hill, and W. E. Perdew, is the title of U. S. Bureau of Mines *Reports of Investigations* No. 2,256. The paper includes a general discussion of the subject and a comprehensive list of references. It may be obtained on request.

Pulverized Coal—A paper presented before the American Iron and Steel Institute. "The Use of Powdered Fuel Under Steam Boilers," has been reprinted for free distribution by the Combustion Engineering Corporation, 43 Broad St., New York, N. Y. Many diagrams and illustrations of various equipment applied to different types of boilers supplement the text.

Drill Steel—The July 7 issue of *Iron Age* (New York, N. Y.; price 50c.) contains a paper, "The Breakage and Heat Treatment of Rock Drill Steel," by A. E. Perkins. This paper is one of several that were presented at the symposium on the breakage of drill steel that was held at the February meeting of the A. I. M. E. in New York. In the same issue appears also a paper on "Drill Steel Sharpening," by Clarence M. Haight.

Asbestos—Bulletin No. 113, Mineral Technology Series No. 24, of the University of Arizona, Tucson, Ariz., is a thirty-one-page pamphlet devoted to asbestos. Though issued primarily for the information of Arizona producers, the bulletin contains much of general interest regarding the occurrence and preparation of the mineral for the market. A list of Arizona producers and buyers in the East is included.

Activities of Bureau of Standards—Although having little to say about mining or metallurgy, most of our readers will be interested in a 300-page report of the war work of the U. S. Bureau of Standards, Washington, D. C., just issued and obtainable free from the bureau. The book gives a good idea of the varied activities of the bureau, but does not go into detail regarding any of the work done.

Management Engineering—A new journal of production under the title *Management Engineering* appears for the first time with the July issue. (The Ronald Press Co., New York, N. Y.; price 50c.) The principal articles include "The Pioneer Spirit in Engineering," as developed in the Federated American Engineering Societies; "The Essentials of Storeskeeping"; and "Training as a Factor in Reducing Labor Costs."

Oil—"Summary Report, 1920, Part B," issued by the Geological Survey, Canada Department of Mines, Ottawa. This pamphlet contains the following reports: "Mesozoic of Upper Peace River, B. C.," by F. H. McLearn; "Upper Elk River Valley, B. C.," by J. R. Marshall; "Review of Prospecting for Oil on the Great Plains," by D. B. Dowling; "Underlying Seams of the Souris Coal Field, Southeastern Saskatchewan," by D. B. Dowling; "Great Slave Lake Area," by G. S. Hume, and "Oil-bearing Rocks of Lower Mackenzie River Valley," by E. M. Kindle and T. A. Bosworth. Geological sections, maps, and illustrations are included.

European Iron-Ore Resources—Bulletin 706, "The Iron-Ore Resources of Europe," by Max Roesler, published by the U. S. Geological Survey, gives a summary of the facts concerning the deposits of iron ore in Europe and estimates of the quantities of ore and of the iron they contain. It reports no original research, but is simply the result of a study of the conclusions of many writers, and is an attempt to reduce the variant products of that work to common values. The geographic review of the deposits is preceded by a brief sketch of the nature and geology of iron-ore deposits in general and a few notes on the methods of utilizing the ores. The geologic distribution of the deposits is considered, and the more extensive deposits are described. The economic value of the iron ore in the several countries of Europe is shown by the statistics of production and consumption.

Book Reviews

Concentration by Flotation. Compiled and edited by T. A. Rickard. Cloth; 6x9; pp. 692, illustrated; 1921. John Wiley & Sons, New York. Price, $7.

The various chapters of Mr. Rickard's latest book on flotation are, with one or two exceptions, reprints of articles which have been published during the last few years in the *Mining and Scientific Press.* Many are now reprinted a second time, for they either appeared originally in foreign publications or were included in Mr. Rickard's former books, now out of print.

This is the largest volume yet published on flotation, and in many respects the most complete. It makes easily available much information which would otherwise be inconvenient of access—information particularly complete as to theory and fundamental principles so far as developed, the current status of litigation, and also well representative of the varied practice found in American and Australian concentrating plants. The various chapters are well arranged, and, needless to say, the matter is well edited.

A book compiled from various separate articles lacks, however, the cohesion of one which is written by a single author; it is bound to be discursive. The ideas of various contributors on a single subject must be given in different places, and an individual critical attitude on the subject matter is missing. Also, there are bound to be some gaps: certain subjects of interest to flotation engineers which come without the field of discussion covered by any of the authors in the articles selected. Little is told of much interesting work in foreign countries outside of Australia on oxidized and complex ores, but this is not the fault of Mr. Rickard or of the other authors; it is because of the secretiveness persisted in by the Minerals Separation interests, which seemingly adhere to certain well-known precepts for wife-training: "Catch 'em young," (and to non-licensees), "treat 'em rough," and "tell 'em nothing."

A book which we shall keep on our reference shelf within handy reach.

E. H. R.

Elementary Qualitative Analysis of the Metals and Acid Radicals. By Frederick C. Reeve. Cloth; 5⅛ x 8; pp. 143. D. Van Nostrand Co., New York. 1921. Price, $1.50.

As in most books on this subject, the author has arranged his material in the form most suitable for use as a high-school or college manual. The book will be useful for prospectors and others who wish to make qualitative tests for the metals, however, as the treatment is practical; detailed working directions are given for the tests; and little used methods are not mentioned.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Safety Regulations in 16 States Specify Use of Telephones in Mines

Sixteen states provide rules or enactments relating to telephones at mines, according to a paper recently issued by the U. S. Bureau of Mines in *Reports of Investigations*. The electrical section of the Bureau obtained copies of all available state safety rules and regulations for the purpose of making a study of the subject. An abstract of the compilation, taken from the various codes, follows:

In California the regulations state that telephone communication shall be maintained between a co-operative station and each mine which it supplies. If the foreman in charge of a station does not reside thereat, his residence also shall be in telephone communication with each mine supplied by his station. In all mines operated and worked in California, when a depth of more than five hundred feet underground has been reached, a telephone system must be established, equipped and maintained by the owners or lessees thereof with stations at each working level below the depth aforesaid, communicating with a station thereof on the surface of any such mine.

The regulations in Colorado state that the mine owner shall provide and maintain an adequate telephone system from the surface, with convenient stations along and at the bottom of the shaft, slope or drift, and convenient to all double partings where trips are made up; provided that more than twelve telephones shall not necessarily be installed in any one mine.

In Illinois the rules were obviously drawn up to cover the coal mining districts, for they read as follows: There shall be a system of party-line telephones which shall include one telephone on the surface not more than two hundred feet from the tipple, and one at the bottom of the hoisting shaft, or, in slope or drift mines at [illegible] and, in addition thereto, there shall be one telephone at each inside parting.

In all Iowa mines, where the working parts exceed 3,000 ft. from the foot of the slope, shaft or the mouth of a drift, a substantial telephone system or other suitable means of communication shall be maintained from the bottom to the surface.

In Kansas it is unlawful to operate or permit to be operated any coal mine not equipped with a party-line telephone system. In Kentucky and North Dakota regulations also refer to coal mines and state that in any coal mine, where more than fifty men are employed underground, one or more telephones shall be installed communicating with the surface.

New Mexico regulations state that it shall be the duty of the operator to install and maintain a telephone system in every coal mine to such extent as may be reasonably required for the operation thereof. With slight modifications, the rules governing Oklahoma and Pennsylvania coal mines with respect to telephones are the same as those of New Mexico.

Tennessee and Texas regulations specify that a metal tube or a telephone system shall be maintained from the top of the shaft to the bottom.

Utah requires that an underground telephone system be installed in all mines in which ten or more men are working more than two thousand feet from the entrance, or in which there are ten or more working places more than two thousand feet from the entrance.

The operator or the superintendent of a mine in Washington must provide, and maintain in good condition, from the top to the bottom of every shaft or slope, a telephone or metal tube.

Wyoming regulations specify that a system of party-line telephones shall be installed and kept in working condition in each coal mine in operation in the state.

Co-operative Surveys Under Way in Idaho

The following geological work is being done in Idaho, during the field season of 1921, by the Idaho State Bureau of Mines and Geology, in co-operation with the U. S. Geological Survey:

Project No. 1—The completion of the study of the ore deposits of the Heath district, in Adams County, the topography and general geology of which were covered by a party under Prof. D. C. Livingston last summer. This work [illegible] Dr. F. B. Laney, head of the department of geology at the University of Idaho, [illegible] the deposits in the neighborhood of Council, also in Adams County. [illegible] "The Copper Deposits of the Seven Devils and Adjacent Districts." Dr. Laney's assistant on this trip is A. M. Piper. Mr. Piper will undertake to secure some important photographs of the mountain scenery of Adams County that will be used in the publicity campaign for the State of Idaho, which the State Bureau of Immigration has in charge.

Project No. 2—A geological survey of the area adjacent to the south half of Pend d'Oreille Lake, including the mining districts of Lakeview, Blacktail, Granite Creek, and other areas. This work will be in charge of Mr. Sampson, of the U. S. Geological Survey, and will be under the general supervision of Dr. Laney, acting on behalf of the survey.

Project No. 3—A reconnaissance of the ore deposits of the Sawtooth area, in Blaine County. This is designed to supplement the work already done by Dr. Umpleby in that area for the U. S. Geological Survey, and the work will be done by S. M. Ballard, of Placerville. Mr. Ballard will also probably do some work in the Boise basin for the bureau during the summer.

Project No. 4—A survey of the artesian water resources of the Snake River Valley and tributary valleys. This work is in charge of O. E. Meinzer, of the U. S. Geological Survey, who will be assisted by Harold T. Stearns. This survey will include the areas of Mud Lake, Big, Little and Lost Rivers, the Pahsimeroi Valley, part of the Wood River Valley, and will conclude with an investigation of the Goose Creek artesian basin in the neighborhood of Oakley, which will be covered by A. M. Piper later in the field season.

Project No. 5—A further study of the stratigraphy in the neighborhood of Boise and Weiser, supplementing the study begun last year of the oil and gas resources of this region by Dr. J. P. Buwalda. Dr. Buwalda's work will probably be done entirely under the supervision of the U. S. Geological Survey without assistance from the state bureau.

Project No. 6—[illegible]

Project No. 7—[illegible]

U. S. Geological Survey. This covers both sides of the Snake River, and the work is being carried on under a triparti agreement between the U. S. Geological Survey and the State Bureaus of Mines and Geology of Oregon and Idaho.

Mining and Metallurgical Society Expresses Appreciation to Mr. Sharpless

At a meeting of the council of the Mining and Metallurgical Society of America, held on July 20, 1921, it was resolved that the resignation of Mr. Frederick F. Sharpless as secretary of the society be accepted with regret, and that the council desires to express to Mr. Sharpless its high appreciation of his three years of efficient and enthusiastic service in advancing the work and aims of the society; and it was further resolved that the good wishes of the council be extended to Mr. Sharpless in his new position, where his broad experience and rare judgment will be available in advancing the good of the profession, and that a copy of the resolutions be engrossed and sent to Mr. Sharpless.

MEN YOU SHOULD KNOW ABOUT

J. F. Callbreath, secretary of the American Mining Congress, is in New York.

A. W. Newberry, of New York, will be in Pennsylvania for a few weeks on examination work.

A. H. Burroughs, Jr., managing director of the Armstead mines, Talache, Idaho, was recently in Salt Lake City.

A. W. Newberry has been employed by **Weld & Liddell** to make an examination of a mineral property in Montana.

R. C. Gemmel, general manager, and **R. G. Lucas**, attorney, for the Utah Copper Co., were recently in Salt Lake City.

J. S. Delury, of the University of Manitoba, Winnipeg, recently made an examination of the Bingo mine, at Herb Lake, Man.

M. H. Newman, geologist for the American Zinc, Lead & Smelting Co., has returned to Knoxville, Tenn., from a trip to Montana.

Oscar B. Hofstrand, metallurgical engineer, of Salt Lake City, has completed an investigation of the Tintic Milling Co. plant at Silver City, Utah.

J. T. Terry, Jr., mining engineer, is president and manager of the Terry Mining and Metallurgical Corporation, with offices at 200 E. Sixth St., Leadville, Col.

G. C. MacKenzie, of Montreal, secretary of the Canadian Institute of Mining and Metallurgy, visited The Pas, Man., recently to meet resident members of the institute.

W. H. Grant, geologist on the staff of the Metals Exploration Co., has recently returned to San Francisco from a three months' trip to Sombrerete and Zacatecas, Mexico.

John D. Ryan has left New York for a vacation trip through the Michigan copper country, after which he will inspect the properties of the Anaconda Cooper Co. in Montana. Mr. Ryan will return about Sept. 15.

Olaf P. Jenkins is in charge of the field work of the Washington Geological Survey and is investigating certain road materials, the Grand Coulee as a reservoir site, and the iron ores of Washington in relation to the possible manufacture of iron and steel.

B. B. GOTTSBERGER

B. Britton Gottsberger, recently elected secretary of the Mining and Metallurgical Society of America to succeed Frederick F. Sharpless, who is now secretary of the A. I. M. E., is particularly well fitted for his new post.

Mr. Gottsberger is a graduate of the Columbia University School of Mines, class of 1895, with the degree of engineer of mines. His first engagement after graduation was with the Montserrat Consolidated Mining Co., Yuscaran, Honduras, where he was assayer and where he remained one year. After a brief visit to the States, he went to Mexico in 1897 in the employ of the El Oro Mining & Railway Co. as engineer for the company, and performed various tasks connected with operations. From Mexico, in 1900, Mr. Gottsberger went to Tennessse as an engineer for the Tennessee Copper Co., which was just then beginning operations under the direction of J. Parke Channing. His experience in the manifold details of construction, mining, and smelting and other problems was exceptionally varied and valuable. He was a handy man on practically every job, and became assistant to the general manager, and finally, in 1906, manager of the entire operations of the Tennessee Copper Co. In 1909 he left Tennessee for Miami, Ariz., where another copper property was being developed by the same interests. He took charge in the early stages of the work, and for ten years was general manager of the Miami Copper Co., now grown to a large and influential copper producer. Mr. Gottsberger has thus had the distinction of being associated with the development of two of the county's successful copper mines from the very beginning of operations. Since 1919 he has been engaged in consulting practice, with headquarters in New York City at 522 Fifth Ave., and has made his home in New York. Mr. Gottsberger was born in Brooklyn, N. Y., in 1874.

Dr. R. B. Moore, chief chemist of the U. S. Bureau of Mines, will leave Washington Aug. 2 for a month's trip, during which time he will look over the chemical phases of the work being done at Bureau of Mines experiment stations at Pittsburgh, Columbus, St. Louis, Denver, Salt Lake City, Reno, and San Francisco.

Mining engineers recently in New York City included: **H. H. Stoek**, Urbana, Ill.; **A. L. Pierce**, Golden, Col., and **C. T. Griswold**, of Oklahoma City, Okla.

OBITUARY

Nephi Packard, of Springville, Utah, died on July 15 at the age of eighty-nine. He was closely identified with mining in Utah in the early days.

B. C. Catern, of Denver, Col., owner of the Smugler, Dunderberg, and Terrible mines, near Georgetown, died on July 14, following a stroke of apoplexy.

Word has been received of the death of **A. L. Waters** at Chun Ping, China, on May 29. He was associated with Charles E. Richardson and was well known in Arizona and Mexico.

Warren B. Shackelford, of Joplin, Mo., died recently at Chicago, following an operation at St. Luke's Hospital. Mr. Shackelford was active in the Joplin district for a number of years, and at the time of his death was general manager for the Admiralty Zinc Co., the Queen Astor Mining Co., and the Sinden Zinc Co.

S. M. Buck, consulting engineer, died at his home in Bromwell, W. Va., on July 16, at the age of seventy-nine. Mr. Buck was a graduate of Williams College, and later studied mining engineering at the Massachusetts Institute of Technology and at the Freiberg School of Mines. He was one of the pioneers in the development of the coal fields of West Virginia.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

Warrant Out for Swindler Rice Not Served

Investment Bankers' Association Protests Against Advertisement of Fake Mining Stocks

Although warrants have been issued in California for the arrest of George Graham Rice and others, it appears that the technicalities of the law are too much for its representatives and the warrants have not been served. In the meantime the California Group of the Investment Bankers' Association of America have recently passed the following resolutions in condemnation of advertisements of wildcat stocks appearing in certain local newspapers:

"Whereas, a large number of [illegible] mining stock advertisements, which are in all instances highly speculative and in many instances obviously fraudulent, have been appearing in the San Francisco and Los Angeles papers, and

"Whereas, these advertisements will doubtless result in substantial losses by ignorant people, to whom advertisements of this kind are most apt to appeal, and

"Whereas, it is not in the best interests of the daily papers, other advertisers, the investing public in general, or for that matter, the State itself, to permit the advertisement and sale of issues of this character. Now therefore be it

"Resolved, that the executive committee of the California Group of the Investment Bankers' Association of America, hereby enter protest to the Commissioner of Corporations of the State of California, against the advertising and sale of such issues, and be it further

"Resolved, that the co-operation of the Associated Advertising Clubs of the World be requested and a copy of this resolution be forwarded both to their local and Eastern offices, and that a copy of this resolution be forwarded to publishers of newspapers in San Francisco and Los Angeles, with a request that the character and [illegible] of their advertisers be carefully [illegible] and that they refuse the advertising of any stock issue which has not received a permit and the approval of the Commissioner of Corporations of the State of California."

Bolivian Tin Property Purchased

[illegible] W. [illegible] reports from La Paz, Bolivia, under date of May [illegible], that an American concern has recently purchased tin lands in Bolivia valued at about [illegible]. He states that the output of this property is not large

WEEKLY RÉSUMÉ

[illegible] *Ladd,* [illegible]

As to industrial conditions, the [illegible] *returned, after reaching an agreement* [illegible]*. In the Michigan iron country, the Oliver* [illegible] *erty of the Michigan Iron & Land Co. to Henry Ford, call Archibald's charges baseless. A so-called "sub-*[illegible] *underground loading and transporting ore* [illegible]

In Arizona, an engineers' registra-[illegible] *Edinburgh, Scotland, the Arizona* [illegible] *nounced that it is negotiating for the* [illegible] *Phelps Dodge Corporation in return for a stock interest. The property of the Silver King of Arizona has been sold* [illegible]*. In California, warrants issued for the arrest of George Graham Rice and* [illegible] *unserved. The plan for marketing* [illegible]

Ely and Pioche May Be United By Railroad

[illegible] between Ely and Pioche [illegible] renewed, [illegible]

New Underground Loading Machine To Be Tried at Ishpeming

So-Called "Sub-Level Slicer" Loads and Transports Ore in Single Operation—Trial Machine Being Made

John D. McCarthy and Henry O. Moulton, engineers in the employ of the Cleveland-Cliffs Iron Co., have made application for United States patent on a sub-level slicing machine, to be known as the McCarthy-Moulton sub-level slicer. The machine has for its purpose the rapid and economical loading and transportation of ore in a single operation, and can be taken into any working place underground. It is small and can easily be carried into a sub-level by two men. The loading at the breast is automatically done by a special type of shovel-skip, which is forced into the ore with a forward and upward motion, and the transportation to the raise is performed by means of an overhead electrically operated trolley upon which the loaded shovel-skip is carried direct to the required point, where it automatically dumps.

Shoveling and tramming by hand are both eliminated. The power unit remains fixed at or near the dumping point, and three cables controlled by the operator serve at the breast to load and then to hoist and transport the load to the dumping point. A simple turntable device is installed to reverse the slicer rapidly for work at another breast. The forward and upward movement which is given the shovel-skip during the loading operation has a special advantage, it is claimed, in that it prevents the stalling of the skip in rough dirt or upon encountering a [illegible] with the overhead [illegible]

[illegible]

for electric power, but where this is inconvenient or inadvisable, compressed air may be used. Although particularly useful in sub-levels and remote working places, the device, it is said, will be equally economical in handling ore in the main level. In such a case the dumping trip can be moved along on the overhead track from car to car until an entire train has been successively loaded without shifting a car. A thorough practical demonstration of the device is to be made at once in one of the mines of the Cleveland-Cliffs Iron Co. Work is now going forward on the trial machine.

Archibald's Claims Ridiculous, Say Defendants

Information Given About Michigan Iron & Land Co. Was Its Property and Was Included in Purchase

Parties to the suit brought by Ralph S. Archibald, of Negaunee, Mich., to recover $75,000 for services alleged to have been rendered in connection with the sale of the Michigan Land & Iron Co.'s holdings in Northern Michigan to the Ford interests deny the validity of Mr. Archibald's claim. His claims are called ridiculous by Robert P. Hudson, one of the defendants, who will have charge of the defense. It is understood that Mr. Hudson will claim at the trial that any information which was given the defendants by Mr. Archibald was the property of the old Michigan Land & Iron Co. and was a part of the sale. Mr. Archibald, it is understood, was in the employ of the latter company before the local men became interested. Such maps as he made and information as he secured was, it is alleged, while he was taking pay from the old company for his services. Thus his work was the property of the old company and was included in the purchase price.

Insinger vs. Cunningham Case Decided

Plaintiff Recovers Amount Spent on Development, But Loses Other Points

Judgment has been handed down in Insinger vs. Cunningham case, in which the plaintiff is a banker of Spokane, Wash., and the defendant a mining operator of Slocan district, British Columbia. The dispute arose over the alleged non fulfillment by Cunningham of certain contractural obligations entered into by him when he took over, under option, the Hewitt mine, at Silverton, B. C. Robert Insinger has been successful in recovering a sum equal to the value of the development work which Mr. Cunningham apparently agreed to do, but did not complete, while he was working on the property in 1918 and 1919. On all other counts, however, the defendant succeeds. He is not required to make an option payment that Insinger claimed was due nor is Insinger allowed damages on account of being prevented from operating the property.

Arkansas To Be Surveyed For Fertilizer Materials

Work To Be Undertaken Soon by State Commissioner of Mines—Farmers' Demand Increasing

The first real effort to determine the quantity and value of raw fertilizer materials in Arkansas is being made at this time by Jim G. Ferguson, Commissioner of Mines, Manufacturers and Agriculture, by a careful survey of the phosphate and limestone beds of the state. Prof. N. F. Drake, geologist, formerly professor of geology at the Universitly of Arkansas, assisted by Chester S. Parker, is in charge of the field work. The survey will extend east and west across the north part of the state, following the older rock beds with which are the phosphate and limestone beds having value as fertilizer.

Prof. Drake started the survey early in July in Independence County, and will work east and west from that place. The heaviest part of the work will lie west from Independence County to the Oklahoma line. In a recent interview Prof. Drake stated that there was no question about the quality and abundance of the limestone deposits, but that the real value of the phosphate deposits was undetermined. Independence County is the only county in Arkansas that has produced phosphate in a commercial way, and that over a decade ago. The Arkansas Fertilizer Co., now of Little Rock, formerly operated a fertilizer plant in this county on Lafferty Creek, near Penters Bluff, and mined from the local beds all the phosphate it used in the manufacture of its various fertilizers. Their plant was destroyed by fire, and owing to better railroad facilities and labor conditions it was rebuilt in Little Rock.

The phosphate values in Independence County are disseminated in the Sylamore sand and its associate shales. This formation is of the Devonian age, and lies between the Boone chert and the St. Clair limestone. The latter is the formation in which manganese occurs in the Batesville field.

The strata carrying the phosphate vary from a few inches to 20 ft. in thickness, and lie in horizontal beds, careful analysis of which has shown from 20 to 70 per cent calcium phosphate. Up to the present only those strata carrying the higher percentages have been utilized. They have been ground up in their entirety, the phosphate content being high enough to permit this. None of the lower grades have been used. It is possible, however, to grind the latter and separate the phosphate from the lighter gangue. At present such treatment of the lower grades would not be profitable.

Phosphate mining in Independence County has been carried on by pit, open-cut and tunnel methods. Tunnels and open cuts were used where the deposits were worked on a mountain side. Open pits were used on the plateaus and ridges where erosion had cut away the overburden down to, or nearly to, the phosphate-bearing strata.

Measurement Certified in Race for Shaft-Sinking Record

As announced in the last issue, the Walter Fitch, Jr., Co. has set out to break the world's record for shaft sinking, the company having contracted to deepen the Water Lily shaft of the Chief Consolidated Mining Co., at Eureka, Utah. With the winning of the gold medal offered by the *Engineering and Mining Journal* as its goal, the company has forwarded to the *Journal* the following letter certifying to the measurement from collar to the bottom of the shaft just before the work was started:

"This is to certify that we, the undersigned, at 8 a.m. on the 15th day of July, 1921, measured the depth of the Chief Consolidated Mining Co.'s Shaft No. 3, known as the Water Lily shaft, and found it to be 115.5 ft. from the collar to bottom of the shaft. The bottom at the time of measurement was free from base or broken ground, and apparently level. Signed

H. J. PITTS,
Engineer Chief Consolidated Mining Co.
J. D. MATHEWSON,
General Foreman, Walter Fitch Jr. Co.
HENRY W. JARVIS,
Shaft Foreman, Walter Fitch, Jr. Co.

Sworn and subscribed to before me this date, July 18, 1921.

C. E. HINCH,
Notary Public, Eureka, Utah.

Silver King of Arizona Sold to W. F. Ainsworth

The sale, under foreclosure of mortgage, of the property of the Silver King of Arizona Mining Co. to W. F. Ainsworth, of New York, for the consideration of $250,000 was confirmed on July 19. Of the purchase price, $20,000 was to be paid in cash, the balance being payable either in cash or by the ten year 7 per cent convertible bonds and overdue coupons thereof of the company, at such proportion of the value as the holder would be entitled to receive through the distribution of the proceeds of such sale in case the purchase price were fully paid in cash. The sale was made to satisfy judgments against the company amounting to about $240,000. The new owners are considering plans to organize a corporation with a view to resuming the development and operation of the property. The plan involves the completion of the new three-compartment shaft to the 1,000-ft. level, lateral cross cutting and drifting on the 800- and 1,000-ft., and the installation of such mining and milling equipment as the result of underground development may justify.

Engineer Registration Board Organized in Arizona

Organization of the new board of registration for engineers, architects, surveyors and assayers in Arizona has been effected at Phoenix. Dean G. M. Butler, of the Arizona University Schools of Mines, is chairman.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Tariff Bill Passes House With Few Changes

Petroleum Again on Free List—Duty on Quicksilver Raised to 35c. Per Lb.—Potash Proposal Denounced—Protection for Bauxite Criticised

The Fordney Tariff Bill passed the House on July 21 with comparatively few changes as reported out by the Committee on Ways and Means. The committee was overruled, however, on the important petroleum, asphalt, and dye duties. After extended debate, characterized by great bitterness, crude petroleum, fuel oil, and asphalt were placed on the free list. The Longworth proposal that the United States Tariff Commission administer the importation of dyes under an embargo proposal was lost.

Probabilities point to greater changes by the Senate in this tariff bill than has been the case before with other tariff bills. Chairman Fordney has the reputation of being that type of protectionist who believes the sky only should limit the upward revision of the rates. The bill reflects Mr. Fordney's ideas. There is much difference of opinion among Republicans as to the wisdom of enacting schedules as high as are those proposed. In many instances the ad valorem rates are less than those provided in the Payne-Aldrich Act in 1909. It is claimed, however, that the substitution of American valuation for foreign valuation will have the effect of increasing these ad valorem rates materially. If the Senate agrees to the new plan of American valuation, it is anticipated that there will be a material reduction in the ad valorem rates. The Senate also is expected to reduce materially many of the specific rates.

One of the important amendments made in the House was the increase of the duty on quicksilver from 7c. per lb. to 35c. per lb. This amendment was agreed to without the necessity of a division, largely because the Secretary of War formally called the attention of the House to the need for such action in the interest of the national defense.

The House also struck out one of the [illegible] and matter from the [illegible]

[illegible] These definitions are necessary, as heretofore spiegeleisen and ferromanganese have carried the same rate of duty. In the Fordney bill, spiegeleisen is dutiable at $1.25 per ton, whereas ferromanganese is dutiable at 2½c. per lb. on the managanese content.

The duty of 1c. per lb. on 30-per cent manganese ore and that on ferromanganese and spiegeleisen were criticised by Representative Wingo, of Arkansas, who said the domestic deposits of manganese could not be developed by such a schedule. He said the schedule was not well balanced. Representative Burton, of Ohio, opposed the duties proposed for mineral raw materials. Among other things, he said:

"It would be better to pay a bounty to some of those who have invested in the development of these (tungsten) ores than it would be to impose this duty, which is approximately, as stated to me by a prominent toolmaker, 300 per cent. I noted the claim made that we have a special supply of some metals. Antimony was one thing discussed here, and manganese was another, and the general result has been that the promise of a domestic supply has been entirely disappointing. I have it from a toolmaker that the quality of the tungsten obtained in this country is not best for the making of tools. The statement made to me was that the tungsten of Colorado is not suitable for the best quality of high-speed tools. If that statement is correct, the result of this duty will be to increase the cost to the consumer of a necessary kind of raw material and at the same time confer no benefit on the domestic producer."

No effort was made to answer the argument against the fitness of domestic tungsten for use in the manufacture of tool steel, but Representative Timberlake, of Colorado, did point out that the cost to the consumer would amount to no more than 3c. per ton of steel. "A tool hardened by tungsten," said Mr. Timberlake, "will perform the work of twenty carbon-hardened tools, so that the cost to the consumer is so small as to be [illegible]."

[illegible] ule, admitted that the rate on tungsten [illegible] said it is one of the highest duties, if [illegible] the Payne-Aldrich Act [illegible]

The increase in the duty on ferromanganese [illegible] the United States Steel Corporation, the principal manufacturer of ferromanganese, as well as other manufacturers, opposed this duty. Mr. Tilson stated that the duty is merely a compensatory duty on the manganese content and was put in the bill at the insistence of the mining interests. This led Representative Wingo to say:

"In putting on this rate of duty they have heeded the demands of the miners throughout the country, who hope to develop their manganese ore, and who have asked for a tariff on manganese. The gentlemen of the Ways and Means Committee in framing their tariff undertook to put a compensatory duty on everything in which manganese was used. I think that is natural from their standpoint.

"In other words, gentlemen, you are so wedded to your own processes that notwithstanding every producer in this country that is in a different attitude or position from the Steel Trust has protested against it because it would give a special benefit to the Steel Trust, and notwithstanding the fact that the Steel Trust itself protested that they did not need it, yet you gentlemen on the committee, in order, as you say, to do something for the miners of manganese, impose this other burden, which is unnecessary, and which will have a very dangerous effect on the independents, the smaller steel manufacturers now competing with the Steel Trust.

"As I recall from the testimony that we had before the Committee on Mines and Mining, possibly the United States Steel Corporation is in a better attitude upon ferromanganese than anybody else. The United States Steel Corporation also owns, as I now recall, the great bulk of the manganese deposits of Brazil. I do not know what their importations are now, but before [illegible] of that product came from Brazil, from the deposits which they own. They are [illegible] Steel Trust [illegible] justify."

[illegible] country to develop a [illegible] outputs or that a byproduct potash industry may be built up.

Largely on the recommendation of General Fries, the head of the Chemical Warfare Service, phosphorus was held on the dutiable list. The rate of duty, however, was reduced from 15c. per lb. to 10c. per lb.

The committee was challenged to explain why it had put a duty of $1 a ton on crude bauxite. It was alleged that the Aluminum Company of America would be the principal beneficiary. Mr. Fordney explained that the object of the duty is to promote the development of the almost unlimited supply of bauxite in the United States. In opposition to the duty, it was said that the duty which would be collected would not go into the Treasury, because the imports are brought in almost entirely by the Aluminum Co. of America, which in turn exports the material to its subsidiary companies in Canada, and the duty is returned to the company under the drawback clause. The Tariff Commission was cited as the authority for the statement that the Aluminum Co. of America owns 90 per cent of the known bauxite deposits in this country. The duty was characterized as "absolutely indefensible."

The House voted to add a paragraph to the bill making crude silica dutiable at $4 a ton and silica suitable for use as a pigment $7.50 a ton.

Platinum sheets and wire and platinum ingots, bars and plates, less than one-eighth of an inch in thickness, were removed from the free list.

Two New Motion Pictures Ready at Bureau of Mines

Two educational motion pictures illustrative of the mineral industry have recently been completed, the United States Bureau of Mines announces. The first of these, the "Story of Abrasives," shows the generation of power at Niagara Falls, its utilization for the production of carborundum (silicide of carbon), and aloxite (aluminum sesquioxide), and finally the numerous operations performed with the aid of the abrasives thus manufactured.

The "Story of Rock Drilling" shows the use of modern types of rock drill, not only for shaft-sinking and underground operations, but also for quarrying and the cutting of the new hydro-electric power canal to connect Lake Erie with Lake Ontario. Requests for the loan of these films for showing at public gatherings where no admission fee is charged should be addressed to the Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.

Committee on Mines Rests

Owing to the fact that a quorum could not be assembled, there was no meeting of the Committee on Mines and Mining of the House of Representatives during the week ended July 23. For that reason no action was taken on the proposed amendments to the War Minerals Relief Act. An effort will be made to present those amendments to the committee during the coming week.

Metric System Bill Introduced

A bill providing for the compulsory use of the metric system, after a period of ten years, was introduced in the Senate on July 18 by Senator Ladd, of North Dakota. The bill is identical with that introduced in the House on April 11 by Representative Britten, of Illinois. An early hearing has been asked.

NEWS BY MINING DISTRICTS

London Letter

Rand Mining Returns Continue Depressing — Randfontein Central Improves—Katanga's Report Out

By W. A. Doman

London, July 11—The mining returns from the Rand for the last month are by no means of an exhilarating character. For many months the controllers of the industry have emphasized the fact that if the gold could not be sold at a premium, several of the mines would be compelled to cease operations.

When a group of companies announces its results simultaneously, the effect is more vividly shown than when the output of an individual mines is given. For instance, the Rand Mines-Central Mining group of companies, consisting of fifteen, makes a very poor exhibit for June. These companies milled an aggregate of 852,468 tons of ore, for a total yield of 292,193 fine ounces of gold, of an estimated value of £1,552,937 and for an estimated value of £422,545. In arriving at the value and profit, gold is taken at £5/6/3 per fine ounce. Companies belonging to other groups take as high as £5/7/6. If a round figure of five guineas be taken, this will show, say, a premium of £1 per fine ounce of gold, and on this basis no fewer than ten of the companies would have worked at a loss apart from the premium.

The case of the Crown Mines is perhaps the most striking, for with a yield of 54,337 oz., on which at least £1 per oz. is estimated to be secured on realization, the profit is stated as only £54,952. At the annual meeting held in May, Samuel Evans pointed out the seriousness of the position. The working revenue remains fairly steady, but the working expense has increased seriously. During the first four months of 1920 the latter averaged 22/9d. per ton milled, and for the corresponding period of the current year, the working expense was 25/9d., so that the total working profit in the latest period was only £150,140, in comparison with £279,331. To some extent the comparison is vitiated owing to the strike of miners in February last, which continued for eight days. The position can perhaps better be shown by stating that, whereas in 1914 the yield was 6.191 dwt., and the working costs 15/7d. per ton, the yield last year was 6.103 dwt. and the working costs 23/9d. Expenses have risen in every direction, for whereas development in 1913 cost 60/3d. per ft., it was 112/2d. per ft. last year. If from the total estimated profit of the Rand mines group of £422,545 a premium of £1 per oz. on 292,193 oz. be deducted, the profit on the milling of 852,468 tons would have been only £130,352 last month—a poor result on the tremendous capital involved, especially as the above is not a net figure.

The Randfontein Central showed a remarkable improvement; not only was there a gain in revenue, but the working expenses also decreased.

The accounts of the Union Minière du Haut Katanga for 1920, just to hand from Brussels, show a gross working profit of fr. 9,864,386, the whole of which is devoted to depreciation. Prospecting work was almost wholly confined to the southeastern portion of the concession, and the ore reserves were estimated as given in the following table:

ORE RESERVES IN 1920 OF UNION MINIERE DU HAUT KATANGA

	Tons	Per Cent Copper	Total Copper Contents Tons
Smelting ore	700,000	16.50	115,500
Ore for concentration	7,100,000	8.00	568,000
Ore for leaching	17,700,000	5.80	1,030,000
Sulphide ores	6,800,000	2.30	156,000
Total	32,300,000	..	1,869,500

The above figures concern ten mines, namely, Star of the Congo, Luiswishi, Luushia, Likasi, Chituru, Kambove, Kambove West, M'Sesa, Kakanda, and Funguruma.

The copper output for 1920 was 18,962 tons, about 4,000 tons less than in 1919, owing to the strike of employees lasting about six weeks. Fuel was also short, owing to a railway strike. Trials of the concentrator have proved satisfactory, and the experimental plant for treating low-grade ore by electrolytic leaching will be running before the end of the year. New capital will have to be raised in due course for the vast construction program that has been arranged by the company for the treatment of low-grade ores.

AUSTRALIA

Queensland

Sapphire-Marketing Scheme Fails — Mount Quamby Gold To Erect Small Stamp Battery

Brisbane, June 26—The arrangement made by the Queensland government about three months ago for the marketing of gems from the Anakie sapphire fields, in central Queensland, appears to have broken down. The plan was for the firm of Rubin Bros., of Paris, who were given a monopoly of all the buying on the field except as to fancy stones, to advance to the sellers 75 per cent of the ruling market value of the gems, sell them within a given period, and then pay the miners the balance less commission and other charges. Recently the firm named advised the government that, owing to a depression in the trade in Europe, it could not advance more than £2/15/0 per carat for fine blues, £2 for second, and 7/— for small stones. The miners considered this price too low, the Minister for Mines agreed with them, and the agreement has been suspended if not entirely brought to an end. On the field many miners have taken exception to the arrangement made with Rubin Bros., believing that they could do better with their gems when there is open competition than when one firm has a monopoly of the buying. At the same time they were not satisfied with the prices obtained when there was open competition.

Work has been resumed at the Baralaba state coal mine, the men having agreed to accept a hewing rate, as insisted upon by the Minister for Mines, instead of the daily wage paid hitherto. The Industrial Court has to decide what this hewing rate is to be. If it should be much higher than that ruling at the Blair Athol coal field, with which the Baralaba mine is in direct competition, the government will still find it hard to make the mine pay.

Mount Morgan, where nothing has been done since last Easter, still remains closed down. The proposal vaguely mentioned by the State Premier three weeks ago as likely to lead to a settlement has apparently been considered further, but nothing definite is known about it. Meanwhile the company's executive and technical staff has been notified of the termination of their present engagements at the end of June, with the option of remaining in their respective positions during July at a reduction in salaries of 20 per cent.

Development and prospecting work is still in progress at the Mount Quamby gold mine in the Cloncurry district. It is intended to erect a 20-stamp battery at this holding to deal with the conglomerate in which the gold is found.

Apart from this and the cobalt mine, there is still nothing except a little development work and some fossicking by "gougers" being carried out in the way of mining in the big Cloncurry copper district. The Hampden company, which used to employ 850 men receiving £18,000 a month in wages and pay £9,000 a month to the men producing copper ore on their own account, is doing practically nothing; the Mount Cuthbert center looks like a deserted village, and the same has to be said of Selwyn, the headquarters of the Mount Elliott company. There is no chance of any improvement until a substantial rise takes place in the price of copper.

Tasmania

Electrolytic Zinc Co. Fast Completing 100-Ton Plant — Tries Experimental Plant on Sulphide Ores

Risdon, June 27—Construction work on the 100-ton (per day) plant of the Electrolytic Zinc Co. at Risdon is approaching completion, and the general manager anticipates that production will start in September. The company has the benefit of a low-rate contract with the Tasmanian government for the supply of current from the Great Lake hydro-electric power station and expects to produce zinc at less than £30 per ton. It is also in the fortunate position of having a contract with the British government for its output at a price which works out at a minimum of £28 per ton. Despite these facts, however, the company has a difficult task to face in the building up of a profitable industry unless the price of zinc shows an improvement on recent figures.

The company had a successful trial recently of an experimental flotation unit erected at Zeehan on the west coast of Tasmania to test the sulphide ores of the Mount Reid-Rosebery mines which were taken over from the Mount Lyell company last year.

Mount Lyell—Copper production is still proceeding at Mount Lyell, but unless the unions accept the offer of the company production will cease this week (written June 27). By order of the Arbitration Court an outside expert was appointed to examine the books and records of the company and to determine the cost of producing copper under the conditions obtaining. The report submitted showed the gross cost per ton of blister copper to be £104/11/6, or £4/10/1 per ton less than the company's figure. It was also calculated that the net cost of producing a ton of electrolytic copper was £95/6/[illegible], and on this basis with copper at £77 there would be a loss of £18/6/2 per ton, equivalent to £95,972 per annum on the basis of the last half year's work.

BURMA

Railway Strike Cuts Burma Corporation's June Output

Namtu—Lead production of the Burma Corporation for June was [illegible] tons gross; that of refined lead was [illegible] tons. The refined silver output was approximately [illegible] oz. Production was seriously affected during June by a strike on the Burma Railways which had lasted practically the whole of May and prevented supplies necessary for June reaching the smelter.

CANADA

British Columbia

Dominion Government Asked To Aid Companies Shipping Ore to Trail

Nelson—The Nelson branch of the British Columbia Prospectors' Association has petitioned Sir Henry Drayton, Dominion finance minister, asking for some arrangement providing for an advance by the Dominion government to small shippers sending ore to Trail. Warehouse receipts issued by the smelter for ore consignments during the depressed condition of the metal markets are not negotiable at the banks, hence the object sought is the securing from the government of some form of certificate upon which money can be realized for continuing operations pending a return to normal conditions.

Silverton—Lessees at the Van Roi mine have concluded arrangements for operating the concentrator on the property.

The arrangement made by the British Columbia department of mines for giving prospectors the advantage of cheaper powder is now in effect. Prospectors pay the full price for the powder they require, but after filling out certain forms and turning these over to a government agent are given a cash rebate of 25 per cent.

Trail.—Ore shipments received at the Consolidated smelter in the week ended July 14 were as follows:

Mine	Location	Tons
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Anyox.—Ore bins of the Granby Consolidated Mining & Smelting Co. were partly destroyed by fire on July 13, involving a loss of $30,000.

Yukon Territory

Outlook Considered Promising—Capital Coming In

The outlook of the Canadian Yukon country is said to be brighter now than at any time since the war began. Capital is being attracted to aid the development of the promising silver-lead properties of the upper Stewart River. The Consolidated Gold Fields Co. of South Africa recently took forty claims in the Keno Hill district and twelve more claims are under option to F. W. Bradley, of the Bunker Hill & Sullivan company of San Francisco. The Yukon Gold Co. has done much development work in the last two years and a shipment of 2,500 tons will soon reach Seattle.

ALASKA

Gold Quartz Found Near Girdwood—High Grade from Indian River Shipped

(Via Seattle)—A. W. [illegible], president of the [illegible] company, has just returned to Seattle from the mine and announces that mill construction is progressing satisfactorily and that the stamps will be dropping" by August. Mining operations are being carried ahead to increase the ore reserves.

One thousand pounds of high-grade gold telluride ore was recently shipped from Anchorage to the Tacoma smelter. The ore was mined near Indian River at Mile Eighty-six on the government railroad.

A newspaper dispatch from Anchorage heralds the strike of several rich gold-bearing quartz veins near the station of Girdwood on the government railroad. It is reported that the veins were first exposed in railroad cuts along Turnagin Arm. Girdwood is 39 miles south of Anchorage.

MEXICO

Sinaloa

Auriferous Gravels Tested at Maripa

(From San Francisco).—Ralph L. Van der Naillen, of the American Gold Dredging Co., recently returned to San Francisco from the west coast of Mexico, where he made a preliminary examination of placer ground at Maripa, in Sinaloa, close to the town of Sinaloa. The examination was made upon a concession described in the *Journal* of April 30, 1921, p. 759. The deposits are similar to the flood plain deposits of California and are evenly distributed over wide areas. The gold is fine. Several 4 x 6-ft. prospect shafts were sunk, and about 20 per cent of the excavated material was washed. The black sands and gold were brought back for assay. The result of the preliminary examination by Mr. Van der Naillen is said to be encouraging. Much coarse gold has been placered in the Bacubarito district, and as the Sinaloa and Fuerte rivers rise in the Sierra Madres and Sierra Tarahumare mountains, it is expected that the gold will be distributed in large areas of flood plain gravels suitable for dredging. Detailed examination by drilling with the objective of discovering the pay areas in the stream beds will be undertaken in September, as the rainy season is now on.

ARIZONA

Phelps Dodge and Arizona Copper Still Discussing Possible Sale of Latter's Property

Clifton.—Norman Carmichael, general manager of the Arizona Copper Co., Ltd., has confirmed a report that negotiations are under way in New York for possible transfer to the Phelps Dodge Corporation of the property of his company, which is represented by J. Pentland, a director of Edinburgh, Scotland. The purchase contemplated would give the Phelps Dodge interests possession of one of the largest properties in the Southwest, including hundreds of mining claims, from Clifton, up Chase Creek Canyon at Longfellow, Metcalf, Coronado and Morenci, with a modern smelter below Clifton, several mills, a narrow-gage railroad system to the main mining groups, a 107 mile broad gage to Lordsburg, N. M., on the Southern Pacific, and Hachita, on the El Paso & Southwestern, the latter a railroad system owned by the prospective purchaser. In the operating plant are included three large stores, large hospitals, libraries and offices.

A notice mailed from the home office in Edinburgh on July 12 says:

"At a special meeting of the board of the Arizona Copper Co. Ltd., held today, a proposal was under consideration by which the undertaking would be sold for shares in an American corporation. In the present serious condition of the copper industry the directors consider it desirable to proceed with negotiations. A communication will be sent to the shareholders as soon as practicable."

It is understood that British war taxes have absorbed the greater part of the returns from operation of the Arizona Copper Co.'s mines for a number of years past, for most of the stock is held in Scotland. Through post-war depression, the mines and works have been closed for months past and the thousands of employees, mainly Mexicans, have scattered. Limited operation is scarcely feasible, for the ores of the district are generally low-grade sulphides, needing economical handling, in large quantity, for assurance of profit at ordinary metal prices.

The Arizona Copper is the oldest copper mining corporation in Arizona, having been purchased in 1883 from the Leszynsky Bros., whose main property at the time was the famous Longfellow mine, with rich oxide-carbonate ores. A notable "baby gage" mining railroad had been built and a railroad to Lordsburg had to be added. In 1892, James Colquohoun, the manager, added a sulphuric acid leaching plant, the first in the Southwest, this at the old Clifton smelter site. In 1914, a short distance below Clifton, a modern smelter was erected, with reverberatory equipment, on designs of Dr. L. D. Ricketts. Last year the local property of the Shannon Copper Co was absorbed, including many mining claims in the Metcalf section, a railroad and smelting and concentrating plants below Clifton.

The Phelps Dodge Corporation already has large interests in the district, dating back to 1895, when a controlling interest was purchased in the Detroit Copper Co. of Morenci, to which point had to be built a remarkable corkscrew narrow-gage railroad, that since has been somewhat straightened by "switchbacks." The Detroit mines have been greatly developed and are equipped with a modern mill. A smelter at Morenci has been dismantled, though with plans for its reerection with more economical equipment.

The district's mining operations have been conducted with all harmony between the companies, with a general side-line agreement in force. In 1903 serious labor trouble resulted in the sentencing of the union leaders to the territorial penitentiary. In 1915 a second outbreak occurred, which was notable in the fact that the new State's government took the side of the strikers, with incidental threats against the mine managers. Litigation over alleged pollution of the streams from the concentrators was ended when the companies erected large dams for impounding the tailings.

Tombstone.—The Solstice Mining & Milling Co. has reached the intersection of the State of Maine and Bonanza veins. The ore is 2½ ft. wide and runs well in silver and gold. Green hornsilver is plainly visible throughout the vein. It is said to be the richest strike made in the district in years. W. T. Boyd is manager and Dr. H. H. Hughart secretary.

Gleeson.—The Black Hawk Copper Co. has been organized to take over the Pemberthy group. Development work will start soon. J. E. Penberthy is at the head of this company.

Patagonia.—The World's Fair group, consisting of fourteen claims and one mill site, was offered for sale at Nogales on July 23 to satisfy back taxes amounting to $17,449.31.

Jerome.—Steps to provide a development fund of $450,000 is reported to have been taken by the Verde Central Mines, Inc. Part of this money is to be secured by issuing 200,000 shares of treasury stock, authorized by the Arizona Corporation Commission. The money is to be spent in exploration at depth of two ore lenses of which the tops are believed to have been cut recently in drifting.

James M. Layman, now in the east, is said to be working on a plan to consolidate the Grand Island and Verde Chief properties, which lie in the south end of the Jerome district.

Lack of employment in the lode mines has driven many miners, mainly Mexicans, to the northern Arizona placers. A large number of men have been washing the sands of Big Bug and other gulches in the Mayer section.

Phoenix.—The State Corporation Commission has authorized the Tom Reed Gold Mines Co. to sell 90,455 shares at $1, the Hackberry Extension Co. to sell 97,500 shares at 5c., and the Moss Mines Co. to sell 500,000 shares at 10c.

Chloride.—Development is reported suspended at the Dardenelles property, near Chloride, after eighteen months work in the course of which the main vein was explored for 400 ft. on the 100 and 160 levels. Nine carloads of ore, averaging $40, have been shipped to smelters. A deep working shaft is planned, with electrical equipment.

W. W. Elliott, a Prescott millwright, has completed construction on the Dean property of a 60-ton mill, with K. & K. flotation machines.

Globe.—The Arizona Asbestos Association is reported to have shut down and discharged 200 men, mainly Mexicans.

COLORADO

Cripple Creek's 1921 Output Expected To Better That of Last Year

Cripple Creek.—During the first half of the year 1921, the production of the Cripple Creek district aggregated [illegible] tons, valued at $2,843,100. Shipments decreased in June on account of floods which delayed work in several of the mines and put the railroad out of operation. About 1,000 miners are now employed, or about twice as many as in December last. The district is credited with a production in 1920 of $4,317,044 in gold, $37,745 in silver, and $25,210 in lead, a total of $4,360,203. An estimate of the 1921 production, based on returns for the first six months, would be about $5,700,000. These figures serve to show how this famous camp has declined since the record years.

Gillett.—The diamond-drill hole being sunk by the Vindicator Company has attained a depth of 1,350 ft. The drill is now in intrusive granite, and broken rock has already appeared in the core.

UTAH

Status of Tailings Dump for Taxation Purposes To Be Decided by Court —Alta Camp Busy

Salt Lake City, July 21.—The question as to whether a tailings dump should be taxed as a part of the mine from which it has been derived, or separately, is being brought up before the U. S. District Court at Salt Lake City. The Utah Copper Co. is opposing the attempt of the officials of Salt Lake County to assess its tailings dump separately from the mine; on the other hand the company that now has control of the dump of the old Cactus or Newhouse mine in Beaver County, is opposing a valuation placed on the dump of three times the net proceeds for the year. This company seeks to have this valuation set aside, on the ground that the tailings dump value could not possibly have exceeded what was actually derived from it, and further that the tailings dump was separate from the mine. The case of the Utah Copper Co. was argued and submitted before Judge Johnson, July 11, but owing to a similarity of issues involved attorneys for the company at Newhouse have been granted permission to file their briefs in the case at the bar.

Eureka.—Ore shipments from the Tintic district for the week ended July 16 amounted to 120 cars as compared with [illegible] cars the week preceding. Shippers were: Tintic Standard, 42 cars; Chief Consolidated, 22; Iron King, [illegible]; Eagle & Blue Bell, 12; Victoria, 10; Dragon, 8; Iron Blossom, 6; Swansea, [illegible]; Mammoth, 1; Gold Chain, 1; Eureka Hill, 1; total, 120 cars. The East Tintic Coalition will resume work. The property is electrically equipped, and has a compressor, hoist, and other equipment.

Park City.—Shipments for the week ended July 16 amounted to 1,475 tons, as compared with 1,267 tons the week preceding. Shippers were: Silver King Coalition, 767 tons; Ontario, 344; and Judge allied companies, 364 tons. Material for the new mill of the Silver King Coalition is arriving; 60 men are employed on cement work, and construction of the mill proper will begin soon. The mine is in excellent condition; new reserves are being opened and production is heavy. Three hundred men are employed.

Alta.—Shipments are being made by the South Hecla, Columbus Rexall, and other companies from Little Cottonwood Canyon. The Cardiff, in Big Cottonwood, is making steady shipments, sending down the ore by trucks, which can now make the climb to the ore bins at the mine instead of halting at South Fork, as formerly. The Woodlawn, also in Big Cottonwood, is making shipments of accumulated ore. Four teams are hauling at present.

Lead furnaces in blast at the Salt Lake Valley plants the latter part of July were as follows: the United States Smelting Co. at Midvale had three lead furnaces in blast and one furnace on matte concentration; the A. S. & R. at Murray had three lead furnaces in blast. The International Smelting Co. at Tooele [illegible] its two lead furnaces July [illegible].

IDAHO

General Engineering Co. Building Mill at Armstead Mines

Talache.—[illegible] construction of the mill for the Armstead Mines, Inc., is well under way. The General Engineering Co., Salt Lake City, is furnishing the plans and supervising construction.

MONTANA

Boston & Montana Dev. Co. Hastening Work of Equipping New Mill

Elkhorn.—The Boston & Montana Development is hastening the work of installing the equipment at its new 750-ton flotation plant. The Hardinge Company, of New York, is supplying the machinery. One million feet of timber has been used in building this plant, which is 500 x 150 ft. in plan and 69 ft. high. Asbestos roofing is used. The flow sheet has been so planned that it will be possible to increase the capacity of the plant 50 per cent by installing rolls between the gyratory crushers and the Hardinge mills. The mill bins have a capacity of 1,500 tons. The specifications for the tramway from mine to mill call for electric motors to haul twelve three-ton cars. Two gyratories, each capable of crushing 250 tons in eight hours, will give the ore its first treatment, the crushed product going to the fine ore bins. There is automatic feeding to 8 ft. x 48 in. Hardinge mills where it will be crushed to [illegible]-mesh. From here it will go to classifiers and to [illegible] roughing tables, the concentrates going to four [illegible] finishing tables. From the roughing tables the tailings will go to [illegible] Hardinge [illegible] mills, where they will be crushed to [illegible]-mesh. Four Dorr thickeners, [illegible] ft. in diameter, will be used, followed by sixteen flotation machines. These in turn being followed by [illegible] Dorr thickeners and Oliver filters. There will be in all [illegible] cells, each with a capacity of [illegible] tons daily, with [illegible] for roughing and eight for finishing. There will be four Hardinge ball mills, two for coarse grinding and two for fine.

NEW MILL OF BOSTON & MONTANA DEVELOPMENT CO. AT ELKHORN, MONT.

OREGON

Gem Mining Co. To Build Small Cyanide Plant

Baker—Following tests by an engineering company of Salt Lake City on ores of the Gem mine, near Susanville, Grant County, on the Sumpter Valley Ry., cyaniding was recommended as the best plan of treatment. The company has announced its intention to build a 60-ton cyanide plant. Recovery of gold is reported to vary from 96.67 to 93.33 per cent, and that of silver from 72.73 to 45.45 per cent. The purchase of the Belle of Baker and Red Fox properties, near Sumpter, on behalf of Hamilton Mammoth Mines, Inc., has been reported.

WASHINGTON

Small Concentrator Erected at Northport Smelter

Valley—Surface prospecting on the Admiral group has resulted in the uncovering of a promising fissue vein with an iron filling strongly impregnated with copper.

Keller—Cyanide tanks for the Iron Creek mill have been hauled from Wilbur to the property.

Northport — A small mill has been put in on the Northport smelter grounds for treating the mixed lead and zinc ores of the Gust Maki mine, a local prospect of promise. A good separation is being effected. It is planned to ship the zinc product to Mineral Point, Wis., for treatment.

CALIFORNIA

Strikers at Grass Valley Return to Work—New Dredge Being Built Near Lewiston

Grass Valley.—Striking miners in this district have returned to work, having agreed to the appointment of an arbitration board which will adjust the wage difficulty.

Colfax.—The old Iowa Hill mining district is again active. It is said that mine properties are under development or are being reopened. Lyman Gilmore, according to local accounts, has succeeded in tapping the Big Dipper channel.

Redding.—L. Gardella is constructing a gold dredge on the Paulsen ranch near Lewiston. Gravels along the Trinity River will be dredged.

The Shasta Zinc & Copper Co. has successfully operated its new plant.

The Mountain Copper Co. is constructing its wire rope tramway from the Hornet and Iron Mountain mines to Mathewson, the new town established four miles north of Keswick. The latter place will probably be abandoned.

NEVADA

Pioche—Stockholders of the Prince Consolidated have been given an opportunity to subscribe to a new issue of 150,000 shares of treasury stock at [illegible]. The funds thus raised will be used to finance the work of exploring the eastern and western orebodies on the 833 level. The company's stock is not assessable.

ARKANSAS

White River Manganese Co. Completes New Washing Plant

Batesville—The White River Manganese Co., operating on a sixty-acre tract on Polk Bayou, ten miles northwest of Batesville, has recently completed a 200-ton washing plant. The equipment includes 25-ft. double log washer, a six-cell cleaner jig, and a five-cell rougher. The larger pieces of ore are recovered directly in the log washer, the fines passing through a chute and sizing screens to the jigs. The mine workings consist of a series of large pits. Drag-line equipment is used. Most of the ore is finely disseminated through clay. The dirt is broken by shallow shots. Three pits will be opened, which will allow the drag line to work in one while the other two are being shot. The company's office is at Gary, Ind. W. Rinehart is local manager.

Guion—The Silica Products Co., which is operating a large glass-sand quarry here, has just completed a 200-ton grinding and drying plant. This replaces a plant of smaller capacity which was destroyed last winter by fire. The equipment of the plant consists of a 16-in. breaker, a large rotary drier, and one set of 24-in. rolls, besides numerous elevators and a power plant. All shoveling in the quarry is carried on with a large steam shovel, which shows a big saving in operating costs over hand operation. The product runs 99.8 silica and contains no foreign matter to make it objectionable. D. D. Duncan, formerly of Joplin, Mo., is in active charge.

MISSOURI

National Silica Co. To Build 100-Ton Mill

Cape Girardeau—The National Silica Mining Co. has a property 5½ miles northwest of Cape Girardeau, near the Cape Girardeau Northern R.R. It consists of one of the largest deposits of pure amorphous silica in the United States. Plans are being drawn for a 100-ton mill. The company also has a bed of kaolin of good grade at a depth of 60 ft., to which a shaft is being sunk. The company is incorporated for $200,000. R. W. Finley is president, J. W. Wood secretary, and Arch A. Campbell, treasurer

MICHIGAN

The Copper Country

More Copper Shipped Abroad—Mohawk and Wolverine Are Holding Own—Seneca's Ground Improving

Houghton—A shipment of 900,000 lb. of copper was taken out July 20 by steamer. It included 300,000 lb. of Calumet & Hecla metal for France, completing a 600,000 lb. order, the first 300,000 lb. leaving July 16. But little inland domestic copper business is being done by any of the Lake Superior companies, only an occasional carload going out. There has been a notable dearth of orders from the automotive centers.

Both Mohawk and Wolverine have had little difficulty in holding their organizations intact and as a result both are producing to capacity. Mohawk is sending 2,600 tons of "rock" to the mill daily, while Wolverine averages 1,000. Sinking has been resumed in No. 1 shaft, Mohawk, and No. 4 and No. 6 are also being deepened. Wolverine is still mining the shaft pillars on the 38th or bottom level. Mohawk is managing to make a new dollar for an old one at the present price of copper, while Wolverine has its costs within a cent of the prevailing price.

Seneca's 6th level drift, north, which has been in ground below that of the average for the mine during the last ten days, is now showing an improvement. The average of the "rock" hoisted from all openings continues high. The 3d and 5th level drifts and the 4th level stope are in good milling "rock."

Marquette Range

Oliver Company To Cut Wages Aug. 1—Mary Charlotte Mine Increases Force

Ishpeming—The Oliver Iron Mining Co. has announced that wages will be cut 10 per cent at the mines on Aug. 1, this being the second cut this year. The first was one of 20 per cent. The company has been working half-time in Michigan.

Negaunee—The Mary Charlotte mine has increased its underground force by 110 men. This is the only property on the Marquette Range which is operating two shifts on a full-time basis. All ore hoisted is being shipped to the docks.

Gogebic Range

Oliver Iron Again Curtails After Recent Resumption on Half time

Ironwood—The Oliver Iron Mining Co., which recently put its mines on half time, has again curtailed work and cut the number of working days to four per week. This gives the majority of men eight working days per month.

Ironwood—Shipments of iron ore from stockpiles have commenced at the Cary and Sunday Lake mines. It is believed that underground operations at these properties will not be resumed until most of the ore in stockpiles has been removed.

Menominee Range

Part of Bates Mine Plant Burned—Carpenter Shipping From Stock

Iron River—Fire recently destroyed the engine house and supply buildings at the Bates mine. Hoisting will have to be discontinued for the present, but the pumps are running. Most of the men have been laid off until repairs can be made.

Crystal Falls—The Carpenter is loading ore from stockpile, being one of the few Menominee Range mines to be shipping from stock. Sixty cars are being loaded daily. The Balkan mine is shipping all ore hoisted, but nothing is moving from the stockpiles. The operators are not so optimistic now that there will be a period of activity before navigation closes.

THE MARKET REPORT

Daily Prices of Metals

July	Copper N. Y. net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
21	12.00	25.75	[illegible]	4.35@4.40	4.20@4.25	4.15@4.20
22	12.00	26.125	27.00	4.35@4.40	4.20@4.25	4.15@4.20
23	11.75@12.00	26.125	27.00	4.35@4.40	4.20@4.25	4.15@4.20
25	11.75	25.625	26.50	4.35@4.40	4.20@4.25	4.20
26	11.75	25.125	[illegible]	4.35@4.40	4.20@4.25	4.20
27	11.75	25.375	[illegible]	4.35@4.40	4.20@4.25	4.20

*These prices correspond to the following quotations for copper "delivered": [illegible]

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

July	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
21	[illegible]	[illegible]	74½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	71¾	74½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	70	70⅞	74½	[illegible]	[illegible]	[illegible]	23	[illegible]	[illegible]
26	70	70⅞	75	[illegible]	[illegible]	[illegible]	23¼	[illegible]	26¼
27	[illegible]	70¾	75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

July	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	July	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
21	[illegible]	99⅝	60⅞	[illegible]	25	[illegible]	99⅝	[illegible]	[illegible]
22	[illegible]	99⅝	60⅞	[illegible]	26	[illegible]	99⅝	[illegible]	[illegible]
23	[illegible]	99⅝	60⅝	[illegible]	27	[illegible]	99⅝	[illegible]	39

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, July 27, 1921

The midsummer dullness has continued in even more acute form during the last week. Prices of lead and zinc have held steady, even with the lack of demand, but copper has succumbed to pressure to sell, and the low level of last March has again been reached, with no prospect of an early improvement. Tin has followed the London quotations and weak sterling exchange, to the lowest price since December, 1907.

Copper

The copper market seems to be demoralized. The small tonnage of miscellaneous wire bars which a broker found it necessary to sell, as reported last week, seems to have started a downward trend in the market. With the decline, consumers remained aloof, waiting to see how low the price would go. Some of the smaller producers, in an effort to market current production, quoted [illegible], delivered, on Thursday and Friday, but on Monday found it necessary to come to 12c., and offers of spot copper at this price were turned down yesterday. In the last three days copper for delivery as late as September has been sold at the 12c., delivered price. It is doubtful if preferred consumers would have difficulty in getting all of the copper they want at this price, especially if they were willing to accept near-by delivery. In fact the [illegible] are reported to be the only ones which are absolutely out of the market at current levels. The fact that the larger producers are [illegible] is considered by many to be an unsatisfactory feature of the present market, as little can be sold at any price, and it will only force weaker interests to make further cuts.

Export demand has been poor, with keen competition continuing from London. To cite an example, on Monday a sale of 300 tons of electrolytic was made at £75 5, which was the equivalent of 12c., c.i.f. Liverpool, or 11.40c., f.a.s. New York.

Lead

The American Smelting & Refining Co. continues its official contract price at 4.40c.

Demand has been poor during the last week, but fortunately there has been no pressure to sell on the part of producers, so that the price has remained at the closing level of last week. The market in the Middle West seems to be in a particularly quiescent state, with practically no sales, and quotations therefore largely nominal. The white lead trade is weakening somewhat, [illegible] pected at this time. Many manufacturers continue to be away behind on their orders. The storage battery business continues to be satisfactory and should remain an important consumer of lead for some time.

Zinc

The market has become a trifle firmer, and it would be difficult to obtain zinc today below 4.20c., East St. Louis. High-grade is in fair demand, and several carloads have been sold at the prices quoted last week.

Tin

Consumers do not seem to have [illegible] that they are wisely advised. Total world stocks of tin, [illegible] low. [illegible]

[illegible]

Gold

Gold in London: July 21st, 114s. 11d.; 22d, 114s. 9d.; 25th, 114s. 8d.; 26th, 114s. 10d.; 27th, 114s. 10d.

Foreign Exchange

Sterling "cables" were quoted throughout the week one-half cent higher than the demand figures given in the table on page 195. On Tuesday, July 26, francs were 7.7275c.; lire, 4.2875c.; and marks, 1.2775c. New York funds in Montreal, 12 7/16 per cent premium.

Silver

After the fall to 37d. on July 20, caused by China sales, the London market advanced sharply on Indian buying. This demand was also felt here, as bids were made in the New York market on the afternoon of the 20th at a very high premium over the official price. London held steady for three days, then advanced because of combined buying for China and India account. New York also advanced despite the continued weakness of sterling exchange, and prices in both New York and San Francisco ruled on a higher level than the London parity.

Mexican Dollars—July 21, 46⅛; 22d, 46⅜; 23d, 46⅝; 25th, 47; 26th, 47; 27th, 47⅜.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 21@23c. per lb.; 22½c. for imports, duty paid.

Antimony—Chinese and Japanese brands, 4¾c.; market dull. W.C.C. brand, 5⅜@5⅝c. per lb. Cookson's "C" grade, spot, 9@9½c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500-lb. lots.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $3@$3.25 per lb.; black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $165@$185 per oz.

[1]**Molybdenum Metal**—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz. Nominal $70, Los Angeles, Cal.

Palladium—Nominally, $48@$52 per oz.

Platinum—Nominally, $65 per oz.

The platinum market has taken a heavy fall declines in price occurring almost daily, but being most pronounced on July 20, 23, and 26, and carrying the market from a $72 per oz. level to a $65 level that is far from being firm. The drop is ascribed to the selling of some Colombian platinum that had been held for a rise in the market and which was sold because the general position of platinum is none too good. The prospect of some Russian platinum being thrown on the market, coupled with the lack of demand from the jewelry trade, is supposed to have influenced the selling of platinum during the week. Palladium has also declined.

Quicksilver—Nominally, $43.50@$45 per 75-lb. flask. San Francisco wires $46.

[1]**Rhodium—$150 per troy oz.**

[1]**Selenium—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.**

[1]**Thallium Metal—Ingot, 99 per cent pure, $20 per lb.**

[1]**Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.**

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—22c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores—Ilmenite, 52 per cent** TiO_2, 1¾@2c. **per lb. for ore. Rutile, 95** per cent TiO_2, 12c. **per lb. for ore, with concessions on large lots or contracts.**

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.**

Zinc and Lead Ore Markets

Joplin, Mo., July 23.—Zinc blende, per ton, high, $24.65; basis 60 per cent zinc, premium, $22; Prime Western, $21; fines and slimes, $20@$18; average settling price, all grades of zinc, $21.62.

Lead, high, $53.60; basis 80 per cent lead, $45@$47.50; average settling price, all grades of lead, $46.51 per ton.

Shipments for the week: Blende, 4,748; lead, 1,552 tons. Value, all ores the week, $174,880.

An effort to secure zinc blende on $20 basis brought a very light tonnage on the market, but later offerings of $21, Oklahoma, secured an increased tonnage, yet less than the production was bought.

Offerings on lead were advanced from $45, with few takers, to $47.50, with sellers accepting all offerings.

Production is variously estimated by different purchasing agents from 4,500 to 6,000 tons per week.

Platteville, Wis., July 23.—No market for zinc or lead ores. Shipments for the week, none. Shipments for the year: Blende, 11,461; lead, 978 tons. Shipped during the week to separating plants, 120 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1, $1,700@$2,000; No. 2, $1,200@$1,500; spinning fibers, $400@$800; magnesia and compressed sheet fibres, $275@$400; shingle stock, $95@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga.

Bauxite—French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $6.50@$8.50; washed, $9@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

---

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

Feldspar—No. 1 soap grade, $7 [illegible] per ton, f.o.b. North Carolina points; No. 1 pottery, $6@$6.50; No. 2 [illegible] $5.50. Market dull. Large stocks are available and quotations are nominal. Producers report cancellations of orders. No. 1, Canadian, ground, $26 f.o.b. cars.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$[illegible]. ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $13.50, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 7@8c. per lb.; chip, 5½@6c.; dust, 3@4½c. No. 1 flake, 6½@7c.; amorphous crude, ¾@2½c. Market quiet.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $56 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

*Monazite — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $12.50; 75 per cent, $11.50; 75@74 per cent, $11; 70 per cent, $6.75; 68 per cent, $6.25; 68@66 per cent, $6.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 12c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $7.50@$11 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic — White arsenic, 6½c. per lb. in carload lots.

Sodium Nitrate $2.50@$2.60 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $16@$18 per ton, f.o.b. Western mines, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.35 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 14c. per lb. of chromium contained; 4 to 6 per cent carbon, 15c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $70, f.o.b. furnace; resale, $90, delivered; English, $70, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, [illegible], f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works. Imported material, $1[illegible].

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $40@$42; 50 per cent, [illegible]; 75 per cent, $1[illegible].

Ferrotungsten—Domestic, 70 to 80 per cent W, [illegible] per lb. of contained tungsten, f.o.b. works. Foreign, [illegible] duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$4[illegible]@$4.50 per lb. of V contained, according to analysis and quantity.

Metal Products

Copper Sheets—Current New York list price, 20½@20¾c. per lb.; wire, 14@14½c.

Lead Sheets—Full lead sheets, 8.25c.; cut lead sheets, 8¾c. in quantity, mill lots.

Nickel Silver — 31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets 16¾c.; sheathing, 16¼c.; rods, ⅜ to 3 in., 13¾c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $[illegible] per net ton, shipping point; arches, keys, wedges, $66; splits, soaps, $84.

Fire Brick—First quality, 9-in. shapes $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $70@$75 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, July 26, 1921

There has been further, though slight, improvement in the demand upon the mills for some finished steel products, and in no important steel product has there been any decrease.

Bars are fairly steady at 1.75c. and plates and shapes at 1.85c., representing declines in the week of $2 in bars and $1 in shapes and plates. Black and galvanized sheets have declined altogether about $5 a ton from the prices formerly announced July 5, with black at [illegible] and galvanized at [illegible]. Steel prices in general are about 40 per cent above their average of 1904 to 1913 inclusive.

At some points mill operations show a slight increase, but there is not much change, and the general average is perhaps not above 25 per cent of capacity. Nearly all business is rush business, arising chiefly from depletion of stocks of jobbers and manufacturing consumers. A little increase in demand for construction steel is noted.

Pig Iron—[illegible] foundry, $19[illegible] Valley [illegible] Valley market [illegible]

Coke

Connellsville—Furnace, $2.75@$3; foundry, [illegible].

---

*Foote Mineral Co., Philadelphia, Pa.

Bismuth Prices Hold Steadily

London Controls American Quotations on the Metal, Which Are Now Below the Pre-War Level

THE bismuth market is closely held in British hands, with one firm, Johnson, Matthey & Co., Ltd., the chief producers and ore buyers. Consequently the London price of bismuth governs the quotation in the United States. American prices are merely the reflection of the London figures, translated into dollars and considering the incidental charges which are necessary to reduce the prices to a c.i.f. basis at an Atlantic port in this country. The London price, it should be noted, is not obtained in an open market as with other metals dealt in on the London exchange, but is fixed at a certain level, only to be altered when a fundamental change in market conditions demands it. Such changes are of rare occurrence. There were but three London price fluctuations during the four years of the war. The present British price is 7s. 6d., a reduction made on Feb. 12, 1921, from the previous price of 12s. 6d. The following table shows the few variations in price during the last nine years:

	Per Pound
January, 1912, to Aug. 17, 1914	7s. 6d
August 18, 1914, to March 7, 1916	10s. 0d
March 8, 1916 to Jan. 27, 1918	11s. 0d
January 28, 1918 to Feb. 12, 1921	12s. 6d.
February 12, 1921 to date	7s. 6d.

The peak quotation was thus 12s. 6d., and the recent drop to 7s. 6d. represents a decline in one step to a pre-war figure. Inasmuch as sterling exchange is now depreciated to about 72 per cent of its normal value, the price of bismuth is below the pre-war parity, calculated to an American basis, but is at the pre-war level from the British standpoint.

Like a good many other metals, bismuth is a byproduct. It is recovered from the electrolytic refining of copper, lead, and tin. References upon the subject frequently fail to state that the refining of tin is an important source of bismuth, due, no doubt, to the fact that the electrolytic refining of tin is a recent metallurgical development, and the bismuth recovery as a byproduct not generally known. Nevertheless, this is a source of bismuth of growing importance.

Bismuth is found in nature in the native state, as the mineral bismuthinite, and in other rarer mineralogical forms, and as sold in ores generally contains at least 10 per cent of metallic bismuth. Impurities such as copper, iron, lead, arsenic, and tellurium are objectionable.

Bismuth is used in the manufacture of low-temperature fusible alloys for automatic sprinklers and safety apparatus. Its use in medicines is also important. The world's production has been amply sufficient to meet current requirements, and bismuth resources have not been heavily taxed. Bolivia is the world's greatest producer, the principal mines being those of Aramayo, Francke & Co. at Tasna, and Choroloque. China is becoming an increasingly important producer, obtaining the mineral from tungsten mining. Australia and the United States are also large producers, the latter country's output being about 200 tons in 1921.

Transvaal Gold Production

The following table summarizes Transvaal gold production since 1917:

RAND GOLD OUTPUT 1917–1921, IN FINE OUNCES

	1921	1920	1919	1918	1917
January	681,382	670,503	676,059	714,183	782,634
February	671,123	625,330	636,728	639,759	721,321
March	588,137	707,036	712,379	696,281	787,094
April	651,593	686,979	694,944	717,099	742,778
May	687,776	699,041	724,915	741,217	729,385
June	678,490	715,957	702,379	727,696	759,724
July		736,099	722,407	736,199	757,890
August		702,083	706,669	740,210	756,658
September		682,173	698,558	708,206	738,231
October		662,472	723,722	679,764	751,290
November		633,737	677,970	658,701	722,839
December		632,215	650,191	641,245	722,419

Movements of Ores and Metals for June, 1921

Imports and exports of the more important metals and ores, as reported by the Department of Commerce for June, 1921, and the figures for June, 1920, as finally revised, are as follows:

IMPORTS, JUNE, 1920 AND 1921
(In Pounds, Unless Otherwise Stated)

	June, 1920	June, 1921
Antimony matte, regulus, or metal	1,523,754	3,367,600
Brass, fit only for remanufacture....	4,947,483	891,194
Copper:		
Ore, contents	6,302,487	3,996,171
Concentrates, contents	5,019,946	34,317
Matte, regulus, etc., contents.....	4,296,965	1,098,577
Imported from (in part):		
Spain	427,077	270,407
Canada	3,782,665	383,737
Mexico	2,571,512	340,712
Chile	5,333,065	3,200,931
Peru	117,401	82,176
Unrefined, black, blister, etc.	23,415,143	12,531,637
Imported from (in part):		
Canada	2,942,447	320,962
Chile	2,735,118	1,099,583
Peru....................	10,985,334	9,951,501
Portuguese Africa	938,546	1,103,736
Mexico	5,569,366	305
United Kingdom	.	6,755
Refined, in bars, plates, etc..........	34,564,563	2,812,467
Old, etc., for remanufacture........	2,015,625	59,432
Composition metal, copper chief value	215,678	434,450
Lead:		
Ore, contents	2,439,656	688,585
Bullion, contents..................	7,111,666	5,582,016
Imported from:		
Canada	1,040,480	227,583
Mexico	8,148,155	5,775,272
Other countries.	362,687	267,746
Pigs, bars and old	1,152,304	17,442,890
Imported from:		
Germany	960	...
Canada	30	.
Mexico	863,482	8,485,130
Jamaica	63,000	...
Brazil	7,777	..
Dutch East Indies	216,801	..
Japan	184	......
Spain	...	8,957,760
Manganese ore, long tons...	80,329	17,169
Imported from (in part):		
Cuba, long tons	32	.
Brazil, long tons........	64,900	9,600
British India, long tons..	4,500	7,560
Tungsten ore, long tons......	104	216
Pyrites, long tons	54,415	17,861
Imported from:		
Spain, long tons.........	27,640	17,861
Canada, long tons...	26,775	.
Tin ore, long tons...........	2,994	1,891
Tin bars, blocks, pigs, etc....	11,680,436	4,133,450
Imported from (in part):		
United Kingdom	4,085,504	1,098,846
Straits Settlements.	4,852,389	2,644,643
Hongkong.............	829,556	91,674
Australia	274,477	56,000
Zinc:		
Ore, contents.	7,681,262	268,387
Imported from:		
Canada	443,664	19,703
Mexico.............	2,001,357	241,678
Blocks, or pigs, and old	1,623	6,203

EXPORTS OF COPPER, LEAD AND ZINC
(In Pounds)

	June, 1920	June, 1921
Copper		
Ore contents	100,000	
Concentrates, contents	15,000	
Unrefined, black, blister, etc.	1,039	
Refined, in ingots, bars, etc.	53,678,323	48,566,463
Exported to (in part).		
Belgium	2,980,876	1,794,449
France	11,315,461	7,310,557
Germany	11,415,403	22,485,354
United Kingdom	11,018,402	2,826,296
Japan	6,657,980	5,628,000
Netherlands	2,992,267	2,658,659
Composition metal, copper chief value	83,036	631
Pipes and tubes	590,104	129,523
Plates and sheets	1,774,008	159,561
Wire, except insulated	4,097,201	1,313,213
Lead:		
Pigs, bars, etc		
Produced from domestic ore	517,710	63,059
Produced from foreign ore	3,531,146	2,800,204
Exported to (in part)		
Canada	11,499	8,960
China	4,788	310
Japan	1,904,080	2,800,000
Zinc		
Dross	334,987	
Spelter:		
Produced from domestic ore	17,477,345	201,328
Produced from foreign ore	8,975,929	336,000
Exported to (in part)		
Canada	3,634	67,032
Mexico	7,250	69,021
Japan		393,730
In sheets, strips, etc	1,803,425	338,404

COMPANY REPORTS

Russo-Asiatic Consolidated, Ltd.

A report of operations of the Russo-Asiatic Consolidated, Ltd., for 1920 states that in [illegible] these properties were confiscated by the Soviet authorities, and claims for £56,000,000 against those authorities, based on the stocks of metals and materials on hand, the profit value of the proven ore reserves and the cost of plant, machinery, and other items, were filed with the Foreign Office.

Following the conclusion of a trading agreement between the British government and the Soviet authorities, certain negotiations took place regarding the return of the confiscated properties and the resumption of work thereon. These negotiations are being continued. No material damage has been done to the properties.

The company owns the capital of certain Russian companies, through which it holds the sole beneficial interest in the following principal assets:

Freehold and leasehold mining, agricultural, and forest land, mining claims and concessions in the Urals and western Siberia covering an area of 2,500,000 acres.

Twelve developed metal mines with 7,260,000 tons reserves.

Coal mines with a present capacity of 400,000 tons per annum. Coal reserves practically unlimited. Being developed for yearly output of 2,000,000 tons coal.

Two copper-smelting plants. Present capacity, 14,000 tons of copper per annum.

Electrolytic copper refinery. Present yearly capacity, 14,000 tons per annum.

Lead plant. Present yearly capacity, 12,000 tons lead.

Zinc plant for yearly capacity of 24,000 tons zinc under construction; 50 per cent completed.

Iron mines, blast furnaces, rolling mills, foundries, and steel works. Present annual capacity, 24,000 tons of finished iron and steel products.

Cyanide and gold mills. Present yearly capacity of 70,000 tons of gold ore. Two slime and bullion refineries for production of gold and silver.

Coal crushing and coking plants.

Dynamite plant. Annual capacity, 1,200 tons.

Sulphuric acid plant. Annual capacity, 8,000 tons.

Twenty sawmills for preparation of timber products for own requirements and market purposes.

Two hundred and fifty miles of broad and narrow gage railways.

River fleet of eight steamers and twenty-four barges.

In addition, the properties are fully equipped with mechanic shops, stores, brick-making plants, and necessary buildings and appurtenances, together with housing accommodation, hospitals, and recreation buildings for 40,000 workmen and their families.

Nechi Mines (Colombia), Ltd.

A report of operations of Nechi Mines (Colombia), Ltd., for the year ended Sept. 30, 1920, states that [illegible] cu.yd. was dredged, the gross value of the gold recovered being $816,188, with an average dredged depth of 50.8 ft. at a field cost of 7.14c. per cu.yd. This field cost, due to rental charges, depreciation, and other items, was increased to [illegible] per cu.yd., compared with [illegible] for the first [illegible] months of the previous year.

The net receipts amount to £198,462 7s. 4d. After debiting the field costs, [illegible], depreciation written off £8,062 10s. 0d., and all London administration expenses, the credit carried to the balance sheet is [illegible]. Adding to this the credit brought forward from the previous period, and deducting the dividends paid on the preference and ordinary shares during the financial year to Sept. 30, 1920, the balance carried forward is [illegible], subject to excess profits duty and corporation tax (if any).

Capital, [illegible] 25 per cent preference shares of 10s. each and 140,000 fully paid ordinary shares of 10s. each.

Mysore Gold Mining Company

Gold; India

A report of the Mysore Gold Mining Co. for the year ended Dec. 31, 1920, shows a decline in the return of 156,759 oz. of fine gold, as compared with 163,719 oz. in 1919. The premium on gold permits the treatment of lower-grade ore at a profit. Under an arrangement with the government of India, three-fourths of the output of gold was acquired after May 14, 1920, by the government at the average "world's price" for the month of delivery, thus enabling the company to profit by the high premium on gold after that date. The concession under which two-thirds of the total price was payable in India in rupees enabled the company to have at hand a large proportion of its required expenditure. The balance of the output (25 per cent) was disposed of in London in the open market. The extent to which this method of selling the output benefited the company is reflected in the expansion in the total revenue from £663,826 in 1919 to £777,130, despite the decline in the output of gold. Calculating the value of the output at par (85s. per oz.) gives a total of £666,276, whereas the output actually realized £804,183, thereby leaving a premium of £137,957. The net profit has expanded from £186,443 to £283,384. The directors have taken advantage of this fact to write off £79,320 in respect of capital expenditure. An allocation of £15,000 raises the reserve fund to £175,000, and an addition of £2,500 leaves insurance and contingency fund at £7,325. Expenses in connection with the new issue amounting to £4,275 were written off. At the same time, as a result of the prosperity of the year, the dividend paid to shareholders was increased from 20 per cent to 25 per cent. Sundry charges, including corporation profits tax, are estimated at £11,000, leaving to be carried forward to the next account a balance of £7,322.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1917	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	293,186	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Kirkland Lake Deficit Increases

Gold, Ontario

The fifth annual report of Kirkland Lake Gold Mining Co., Ltd., for the year ended May 31, 1921, states that production amounted to $277,077.09. Mining account follows:

[illegible]		
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
		[illegible]
[illegible]		
[illegible]	[illegible]	
[illegible]	[illegible]	
		[illegible]
[illegible]		[illegible]
[illegible]	[illegible]	
[illegible]	[illegible]	
		[illegible]
[illegible]		[illegible]

[illegible]

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Capitalization, [illegible] shares of $1 par value.

MINING STOCKS

Week Ended July 23, 1921

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Ahmeek	Boston	48	47½	47½	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*38	*35	*37		
Allouez	Boston	....		20	Mar. '19	1.00
Anaconda	New York	38	37¼	37½	Nov. '20, Q	1.00
Arcadian Consol.	Boston			2½		
Arizona Com'l	Boston	8	7	8	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*27	*22	*24		..
Bingham Mines	Boston			9	Sept. '19, Q	.25
Calumet & Arizona	Boston	46½	45½	46	June '21, Q	.50
Calumet & Hecla	Boston	224	220	224	June '20, Q	5.00
Canada Copper	N. Y. Curb	*32	*27	32		
Centennial	Boston	....		7½	Dec. '18, SA	1.00
Cerro de Pasco	New York	26	25	26	Mar. '21, Q	.50
Chile Copper	New York	10½	9¾	10⅛		...
Chino	New York	23¼	22⅞	23⅛	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*29½	*28½	29		
Con. Arizona	N. Y. Curb	*3	*3	*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1⅜	1⅜	1¼		
Copper Range	Boston	32¾	31½	32½	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*34	31	34		...
Davis-Daly	Boston	6	6	6	Mar. '20, Q	.25
East Butte	Boston	8	8	8	Dec. '19, A	.50
First National	Boston Curb	*52	50	*50	Feb. '19, SA	.15
Franklin	Boston	1¾	1½	1½		....
Gadsden Copper	N. Y. Curb	.		*25		
Granby Consol.	New York	17¾	17¼	17¼	May '19, Q	1.25
Greene-Cananea	New York	20½	19	19	Nov. '20, Q	.50
Hancock	Boston	.	.	3¼		
Howe Sound	N. Y. Curb	2⅛	2	2	Jan. '21, Q	.05
Inspiration Consol.	New York	34½	33	33¾	Oct. '20, Q	1.00
Iron Cap	Boston Curb	5⅜	5½	5½	Sept. '20, K	.25
Isle Royale	Boston	....		20½	Sept. '19, SA	.50
Kennecott	New York	19½	18¾	18⅞	Dec. '20, Q	.50
Keweenaw	Boston	1⅛	1¼	1¼		
Lake Copper	Boston	2⅜	2½	2½		
La Salle	Boston	1⅜	1¼	1¼		
Magma Chief	N. Y. Curb	*6	*6	6		
Magma Copper	N. Y. Curb	18½	18¼	18¼	Jan. '19, Q	.50
Majestic	Boston Curb	6	6	6		
Mason Valley	Boston	1½	1¼	1¼		
Mass Consolidated	Boston	....		1½	Nov. '17, Q	1.00
Miami Copper	New York	21	20½	21	May '21, Q	.50
Michigan	Boston	1½	1½	1½		
Mohawk	Boston	48	47	48½	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	5⅜	3½	5¼		
Nevada Consol.	New York	11⅛	10½	10¾	Sept. '20, Q	.25
New Baltic	Boston Curb			3		
New Cornelia	Boston	14½	14	14	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	.		5		
North Butte	Boston	9½	9½	9⅛	Oct. '18, Q	.25
North Lake	Boston	....		*25		
Ohio Copper	N. Y. Curb	*9	*6	*6		
Old Dominion	Boston	22	22	22	Dec. '18, Q	1.00
Osceola	Boston			26	June '20, Q	.50
Phelps Dodge	Open Mar.	†160	†145	...	July '21, Q	1.00
Quincy	Boston	37	37	37	Mar. '20, Q	1.00
Ray Consolidated	New York	12⅛	12¼	12⅛	Dec. '20, Q	.25
Ray Hercules	Boston Curb	....		24		
St. Mary's Min. Ld.	Boston	33	33	33	June '20, K	2.00
Seneca Copper	Boston	14½	14½	14½		
Shannon	Boston	*85	*85	*85	Nov. '17, Q	.25
Shattuck Arizona	New York	7	6½	6¾	Jan. '20, Q	.25
South Lake	Boston	1⅜	1¼	1¼		
Superior Copper	Boston	....	.	3	Apr. '17,	1.00
Superior & Boston	Boston	1¼	1	1¼		
Tenn. C. & C. cfs.	New York	7⅛	7½	7¾	May '18, I	1.00
Tuolumne	Boston	*51	*50	50	May '13	.10
United Verde Ex.	Boston Curb	24	22½	23½	May '21, Q	.25
Utah Consol.	Boston	3¼	3½	3⅞	Sept. '18,	.25
Utah Copper	New York	49	47¼	48¾	June '21, Q	.50
Utah Metal & T.	Boston	1⅛	1⅛	1	Dec. '17,	.30
Victoria	Boston			1¼		
Winona	Boston	....		50		
Wolverine	Boston	11	10	11¼		
NICKEL-COPPER						
International Nickel	New York	14	13½	13¾	Mar. '19	.50
Internat. Nickel, pf.	New York			84	May '21, Q	1.50
LEAD						
National Lead	New York	75½	74½	75½	June '21, Q	1.50
National Lead, pfd.	New York			100	June '21, Q	1.75
St. Joseph Lead	New York	11¼	11¼	11¼	June '21, Q	.25
QUICKSILVER						
New Idria	Boston	.		*50		....
ZINC						
Am. Z. L. & S.	New York	8¼	8¼	8¼	[illegible]	1.00
Am. Z. L. & S. pfd	New York			24	[illegible]	1.50
Butte C. & Z.	New York	4¼	4¼	4¼	[illegible] '18	.50
Butte & Superior	New York			12	Sept. '20,	1.25
Callahan Zn-Ld	New York	4½	4	4¼	[illegible]	.50
New Jersey Zn.	N. Y. Curb	112	110	[illegible]	[illegible]	2.00
[illegible]	N. Y. Curb			[illegible]	[illegible]	.03
Yellow Pine	Los Angeles			[illegible]	[illegible]	.03

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	New York	⅜	⅜	⅜		......
Alaska Juneau	New York	1½	1⅜	1½		.....
Carson Hill	N. Y. Curb	.		13½		...
Cresson Consol. G.	N. Y. Curb	1⅛	1¼	1¹¹⁄₁₆	June '20, Q	$0.10
Dome Extension	Toronto			*75		....
Dome Mines	New York	17¼	16½	17¼	July '21, Q	.25
Florence Goldfield	N.Y. Curb	*35	*30	*35		
Golden Cycle	Colo. Springs	*69	68	*68	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*5	*5	5	Dec. '19,	.05
Hollinger Consol.	Toronto	7.07	7.07	7.07	July '21, M	.05
Homestake Mining	New York			55½	June '21, M	.25
Kirkland Lake	Toronto	*33	*32	33		
Lake Shore	Toronto	1.19	1.15	1.19	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.97	1.88	1.96	May '21, K	.05
Porcupine Crown	Toronto	*14	14	*14	July '17,	.03
Portland	Colo. Springs	*50	*50	*50	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb			*4	May '19,	.05
Silver Pick	N. Y. Curb		.	11	.	....
Teck Hughes	Toronto	*11	10	*11		....
Tom Reed	Los Angeles			71	Dec. '19,	.02
United Eastern	N. Y. Curb	2½	2⁵⁄₁₆	2⁵⁄₁₆	Apr. '21, Q	.15
Vindicator Consol.	Colo. Springs	....	.	*27	Jan. '20, Q	.01
West Dome Consol.	Toronto	*6¼	*6¼	*6¼		....
White Caps Mining	N. Y. Curb	*6	*6	*6		......
Yukon Gold	N. Y. Curb	1⅛	*95	1¹⁄₁₆	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*21	18	*19	Apr. '20, M	.03
Batopilas Mining	New York	¾	¾	¾	Dec. '07, I	.12½
Beaver Consol.	Toronto	*25½	*25	25	May '20, K	.03
Coniagas	Toronto	1.70	1.70	1.70	May '21, Q	.12½
Crown Reserve	Toronto	*8	*8	8	Jan. '17,	.05
Kerr Lake	Boston	3	3	3	July '21, Q	.12½
La Rose	Toronto	*20	*20	20	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*16	*16	16	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.05	1.05	1.05	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4¼	4⅛	4⅛	July '21, Q	.15
Ontario Silver	New York	....		4	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb			*17	Jan. '12,	.10
Peterson Lake	Toronto			4½	Jan. '17,	.01¼
Temiskaming	Toronto			20¼	Jan. '20, K	.04
Trethewey	Toronto			12	Jan. '19,	.05
GOLD AND SILVER						
Barnes-King	Butte	65	55	60	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*69	*57	*67		....
Cash Boy	N. Y. Curb	*4	*4	4		....
Consol. Virginia	N. Y. Curb			*24		
Dolores Esperanza	N. Y. Curb	2⅛	2	2⅛		....
El Salvador	N. Y. Curb	*30	14	*28		....
Jim Butler	N. Y. Curb	*10	8	9	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	5	*4	4	June '16,	.05
Louisiana Con.	N. Y. Curb					...
MacNamara M.& M.	N. Y. Curb	17	15	17	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	‡			Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1¼	1	1	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*85	62	78		...
Tonopah-Extension	N. Y. Curb	1½	1½	1½	July '21, Q	.05
Tonopah Mining	N. Y. Curb	1	1⅛	1³⁄₁₆	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	*82	*75	*80	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*9	*9	9	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	†1.22½	1.17	1.20	Dec. '21,	.15
Chief Consol.	Boston Curb	2½	2¼	2½	May '21, Q	.05
Consol. M. & S.	Montreal	13	13¼	13¼	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†3.00			July '20, Q	.10
Daly-West	Boston	2¼	2¼	2¼	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb			2	Apr. '21, K	.05
Electric Point	Spokane	*3	*3	3	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*54	30	*50		.
Federal M. & S.	New York			7	Jan. '09	1.50
Federal M. & S., pfd	New York			22	June '21, Q	1.00
Florence Silver	Spokane	*11¼	*5	11	Apr. '19	.01
Grand Central	Salt Lake	†*25	†*10		June '20, K	.03
Hecla Mining	N. Y. Curb	4⅛	4	4⅛	June '21, Q	.08
Iron Blossom	N. Y. Curb			*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†3.00		...	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*4	*4	*4	June '21, I	.02
Prince Consol.	N. Y. Curb			*26	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*4½	4	4	Feb. '19	.01
Rex Consol.	N. Y. Curb	*11	*7	11		...
South Hecla	Salt Lake	†*30	†*40		Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*13	*12	*12	Oct. '17	.05
Stewart Mining	Boston Curb			*6	Dec. '15	.05
Tamarack-Custer	Spokane	1.75	1.70	1.75	Jan. '21, K	.04
Tintic Standard	Salt Lake	2.45	2.37	2.45	July '21, Q	.05
Utah Apex	Boston	1¼	1¼	1¼	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*1	*1	*1	Nov. '17,	.01
VANADIUM						
Vanadium Corp.	New York	29¼	27¼	29¼	Apr. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal			46	Apr. '21, Q	1.50
Asbestos Corp., pfd.	Montreal		*76		Apr. '21, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	37¾	36¼	37	Mar. '21, Q	1.00
Amer. Sm. & Ref. pfd.	New York	71	70	70	June '21, Q	1.75
Am. Sm. pf. A	New York			67½	July '21, Q	1.50
U. S. Sm. R. & M.	New York			30	Jan. '21, Q	.50
U. S. Sm. R. & M. pf.	Boston			39	July '21, Q	.87½

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, August 6, 1921 Number 6

Congress and the Tariff

THE TARIFF is not a simple subject. We announce frankly that we do not plumb its depths. And in the minds of those who seek for tariffs, or oppose tariffs, we do not find any depths of understanding. "It will fatten MY pocketbook" is the sole honest argument, although each tariff bill is generally smugly prefaced by the statement that the object is to provide revenue for the National Government. The sole honest argument of the opposition in each case is: "It will tap MY pocketbook." But these reasons, excellent as they are, are not national reasons; and either of them, or a compromise between the two, cannot safely be made the basis of legislation for the hundred millions.

The two parties proposing and opposing a tariff, for example, on graphite in pencils, representing the graphite miners and the pencil manufacturers, are often absurdly small numerically, and also in proportion of money interests involved, to the population and wealth of the United States; yet this last factor, the great third party involved, is generally not considered, and Congress decides between the two intensely interested minor groups and imagines it has acted with the wisdom of Solomon dividing the child. In other cases, there is really only one interested party sufficiently involved to appear as a special pleader, the party whose pocketbook the tariff will fatten; and that makes it easy for Congress, for it is a case of the interested producers or manufacturers versus the American public, and the latter do not appear. A special attorney should be appointed to represent the hundred millions, otherwise the *consumers*, in all these arguments; and then all parties would be represented.

A great step in advance has recently been made in the calling by Congress on the Tariff Commission for information. This commission has apparently conducted itself with great discretion, holding itself impartial as to theory and only ready as a source of unprejudiced and uncontaminated facts, which Congress finds it practically impossible to obtain from the interested parties. The Tariff Commission has helped specifically; but more than that it is a most hopeful precedent, in that the busy lawmakers of Capitol Hill call upon the expert students, steeped in investigation and free from interest, at the other end of the Avenue. We hope to see this liaison perfected at all points of contact.

The Foundation in Tariff Thinking

IT IS NECESSARY for each one to do his own thinking. He will often find himself rebuked for it as presumptuous: but the fact remains that he must do it, and each of the hundred millions must, too, otherwise good-by to democracy. The professional economists, we understand, have not been able to get themselves accepted as infallible in economic questions, such as the tariff: Congress and the press does not blindly follow them, and they differ among themselves. Therefore, disagreeable and unpopular as it is, we must think.

Our thought leads us to the proposition that *any legislation which benefits more people in the United States of America than it injures is good legislation; and, conversely, any legislation that injures more citizens than it benefits is bad legislation.*

Do you accept that? It is the rule of the majority; the principle of the greatest good for the greatest number.

Second, *that in considering the relative number benefited, and those injured, heads and not dollars must be counted.* Do you accept that? Legislation to benefit one man to the extent of one hundred million dollars, and to tax one hundred million Americans to the extent of fifty cents each, is bad legislation. Do you accept that? You must accept it. It is the foundation of our Government. And if you accept it, you must accept all variations of the rule. Any legislation that benefits a hundred thousand people and taxes a hundred million is bad legislation. It tends to enrich the few for the benefit of the many; whereas our ideals are democratic, and favor the striving toward maximum equality. And this is true no matter how greatly the legislation enriches the minority; in fact, it becomes more and more true. It is heads and not dollars that must be counted. Do you agree to that? If so, we have, right or wrong, some broad, honest, fair, sporting foundation to begin with.

If you agree to that, then it follows that any one who undertakes to obtain a minority advantage over the majority—that is to say, over the country—by special legislation, is a traitor, and is conspiring against the existence and growth of this free and democratic government. You have to agree to this, if you accept the premises.

Now, the tariff is legislation; and so, humbly but honestly groping for a firm foundation, we have some point to start from when specific instances come up.

The Many Industries in Mining

EVERYBODY THINKS LOOSELY; some people more so than others. A lot of people talk about protecting the mining industry. There is no mining industry as an entity. There is the coal industry, or rather the anthracite industry and the bituminous industry; the iron and steel industry, the copper industry, the graphite industry, the [illegible] industry, and many more. They are separate industries, with quite separate problems. You cannot lump them. Their classification together is founded on the broadest of common characteristics. The mining industries for practical purposes are no more to be grouped than are the manufacturing industries. What group would be so ignorant and narrow as to try to urge uniform legislation for manufacturing industries? Yet we find them undertaking to do it for the mining industries.

So we have arrived at a further point, that we must consider each industry separately.

The Tariff for National Defense

NOW WE MUST RECORD an exception to the economic conclusions we adopted above, and make the proposition: Legislation is good legislation if it is necessary for the protection of the nation, even if it works against the economic advantage of the majority and for the financial benefit of the minority. Here is a dangerous principle, but a sound one. Legislation to support an army, coast defenses, build the Panama Canal, are instances. The reason is that what is necessary to maintain the independence and power of the nation, cost what it may, is finally for the good of all.

The Application of the National Defense Tariff Theory

WE SAID ABOVE that this principle is a dangerous one, because it requires a clear judgment to apply it. Just as most of our selfish tariff measures are prefaced with the hypocritical statement that they are intended to raise revenue for the Government, just so many of these purely selfish claims are put forth with the sly statement that they are intended to provide the nation defense in time of war. Selfishness is honest: we cannot dispense with it; but smug hypocrisy is intolerable in all but ourselves. Therefore, in God's name, speak the truth, and let us get down to brass tacks.

As to the defense of the nation, there are two schools of thought that have arisen: One follows the theory that a certain mining industry should be encouraged and fanned by special legislation in order that the metal in question might be ready for the Government in case of war. The other advances the statement that the mineral supplies in question are in many cases limited, and that the legislation in question will very likely gut the ore reserves, or even exhaust them, before the next war. On looking over the ranks, we will find the special interests supporting the former view, the detached students the latter. Congress is perplexed by all this, and endeavors to face both ways at once, like the old god Janus.

The last efforts of the House of Representatives, for example, put tariffs on manganese and quicksilver to provide for the national defense by stimulating the industry, and removed the tariff on petroleum on the ground that our limited national petroleum reserves should be conserved. Yet one and the same condition applies to all three. Of course, Congress did face one way at first, and that all for the theory of artificially stimulating mineral extraction so as to have the minerals ready for war purposes. It adopted this theory, for petroleum, under the stimulation of the domestic petroleum producers; but none other than President Harding went to them and pointed out the necessity of having a national and democratic policy, not a sectional and plutocratic viewpoint, and Congress saw in the case of petroleum, but remained blind for other angles of vision. We understand that Mr. Harding was advised by Mr. Hoover, a mining engineer—one of the greatest—and, Mr. Hoover knows.

Soon afterward, the War Department comes to Congress with the opposite theory in the case of quicksilver, and induces Congress to place a heavy duty on this, in order that the War Department might have quicksilver in time of war. Now some years ago, Mr. F. L. Ransome, of the U. S. Geological Survey, having studied the quicksilver deposits of the United States exhaustively, announced that the reserves were limited, and that any policy of artificial stimulation would ruin them very soon, in which case the nation—and the War Department—would be without domestic reserves, and would be dependent upon overseas supplies. Now, the War Department had better keep out of this. The trail of the serpent is plain in its interference; and that it is being used as a stool pigeon.

An Answer to Prospective Correspondents

DO WE OR DO WE NOT represent the mining industries? We do—we represent fine and honest industries, and we try to do so finely and honestly. And we will not stand for any plan which we are not convinced is for the greatest good to the greatest number; that is to say, for the country. In other words, we shall strive to avoid being ultimately treasonable, which is as important an error to avoid now as during the blaring days of the Great War. We have the greatest mining industries in the world, and we shall see them revive with the general revival of business. You cannot keep them down permanently. But the welfare of the nation is our welfare.

The Proposed Monazite Tariff

WE WOULD LIKE to discuss each proposition for a tariff on minerals separately. But we do not know enough; and there are many mining industries. One of the most absurd movements, which Congress, we are glad to say, eliminated, was for a duty on monazite. The thorium element in monazite is used in the mantles of Welsbach gas lights. Our monazite supplies are very poor and scanty: those of Brazil and India rich and abundant. Very few people indeed would have benefited by even a high tariff: but every buyer of a Welsbach mantle would have paid the tax. According to our rules laid down above, it was bad legislation, and, therefore, Congress did well to cut it out.

The Potash Tariff

ON THE OTHER HAND, there is the question of potash. The House is willing to grant this tariff protection for a few years, after which it must stand on its own feet. The tariff protection will benefit only a limited amount of potash producers, and, on the other hand, will tax every farmer, and hence every eater, in the United States—and that includes most of us. By our first rule, it is bad legislation; but by our second rule, that is for the defense of the nation, we favor it. Here there is little question of conservation involved. It is true that our mineral reserves of potash salts are very limited; but our resources of manufactured potash as a byproduct or as one product of a two- or three-product manufacturing proposition are great enough to warrant the hope that a great and permanent potash industry might be established with nursing; and it would then be impossible to starve us out.

What About Zinc?

THE TARIFF ON ZINC is one of the best subjects for a real tariff argument that we know about. The zinc industry is national, not sectional—the American industry comprises all branches—mining, smelting and refining, manufacturing, consuming; we must grant that it is at least a fair subject in connection with which to consider national legislation. We have no firm opinion as yet on this subject, and should like to be instructed. First, do American zinc producers as a whole, including those who produce at home and those who produce abroad, desire a tariff on zinc? Second, what arguments can they present other than the understood one that they need the money—and in connection with that they must also show that they will get the money under a tariff. We hope to present some arguments on this subject from those who have studied it carefully.

The zinc people complain, among other things, that American exported zinc has been reimported into this country, spoiling the market for new American zinc. The same thing has happened in copper. Why has nobody asked for a tariff on copper?

Flotsam and Jetsam

OUR knowledge of the Sargasso Sea, that vast stretch of still water and floating seaweed in the North Atlantic, is somewhat hazy. So it probably is with most people if not with all, for the region has rarely been visited except by the occasional mariner unfortunate enough to lose his bearings and become entangled on its edge. We have no wish to visit it save in our imagination, which route is both cheap and safe. We imagine it must be rather hot and even sticky, with plenty of flies, mosquitoes, and the like, and with only an occasional hulk, long lost and unsinkable, to break the monotonous round of days. Perhaps what was once a Spanish galleon drifts by, its hull barely showing above the surface, and, of course, filled with ducats and doubloons. This would indeed make it less monotonous for many. This region is a sort of lost and found department of Father Neptune, where the owners never apply, and where, sooner or later, all the flotsam and jetsam of the Seven Seas finds its way to its last abode.

Lest this seem like a midsummer day's dream, we assure everyone that we are wide awake, for a while at least. But we can't help but feel occasionally as if we were in the middle of a sort of Sargasso Sea as we watch the matter coming to us, much of it unsought, from all quarters of the globe, for which publicity is asked or thought advisable. The stream is never ending. And that which attracts our attention most—the Spanish galleon, as it were—is the far too frequent prospectus or advertisement of the fraudulent promoter. Some of these are funny; occasionally we reproduce one for the benefit of our readers, but most of them are wearying. Ignorance on the promoter's part or a bland assumption of his reader's ignorance distinguishes them.

It would be far better for the public were there not so much technology connected with the mining and preparation of ores. Every scientific term or phrase is an asset for the faker and a means for deceiving the untutored. The latter still respect "learning," though to a less extent than formerly, and are readily gulled by the smooth-tongued fraud who, with his glittering promises, combines a glib use of technical terms.

But the flotsam keeps coming, and if, after picking it up and inspecting it, we jettison it into the wastepaper basket, the supply is not diminished. Nor will it be, so long as the laws remain as they are, and anyone, whether crook or fool, may lie to the limit about a hole in the ground and usually get away with it.

Efforts to Widen Copper Market Still Meager

WE HAVE YET to see any public evidence of efforts to extend the uses of copper by the committee which was supposedly formed for that purpose in 1920. Possibly it is considered that the time is not propitious for publicity work. Or it may be that the various producing, manufacturing, and selling interests are not willing to co-operate to the extent of financing the project. Meanwhile there is something like three-fourths of a billion pounds of copper above ground which is serving no useful purpose and taking up valuable storage space; our copper mines, mills and smelters are generally closed down; and much personal hardship to employees is likely to result. It begins to look as if copper was destined still to find its own outlet, as it has always done, and as it will if only bought for those purposes for which consumers resist the persuasion to use iron, aluminum, nickel, or zinc.

Some commercial organizations in the Michigan copper country are reported to be trying to increase the demand for copper in various manufacturing circles. A light-weight, durable, traveling bag or sample case of lacquered sheet copper has been developed, to take the place of leather. Some candy manufacturers have been persuaded to use thin sheet copper boxes for their product, the box being sufficiently attractive, durable and useful to have a selling value apart from the candy contents. Copper strips have been found useful to place between the leaves of automobile springs. Holes are punched in the copper which hold grease for lubrication, thus eliminating squeaks. A spring so made is said to be more resilient.

Who else is to develop similar new uses for copper and tell the world about them? We should not depend on local effort, but some organization representative of the industry as a whole should handle the project. If the Copper and Brass Research Committee is not functioning, possibly one of the large advertising agencies can perfect some kind of organization in which the expense would be borne partly by the producers, in the ratio of their normal annual production, and partly by the manufacturers, in the ratio of their normal amount of business done. We do not know if any advertising agency has tried this. It would no doubt turn out to be a real man's job.

In any campaign, particular attention must be given to selling copper and brass products at a reasonable price, as we have taken occasion to mention before. Possibly retail sales agencies will have to be established. Prices continue exhorbitant, even though some reductions have been made. We were glad to note the other day that copper window screening is now 17c. instead of 18c. per sq.ft., at our local hardware store, and we wondered if anything we had said had had anything to do with the reduction. We understand that jobbers expect a profit of something like 100 per cent on copper products, whereas 15 or 20 per cent is considered satisfactory in the case of iron and steel, which are looked on as standard. Copper, being a luxury, is sold in much smaller quantities and is assessed a high overhead, with apparently a few other extras hitched on in addition to be certain that the transaction shall be a profitable one. It would appear that a fine opportunity exists for some one particularly interested in the sale of copper to bridge the gap between the manufacturer and the ultimate consumer.

WHAT OTHERS THINK

Graphite and the Tariff on Minerals

Mr. Marc Pawl,
New York City.

Dear Sir:

I was greatly interested in your article, "The Tariff on Minerals," published in the June 11 issue of *Engineering and Mining Journal*, especially what you wrote concerning the occurrence of graphite in the United States. Reading the article the second time prompts me to ask you your source of information concerning graphite in our country.

As a matter of information I am mailing to you, under separate cover, a small sample of our crystalline graphite, mined here in Montana. These are small lumps—that is, they have been graded down from the larger lumps. The graphite occurs in lumps often weighing several pounds, and is as pure as the sample sent you. This material was mined continually during the war and shipped to Pennsylvania. It would be shipped now if the Ceylon product (the only competitor of our grade) was not allowed to come into this country free from duty, after having been dug by some of the cheapest labor on earth.

All of this is for your information as a writer of articles which help to mold public opinion. If it were only possible for all of the writers of such articles fully to inform themselves of the facts concerning these minerals, and of our vast undeveloped mineral resources, before sending out their material to the reading public, our public opinion, which we hear so much of, would be on a more reliable basis.

With best wishes for your succeeding articles, for which I shall watch with much interest, I am,

Yours truly,

PEARL I. SMITH,
Crystal Graphite Co.

Dillon, Mont.

Mr. Pearl I. Smith,
Crystal Graphite Co.,
Dillon, Mont.

My dear Mr. Smith:

In reply to your letter of July 3, received through *Engineering and Mining Journal*. It is a matter of regret to me that each person applying for a tariff on his particular product who has replied to my article on "The Tariff on Minerals" should have found the article to show so much ignorance. There is, however, a possibility that it is due to a misunderstanding of what a person's knowledge is or should be. I have examined graphite deposits from those interbedded with the schists of the Sawtooth Range near the Arctic Ocean to the beautiful amorphous deposits in Mexico, so that if my article makes me appear altogether ignorant of the subject it is because of lack of skill in writing. I have known of your deposit since it was first worked, was wholly aware of your output, and had it in mind when I wrote the paragraph on graphite. According to the figures of imports of graphite as collected by the Department of Commerce, the imports of graphite from Ceylon in 1913, the year before the war, were 16,996 short tons, valued at $1,674,764. In 1916, a year in which prices were exceedingly high, the imports were 42,494 tons. From then on, difficulties of shipping reduced the imports from Ceylon, until in 1918 this country received only 9,418 tons; but prices were accordingly higher.

In 1913, if I am not mistaken, your deposit had been for several years under development, but had not yet made any considerable production. In 1918, under the distressing shortage and the exceedingly high prices for graphite in this country, I should be surprised if your deposit was able to produce a quantity equivalent to much more than 2 per cent of the Ceylon graphite imported, a quantity that under a normal year like 1913 would become a much smaller proportion, probably less than 1 per cent. It is on this basis that I made my argument. Under no conditions can this country produce from its own deposits any considerable part of the lump graphite needed.

New York. Cordially, MARC PAWL.

A War Minerals Relief Claimant's Point of View

The camel's back is broken. The last straw is your latest philippic which appears in your editorial columns printed under date of July 2. We can no longer remain silent on your hostility toward the claimants seeking relief under the War Minerals Relief Act. Our view may be one of those which you class as "inevitably . . . personal"; but may we make so bold as to apply your own phrase to your opinion? If our memory serves correctly, we attended a meeting in December, 1918, at Washington, of war mineral producers who were seeking relief, and while there were told by you that "some 80,000 tons of chrome ore were brought into this country in spite of the embargoes, through some loose governmental machinery."

In the beginning, when you were part of the War Industries Board, meetings were held to determine a method of stimulating the production of chromite for war purposes. Requests from this board in no uncertain language were sent to us in the West. We were told "it would be a patriotic act to produce chrome in California." A brief for the claimants now should be unnecessary. Congress passed the relief measure, but the administration of relief to the claimants is opposed by the editor of the *Engineering and Mining Journal*. We thought a mining publication supported the necessities of the miners; we have evidence of this in our midst through the editorial columns of a well-known mining publication on this coast. Should the editor of a mining journal seek to obstruct relief that Congress intended the miners to have, we believe some other publication should be used. We could name many; perhaps the *Appeal to Reason* would be fitting. You commend the truculence displayed in the administering of the relief, and we think we are not far wrong in saying such a paper also has a truculent policy. All claimants we have talked to are unanimous that truculence was an "outstanding characteristic." Further than this we know not.

Notwithstanding our geographical handicap, the West went to the East by the latest mode of travel only to learn through the truculent reception that such presumption was not tolerated. Our journey should have been made on foot with pebbles in our shoes, and frankincense and myrrh in our burden. Then, perhaps, by supplication, we could have overcome the truculence and been permitted to continue on our way and sin no more.

"Honest John Shafroth" has our sympathy. We found the truculence was so outstanding that it usurped the chairmanship. Yea, we believe it would have arrogated unto itself the chief executive's chair were it possible. We do not wonder that Secretary Fall accepted the resignation of truculence. It has permeated the relief measure too long. Secretary Fall saw this from afar, and needs not the guidance of the *Engineering and Mining Journal's* vision.

Glittering objects attract weak eyes. This glittering truculence has been so outstanding that to all appearance it has not only attracted the editorially weak eyes of the *Engineering and Mining Journal*, but blinded them. Upon close approach you could only see the reflex of yourself, a pleasing thing to warped visions. Peering around, the new appointment meets your view, and no glittering truculence presents itself; so you hurl an invective, and a maladroit innuendo is cast at our Secretary of the Interior because he chooses a new commissioner from a peculiarly named West Virginian town. The quality of this thrust is not lost in attempted facetiousness. It asserts itself, as did the truculence, now terminated by Secretary Fall. Our new Secretary would not prostrate his office to its domination. He willingly combats it; he discards it; he regards it as the antithesis of relief; and he can now proceed to administer relief to the claimants as was intended by the act.

We do not attempt to disculpate ourselves in saying your malignment of Senator Fall's liberality is praise indeed. Ours may have been an erring path, but it was human; nor do we look for support or sympathy in your columns. The facts we righteously demand, and we would ask you to explain your apparent ignorance of Congressional inquiry into the truculent adjudication of the claims. We would call this inquiry the result of "the breath of criticism" you deny. In explaining, you might include the theory by which you conclude "They (the commission) have completed their work." Claims are still pending, and we cannot believe you are purposely misleading, but might infer you intend ambiguity. The second paragraph of this editorial is to the point. "We all have a tendency to 'know better.'" Undoubtedly you "know better" than Secretary Fall. You can run the Secretary's office better than he can. You can pass on the claims better than his commission.

We have often pitied the boorish orator who at his peroration resorts to mingling flag waving with his speech, arousing thereby maudlin cheers which in its surfeited bigotry he interprets as public praise. The writer can wave no flag in print, but his recourse is the unbeatable argument of protecting the taxpayer's pocket. Concluding in this way as you did affects our digestion; we expected logic.

That Secretary Fall may read this in your columns is perhaps an unreasonable desire. It is not a necessity, as his fearlessness has been proven. He intrepidly overcame the truculence of the old regime, he casts aside the precedent of parsimony, and says the meaning of relief is plain. No stunted stature is his lot in life, and he strives to achieve success without prejudice; he can view from lofty heights and with human kindness be humane to the deserving.

Our hats are off to Secretary Fall and his new commission. The truculent have flourished like the green bay tree, and as we look now they are not.

San Francisco, Cal. C. S. MALTBY.

The National Geographic Society Championed

Your editorial, "Science, Journalism, and Hypocrisy," in *Engineering and Mining Journal* of July 9, 1921, shows vividly how nearly dormant the mining industry really is. Have you really nothing better to do than make such a gratuitous attack upon the National Geographic Society?

Your case is so weak that it would fall of its own weight—if it had any. In the seventh paragraph you admit that anything left over from the costs of the magazine goes to support expeditions and the like, but have you attempted to find out how much of each member's $3.50 is used in that way? Does not the fact that the society and its magazine are non-commercial, and that even part of the $3.50 is used for other purposes than the production of the magazine, sufficiently distinguish the *National Geographic Magazine* from those of the class to which the *Engineering and Mining Journal* belongs, and justify the classification of the $3.50 as "dues" rather than as "subscription"?

Much can be forgiven you, taking into consideration the fact that the metal markets are rotten, and that you are no doubt hot, and half mad because you have to stay in the city; but be careful how you attack the magazine of the "700,000," or some one may point out why your subscription list is 10,000, while the other is 700,000. WALTER O. BORCHERDT.

Austinville, Va.

The Dignity of Engineering

An article appearing in the July 9 issue of *Engineering and Mining Journal*, under "What Others Think," was given the strange title, "Not Even a Correspondence School Engineer." The last paragraph of this article, in which the writer admits that the whole thing is a series of "rambling observations," probably explains the imbecility of the comparison he tried to draw between a man educated for, and experienced in, the engineering profession, as against a would-be promoter in one case and a prospector in another. It would be necessary to "ramble" far afield to stretch the imagination to a point where such a comparison as this could be reasonably drawn.

Why should an engineer of any kind, mining, mechanical, or civil, be given preference over a barrister, lawyer, or doctor, when attempting to make a comparison with a promoter or prospector? We all know that an engineer is trained to have the highest regard for facts, and cannot become a successful engineer unless he religiously applies the training to his everyday work and applies himself to engineering work and not to promoting or prospecting, or some other line of work foreign to his profession.

I think we will all agree that the average promoter has never received a special training which would prepare him to deal exclusively with facts.

The admission that all the statements in the article, "Not Even a Correspondence School Engineer," are rambling observations, does not, however, explain why the writer thinks he should term himself an engineer of any description. Just because a man failed to get through a college course, after making three attempts with three different educational institutions, and afterwards also failed to promote a number of mining propositions, is no good and valid reason why he should call himself some kind of an engineer. Neither does the lack of understanding concerning the duties of an engineer entitle him to an E. M. or a C. E.

Leaving the question of whether or not this gentleman's observations are inclined to "ramble" and whether or not he has any title to call himself an engineer of any kind, I sincerely hope that circumstances may bring him in contact with a real engineer of education and ability, of which there are many, and that through this source he will learn that the average real engineer would far rather live up to the highest standard of his profession, and execute a creditable piece of engineering work for a salary or fee, and the satisfaction of having done a good job, than be the middleman in some promoting scheme for which he would receive a large commission, which generally is not earned.

An engineer does engineering work, not because he lacks the "gumption" and ability to promote or prospect, but because he is an engineer. B. BARNES.

Bauxite, Ark.

Converting High-Grade Matte

I have been much interested in the problem of converting high-grade copper matte in basic-lined converters, and am offering the following comments on a recent inquiry of one of your correspondents on this subject.

From the limited account in the short paragraph in your issue of Jan. 29 it would be impossible to give an exact method of procedure for continuous operation. However, it is probable that with the proper converting equipment and a reasonable amount of care this work could be done.

To solve this problem it would be necessary to know the copper content of what is called a "combined mass of shot copper and high-grade matte," as well as the percentage of metallic copper present. It is probable that this metallic portion would contain about 95 per cent copper. It would also be necessary to know the analysis of the siliceous rock used as converter flux, particularly its silica and alumina content, as well as the elevation of the plant above sea level and the size of the converter to be used.

As a provisional answer I would say that if this work were to be done in a successful manner it would be necessary to use a basic-lined converter having a fairly large capacity, at least nothing smaller than the 10-ft. diameter Peirce-Smith converter with 30 tuyères 1½ in. in diameter, or the 12-ft. Great Falls type with 24 tuyères 1½ in. in diameter, though it is possible that a smaller size might do. The air-gage pressure at the converter tuyères would have to be at least 15 lb. if the plant were situated at sea level, or at least 18 lb. if the plant were a mile above sea level. The converter flux would have to contain at least 85 per cent silica and less than 5 per cent alumina and be fed to the converter in a maximum size of 1 in.

If the matte is so high grade that no iron is present, the converting process would require no silica and would become an easy matter. Securing a slag that can be skimmed when the matte contains only a small amount of iron is much more difficult.

The temperature of this matte would be incidental. The fact that such a mixture could be tapped and transferred in a pot of any kind without making excessive skulls in transfer pots and launders would be sufficient assurance that its temperature was sufficiently high. It would probably be necessary to heat the converter up to at least a bright red heat for the initial charge of hot matte, but the heat from the previous charge would be sufficient after regular operation was established, provided the time lost in pouring out the copper made was not too much.

I have been able to convert a copper matte containing up to 60 per cent copper in a Peirce-Smith type of basic-lined converter at an altitude of 7,000 ft. with an air-gage pressure of 14 lb. at the converter bustle pipe. This work could not be done with a pressure of 12.5 or 13 lb. An attempt to convert a 65 per cent copper matte with 14 lb. pressure was also unsuccessful because it was impossible to "raise" a converter slag that could be skimmed. This might be partly because of the poor grade of silica flux used, which contained 62 per cent silica and 15 per cent alumina. It might be interesting to note that the 65 per cent copper matte contained 3.5 per cent "metallics" which analyzed between 92 and 96 per cent copper.

The most interesting part of the paragraph was the statement that the furnace slag contained 0.2 to 0.3 per cent copper. What was the mineralization and composition of the charge and the percentage of matte fall? What was the slag analysis? M. S. MAZANY.

Rancagua, Chile

Referring to the correspondence concerning the conversion of high-grade matte in *Engineering and Mining Journal* of Jan. 29, March 26, and April 30, I incline to the opinion of Mr. Grabill that Mr. Demond is putting it too strongly when he states that "it is quite out of the question to treat in a converter the high-grade reverberatory product" under discussion, consisting of a "combined mass of shot copper and high-grade matte."

At several times in my experience, matte running from 60 to 65 per cent copper has been poured into small basic-lined converters when mixed with as much as 25 to 45 per cent of its own weight of molten metallic copper, and the converting operation has been successfully carried out without pre-heating, and without the addition of fuel or any other substance the combustion or action of which would tend to add heat to the charge.

It would certainly be interesting to obtain more data as to the method of obtaining, along with the high-grade matte and copper, the reverberatory slag of 0.2 to 0.3 per cent copper, a product far cleaner than that obtained in ordinary practice, and I would add my plea to yours and that of Messrs. Demond and Grabill that your original correspondent come forward with additional data, no matter how fragmentary.

Westbury, L. I. M. H. MERRISS.

THE CARBON MOUNTAIN MILL OF THE QUENELDA GRAPHITE CORPORATION

Graphite Industry of the United States And Canada

Review of the Geographical Distribution of the Mineral, Various Methods Of Milling Now Practiced and the Present Position of the Graphite Miner —The Proper Marketing of Graphite an Important Problem of the Industry

BY BENJAMIN L. MILLER

Written for Engineering and Mining Journal

NOTWITHSTANDING the fact that graphite in one form or other is in almost universal use among civilized peoples, a great many erroneous ideas concerning its economic utilization are still prevalent. The most common mistake made is the assumption that only one variety of graphite exists, and consequently that the product of any region may be utilized for all the various purposes for which graphite is used. Numerous instances might be cited to prove that unscrupulous promoters have deceived their clients in this respect.

When presented with Government statistics showing that the bulk of the graphite used in the United States has been imported from far-off Ceylon, many a man has been eager to invest in a company engaged in the exploitation of a domestic graphite project, only later to learn that his product was unsuited for many purposes. Indeed, so much money has been lost in graphite ventures in Canada, New York, Pennsylvania, Alabama, and Texas that among many people the mineral itself is no blacker than the reputation of the graphite industry. In every one of these regions, abandoned mines and decaying concentrating mills bear witness to the unwise investments of capital. In fact, it is doubtful whether among the hundred or more companies formed to exploit the domestic graphite deposits there are more than four or five that have returned the capital invested. Many a man has congratulated himself when he has succeeded in selling his interests to some one less familiar with the difficulties of the business.

In many attempts to create a domestic graphite-producing industry the history is about as follows: The discovery of graphite-bearing rock leads to the formation of a company in which all the stockholders are certain that the profits will be extremely high, owing to the early capture of all the American markets supplied by foreign concerns. A mill for concentrating the graphite is soon built at a cost of $25,000 to $75,000, and operations are started. After a few days of operation the mill is closed to make adjustments or to replace portions of the machinery to effect a more complete recovery or to produce a better product. In some properties short periods of running and long periods of repairing and refitting go on for years until the working capital is exhausted, the stockholders are disgusted and unwilling to advance more money, and the operations cease. Reorganizations with new capital may be effected, but the same procedure of partial or complete overhauling of the mill equipment at frequent intervals continues.

MANY CHANGES CAUSED BY THE WAR AND ARMISTICE

The Great War brought about great changes, due to the unusual demand for crucible graphite and the difficulty of obtaining the foreign product from Ceylon and Madagascar. Renewed activity and the development of many new properties in the domestic production, especially in Alabama and Texas, occurred, followed by almost complete stagnation, which still continues. Only a high import tariff can save the situation, in view of the fact that graphite crucible manufacturers still prefer the Ceylon product, and further, the Madagascar graphite, which is similar to the flake variety produced in the United States and Canada, can be put down in New York in quantity at less cost than that of the domestic product, according to the testimony offered by the operators in a recent Congressional hearing.

Three fairly distinct varieties of graphite, amorphous, vein, and flake, are found in various countries. The amorphous variety is soft or pulverulent, and in places occurs in beds representing metamorphosed coal beds. It is the cheapest variety, has a wide distribution in the metamorphic rocks, and is used mainly for foundry facings and paint. Some of the purest amorphous graphite from Mexico is used for lead pencils. The vein graphite of commercial importance is practically confined to Ceylon, and it has long been regarded as superior to any other for crucible manufacture. The flake graphite occurs as thin flakes disseminated through metamorphic limestones, schists, and gneisses. This is the variety that has been the foundation of the graphite-producing industry of the United States and Canada. It is especially adapted for use as a lubricant, but the better grades have also been used for crucibles and the poorer ones for paint, stove polish, and various other uses. The controversy concerning its desirability for crucible manufacture in comparison with the Ceylon product still continues.

NORTH AMERICAN GRAPHITE MAINLY IN THE EASTERN UNITED STATES AND CANADA

Alabama, New York, Pennsylvania, and Texas contain the principal deposits of flake graphite. Rhode Island, Michigan, and Nevada possess the amorphous variety, and Montana has the only occurrence of vein graphite of any importance. In Canada the provinces of Ontario and Quebec contain the most important deposits thus far developed.

The mining of graphite rock in the United States and Canada is very simple. Open-cut mines are the most common, but, with increasing depth, underground mining becomes necessary. In most of the mines of the United States only the decomposed rock is utilized, and few of them have been extended in depth to a point where the pit method becomes impracticable. When underground mining is done it is seldom that any considerable amount of timbering is necessary. Stoping is generally simple, as the workable beds are usually several feet in thickness and fairly uniform. As the graphite occurs in regions that have undergone considerable deformation, steep dips are common.

REFINING FLAKE GRAPHITE AN IMPORTANT STEP

The greatest problem confronting the flake-graphite operators is the economical and efficient separation of the graphite from its associated gangue minerals. These associated minerals may be divided into two classes: those minerals that are loosely associated with the graphite particles and easily freed, and those smaller impurities that are intimately associated with the graphite and commonly lie between the thin laminæ of the graphite flakes.

The cleaning of graphite in most mills is divided into two stages which are, in a general way, concerned with the removal of these two kinds of impurities. In the first stage, termed the concentration process, the ore as it comes from the mine is crushed and treated in various ways to free the coarser and loosely adherent impurities, the resulting product being called "concentrate." The further cleaning of the graphite by finer crushing and screening by which the more firmly adherent impurities are removed is designated the "refining" process, and the product is called "refined graphite." In both processes the object is the same, but the methods, as well as the types of machinery employed, are, in most mills, quite unlike.

The problems encountered in the separation of disseminated graphite from its associated minerals are numerous and difficult. The ordinary processes of milling are reversed, because in graphite concentration it is the mineral with the lowest specific gravity that must be saved. If the separation be a gravity one, the difference in specific gravity of graphite and its most commonly associated minerals, quartz and feldspar, is so small that the process is delicate and a slight change in the adjustment of the machines seriously affects the separation. Graphite has a specific gravity of 2.09-2.23, quartz 2.65-2.66, feldspar 2.47-2.67, calcite 2.71, mica, 2.7-3.1. The less common minerals, such as hornblende, pyroxene, pyrite, pyrrhotite, epidote, scapolite, and limonite, with much higher specific gravities, are easily separated from the graphite except when firmly adherent to the graphite flakes, and even then can be loosened by fine grinding, after which gravity separation can be readily accomplished.

CRUSHING GRAPHITE A SPECIAL PROBLEM

Graphite occurrences are of two kinds, the hard ore and the soft decomposed ore. Most of the mines are operating in the soft ore, so that a minimum amount of crushing is required, but some graphite is contained in hard rocks that have undergone slight changes. In such formations the crushing is a matter of considerable expense.

In the crushing of the ore, considerable care must be taken because the softness of the graphite causes it to break much more readily than the accompanying minerals. The larger the flakes the higher the price that can be obtained for the product; consequently it is advisable to crush the ore only enough to secure the maximum amount of large clean flakes, and yet without losing too much of the graphite in the tailing, due to incomplete crushing and imperfect separation of the graphite from adherent minerals of higher specific gravity.

In hard ore the graphite is set free by the breaking of the quartz and feldspar with which the graphite flakes are intimately intergrown. Soft ore as it goes to the mill may be in lumps of a foot or more in diameter, yet the binding material is only the kaolin formed by the decomposition of the feldspar. In the crushing of hard ore, naturally more of the soft graphite flakes will be cut by the angular fragments of the quartz and feldspar, but this is partly counterbalanced when compared with the decomposed ore on account of the firmer character of the flakes. Although graphite itself is scarcely chemically affected by weathering, the physical character is changed somewhat so that the flakes crumble more readily, probably due mainly to frost action when water passes between the laminæ of the flakes and in freezing pushes them apart.

TWO-STAGE GRINDING GENERALLY PRACTICED

The common practice is to grind the ore wet, although some mills have been equipped with driers through which the ore passes before going to the separation machines. In almost every mill the crushing is in two stages. The ore from the quarry is passed over grizzlies or through revolving trommels, the oversize going to gyratory crushers, jaw crushers, or directly to a Chilean mill. The second stage of crushing is accomplished by rolls, stamps, Chilean mills, or ball mills. As many as three sets of rolls may be employed in series, the product of the first set of rolls passed over screens with the oversize going to a second set of rolls and screens, and the oversize being again sent to a third set of rolls.

Stamps have been used in some of the mills, but they were not satisfactory, because of the tendency of the wet graphite to form compact smooth masses, which adhered to the walls.

Chilean mills have been found effective for the soft ore, either preceded by coarse crushing or not. When the ore is crushed wet the flake is floated off to the washing machines as soon as liberated. The product may be passed through rolls before being washed, although this is not the most common custom.

Moses,[1] in some experiments for the Bureau of Mines, reached the conclusion that the pebble or ball mill was the most effective fine-grinding machinery for soft Alabama graphite ore. He says:

"It was decided that although the coarse sand impurities were much harder than the graphite flakes, they were, at the same time, so much more brittle than the carbon that the concentrate could be ground in some manner so as to materially reduce the size of these hard brittle particles without causing a material reduction in the size of the graphite particles themselves. A careful survey of the different classes of grinding machinery indicated that this operation could be carried out with the greatest chance of success in a mill of the ball or pebble type.

"The difference in the specific gravity of the two classes of substance was also a reason for believing that this sort of selective grinding could be done. It was thought that under the correct conditions of dilution the heavier sandy material would tend to classify in the bottom of the charge among the grinding balls, where it would be ground more than the graphite, which, because of its lighter weight, would tend to segregate higher in the charge and out of the grinding zone. Such a separation corresponds closely to that in a hydraulic classifier. The results obtained from experiments proved that in most particulars the assumptions were fundamentally correct."

GRAPHITE CONCENTRATION EMPLOYS MANY PROCESSES

After the ore has been crushed, the next step is to separate the graphite from the other minerals. In the crushing the graphite and mica have been broken into thin flakes, and the quartz, feldspar, kaolin, and other brittle or pulverulent minerals have been broken into angular fragments. The shape of the graphite and mica particles renders them more easily held in suspension in running water, and they can be floated off, although they are more than twice as heavy as the water, or if treated with an air blast will be blown much farther than the angular pieces of quartz.

Numerous methods have been devised for the separation of the graphite flakes from the accompanying minerals, so many in fact that it is not advisable to attempt to describe all of them in detail. All make the attempt to recover as great a percentage of the large flakes as possible, even though there be considerable loss in the tailing. It is not uncommon to have the largest and thickest flakes lost, as well as considerable amounts of dust. A perfect recovery is not possible, and it may even be found practicable to permit what might seem to be an unusually heavy loss.

The practice varies also in regard to the grade of concentrate produced. Certain operators prefer to make a high-carbon concentrate with practically all foreign minerals removed except those that occur between the laminæ of the flakes. Other graphite producers consider it more profitable to produce a lower grade, with the thought that the impurities will be removed in the finishing or refining mills. These matters are governed by the type of concentration machinery used, the cost of producing a clean concentrate, and partly by the personal equation of the operator.

The various processes of concentration may be grouped in the following classes:

- Water flotation processes
  - Log washer
  - Buddle
  - Concentrating tables
  - Float boxes
  - Oscillators
- Oil flotation processes
  - Minerals Separation process
  - Callow cell
  - Simplex process
  - K and K flotation process
- Pneumatic process
- Dry screening process
- Sutton, Steele & Steele dry process
- Electrostatic process

A number of mills use various combinations of two or more processes. In fact, there is a growing belief that some combination will eventually be found most efficient for all the graphite ores.

The lack of unanimity in any district, as one can often obtain from the operators exactly opposite opinions regarding the advantages or disadvantages of any particular process, renders it unwise to attempt to pronounce upon their comparative value so long as experiments performed under similar conditions and on the same type of ore are lacking.

WATER FLOTATION PROCESSES

Log-Washer Process—One of the simplest but nevertheless most efficient machines used in many graphite districts is the log washer, one of the oldest types of washing machinery used in ore dressing. In practice a number of washers are arranged in series, with the sand rewashed several times before being discarded as waste. A little oil is generally used, to hold the flakes on the surface and to prevent them from again becoming mixed with the sand. The float is washed in revolving hexagonal reels. The angle of inclination of the screw must be carefully determined by experiment, so that the graphite and a minimum amount of impurities may be floated off at the lower end of the box, and a minimum amount of graphite permitted to settle in the box and be forced out of the upper end of the box by the revolving screw.

During 1918 two Alabama plants used log washers. The process is less popular than formerly, although it possesses the advantage of cheapness on account of the low equipment cost, and eliminates the necessity of drying the ore.

Buddle Process—Buddles have been extensively used in the Pennsylvania mills and have been fairly successful, although within recent years the amount of labor involved in their use has caused operators to abandon them. There seems to be no satisfactory way of getting concentrate, middlings, and tailings out of the buddle except by hand shoveling, which is both slow and expensive.

---

[1] [illegible] G. Moses, Refining [illegible] Alabama [illegible] War Minerals Investigations Series, No. [illegible] Washington, D. C., 1919.

The buddles consisted of circular tanks about three and one-half feet in depth and about sixteen feet in diameter. The ore from the crusher was mixed with much water and poured into the center of the tank. One or more revolving arms attached to a central shaft kept the water agitated sufficiently for the graphite to be mainly floated to the side of the tank, whereas the impurities remained near the central shaft. After the tank was filled, and material allowed to partly dry, it was then shoveled out. The outer portion was composed of rather clean concentrates and the middle portion contained both graphite and impurities and had to be passed into another buddle. The inner portion, consisting of sand tailings, was discarded.

Concentrating Table Processes — Experiments in graphite concentration by means of shaking tables, such as the Wilfley, James, and Overstrom, have been made, but so far as known no mill has ever found them entirely satisfactory. The chief difficulty seems to be due to the large amount of middling produced. The claim is sometimes made that the tables have not been given a fair trial and that they should prove successful.

GENERAL LAYOUT OF THE PLANT OF THE QUENELDA GRAPHITE CORPORATION, LINEVILLE,

Float-Box Processes—Several different types of machines have been constructed, all based on the principle that dry graphite flakes when thrown on the surface of water would not be wet readily and would accordingly be floated over a spillway while the irregularly shaped particles of other minerals would settle at once. In the use of this process, which Dub terms "water 'skin flotation,'" it is necessary to dry the finely ground ore before sending it to the concentrator.

In some mills the custom has been to send the unclassified ground ore direct from the drier to the concentrator, but the best results have been obtained where the material is first treated in an air classifier. In this way much of the fine dust is removed as waste and a better recovery made with evenly sized ore. The regulation of the feed and the speed of the water current can be made to suit the character of the ore when separate machines treat the different sizes.

Air classifiers are of various designs, but in the form of boxes or chambers in which a suction fan is placed at the back and the graphite ore fed in front of the top in the form of a falling sheet of fine ore. Baffle boards in the box divide it into several parts, each of which connects with a hopper or bin below. In operation, the larger quartz and feldspar particles, scarcely affected by air suction, drop almost vertically into the first pocket while the finer materials are carried into other pockets farther back, and the finest dust is sucked out of the box into a collecting dust chamber. The number of products made varies.

The greatest disadvantage of the float boxes is that a considerable loss of the thickest flakes always occurs, on account of the readiness with which they sink. Also, any flakes of mica present will float off with the graphite. If a small amount of oil be added to the water to aid in the flotation of the graphite, a better recovery is effected.

The most elaborate modification of this type of concentration machine is known as the Munroe washer, in use in several graphite mills in Alabama.

The Colmer washer, also used in Alabama, differs from the Munroe machine in that it is circular in form and the feed is over a revolving conical plate with ribs which throw the graphite particles on the surface of the water in a tangential direction. It is claimed that this method of feed does not break the surface tension film of the water as readily as in the other methods.

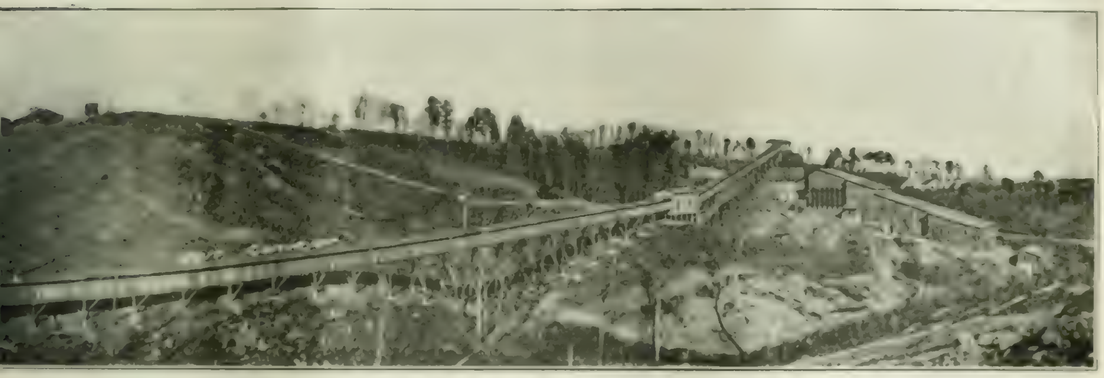
Oscillator or Rake-Box Process—The principle of the oscillator or rake-box process is the same as that of the log washer, as the ore mixed with water is kept agitated and the sand is carried forward in an inclined box by rows of rakes with staggered teeth attached to an eccentric. The teeth rake the material forward, are then lifted and carried back, and again dropped in the box. Water spilling over the lower end carries the flakes from each box to hexagonal revolving reels. In one mill the sand passes through three rake boxes and then to rolls. After grinding, it passes through another rake box and is discarded. Some kerosene is allowed to drip in the upper portions of the rake boxes from suspended cans and aids materially in the flotation of the graphite flakes.

Excellent results have been obtained by this type of machine where soft ores are being worked. It bids fair to become the most approved process in the Pennsylvania graphite region.

OIL FLOTATION NOT NEW TO GRAPHITE PRODUCERS

Long before oil flotation processes were devised for the separation of metallic ores from the gangue, and before the invention of special flotation machinery, oil was used in the Pennsylvania graphite district to aid in the flotation of graphite. The discovery is said to have been made when a man carrying an oil can happened to let a few drops of oil fall on the surface of the water in a log washer, and observed that it collected and held a cluster of flakes on the surface. Accordingly, a tin can with a small hole in the bottom was filled with oil and suspended over the washer, thus permitting occasional drops to fall on the surface of the water. This simple practice is still continued, but, in addition, several more elaborate oil-flotation processes in which special machines are employed have been installed in graphite mills.

In Pennsylvania the Kraut and Kohlberg (usually known as the K. and K.) process is the only oil-flotation process ever used, and it was discontinued, but in the Alabama graphite district there are mills equipped with Minerals Separation flotation machinery, Callow cells, and the Simplex process machinery. As all of these processes are well known and contain no special features as used in graphite concentration that distinguish them from their uses in the concentration of metallic sulphides, descriptions are not necessary.



ALA. SHOWING OPEN-CUT WORKINGS AND MILL. THIS PLANT IS NOT NOW OPERATING

Oil flotation for graphite concentration is undoubtedly very efficacious, but the use of more elaborate types of machinery introduces problems that have not been entirely overcome. Special skill seems to be required on the part of the mill superintendent to avoid excessive waste. Some graphite producers prefer to use oil flotation in combination with water flotation, especially in fresh ore with much pyrite, as the pyrite particles are also carried off by the oil.

PNEUMATIC PROCESS ANOTHER CONCENTRATING MEDIUM

Although there have been few examples of air concentration for many years, it may not be out of place to include a description of the Hooper pneumatic concentrator, which has been tried in one or more mills.

"The Hooper pneumatic machine consists of a flat chest containing a diaphragm actuated by eccentrics on a driven shaft running horizontally beneath the chest, and this chest, in turn, is surmounted with a movable deck of a peculiar design, the two separate parts being connected with a hollow ball and socket joint.

"The eccentrics, which are adjustable, act upon the diaphragm, causing pulsations of air to pass up through the ball-and-socket joint and through a second diaphragm immediately below the deck, which consists of a cast-iron grating covered with broadcloth. Over this grating is the concentrating top, consisting of a cast-iron frame with parallel strips of sheet brass extending diagonally from side to side, and these in turn are surmounted by another set of parallel strips diagonally in the other direction. The ball-and-socket joint permits of the top being set at any vertical or lateral inclination.

The ore is fed to the upper end of the concentrating top and aided in travel to the lower end by the rapid pulsations of the air which pass up through the broadcloth, effecting at the same time a concentration according to gravity. The lower brass strips, or riffles, carry the heavier portions to the lower side of the deck while the upper brasses or channels carry the lighter or top stratum diagonally to the upper side. At the discharge end of the deck are finger pieces which guide the various products to their respective receptacles. These machines require very accurate sizing of material, and when once set as to eccentric throw, speed, and vertical and lateral inclination require no further care beyond cleaning the broadcloth bed, which should be done about every five hours."

Dry Screening Process—Within recent years a dry process that had been previously used in Canada was tried in the Pennsylvania region. The ore was dried as it came from the quarry, ground in rolls, and passed over tap screens a number of times. The chief objection to the process was the small recovery of good flakes and the excessive amount of middling, which was cleaned with difficulty.

Sutton, Steele & Steele Process—At least two mills in the Alabama graphite district have been equipped with Sutton, Steele & Steele dry-concentrating machinery. At the time of my visit to the region one of the mills was being overhauled and the other was in course of construction, so that no first-hand information could be secured on which to base an opinion of the efficiency of the process. Dry-concentrating tables, jigs, and dedusters were employed.

Electrostatic Process.—The Huff electrostatic machines, with some modifications, have been used with success in one plant in the Alabama district for several years. The principle that renders the process useful is the difference in electric conductivity between graphite and its associated impurities, consisting mainly of quartz and mica.

The chief objection to the process is that it is not entirely satisfactory in working soft decomposed ores containing much limonite. The high mining and crushing costs of the hard ore render it difficult for a company working such ores to compete with companies operating in the soft ores, so that it is not probable that the electrostatic process will be widely adopted unless supplemented by other machines. If the rough concentration is first effected by water flotation, as in one of the Alabama mills, the electrostatic machines produce a high-grade concentrate. This process has been tested also in the Pennsylvania district.

RECRUSHING OF CONCENTRATE MAY BE REQUIRED

In some mills no attempts are made to further clean and classify the concentrate, but after drying it is at once marketed. The concentrate contains some large flake material that may be worth more than 6c. a pound and much graphite dust that is worth less than 1c. a pound, together with many fine particles of quartz and other materials attached to the flakes of graphite or included between the laminæ. It is difficult to produce graphite concentrate containing much more than 80 per cent graphitic carbon by any of the concentrating methods described, and the carbon content usually falls far below the figure given, because considerable amounts of mica, quartz, and other impurities lie between the laminæ of the graphite crystals, entirely inclosed by the graphite. The only way in which these foreign materials can be removed is by separating the flakes into thin pieces by grinding the concentrate. The flakes also acquire a polish in the additional grinding. It is not uncommon to find that ash resulting from the burning of the carbon of graphite flakes will still retain the approximate shape and size of the original flakes. The interlaminated impurities can be observed in microscopic sections. They may amount to as much as 10 per cent by weight.

The concentrate also contains some detached or adherent particles of quartz, feldspar, mica, and other impurities, as it passes into the finishing mill. The mica which in most concentrating processes remains with the graphite is likely to have been made brittle in the drying of the concentrate, so that it can be readily pulverized by additional grinding, which also reduces the more angular mineral impurities to a powder.

In the refining or finishing operations of flake graphite it is advisable to have the concentrate fairly clean, as the presence of angular pieces of quartz will otherwise cut the flakes. In these steps the methods employed in all the mills are much the same. The kind of machinery employed is mainly that used in the manufacture of flour.

The concentrate from the drier is elevated to a bin, whence it can be fed into rolls or buhrstone mills. In such machines the flakes, on account of their flexibility and shape, tend to flatten out and though pulled apart along cleavage lines are not materially disintegrated, whereas the more brittle minerals are broken into fine powder. Most mills use both steel rolls and buhrs, and the material is ground several times to obtain the desired product. The more frequently the flakes are ground the cleaner the graphite becomes, but the proportion of graphite dust in comparison with the flake also increases with each regrinding.

From the rolls or buhrs the concentrate is passed through various flour-mill reels to classify the materials. The process is similar to the separation of the flour and bran in flour mill. Successive reels have fine wire or silk cloth with various sized meshes for the separation of the larger and finer particles. The details of the construction of the reels, the kind of wire or cloth used, and the arrangement of the reels vary, but the principle is the same.

There have been wide variations in the classification or grading of the finished graphite products. Some companies have marketed as many as five grades of flake and two of dust. The tendency, however, is now to produce fewer grades, commonly No. 1 Flake, No. 2 Flake, and Dust. Differences are due mainly to the size of the graphite particles but also to the percentage of impurities, the dust having a lower carbon content.

As graphite is so slightly affected by chemicals, it is possible to remove many of the impurities by simple chemical treatments. The Germans and Austrians have used some chemical methods economically and have produced practically pure graphite carbon. Hydrofluoric and sulphuric acids are employed in the treatment of the concentrate. It seems highly improbable that these methods could be profitably employed in the refining of low-grade disseminated graphite ores such as occur in the United States, and few experiments of the kind have been made.

IMPROVEMENTS IN MARKETING OF GRAPHITE NECESSARY

The marketing of graphite has been somewhat haphazard in the past, and few attempts have been made to systematize it. In the first place, almost every company operating in a graphite district has produced material of different quality, and the product from any one mill may also vary greatly at different times. The manufacturers of graphite products have been hampered by this variation, and probably for this reason have acquired a prejudice against the domestic flake graphite. The Alabama Graphite Producers' Association realized the importance of standardizing the Alabama product and took measures to have all the material produced by the members of the association carefully sampled and assayed by a reliable chemist before being shipped from the district. Where this has not been done there have been many instances of shipments being declined by the manufacturers, or accepted at a lower price than that agreed, because they did not meet specifications, or were of lower grade than the sample previously submitted. Unpleasant disputes and serious losses can be traced to this lack of uniformity of the marketed product. This defect is now fully realized by the operators, and is being remedied.

The irregularity of the supply has also been a drawback in the domestic graphite industry. Operators often have made contracts to furnish definite amounts regularly, and, owing to mill defects, have been unable to meet their obligations. For that reason manufacturers have experienced difficulty in dealing directly with the operators. Where they have continued to do so they have found it necessary to lay in large stocks when the product was available, and then for a number of months they would not be in the market. Thus the operating companies with small working capital have frequently suffered financial difficulties because of inability to dispose of their product promptly.

All of these conditions have resulted in the development of middlemen, who have been ready to buy anything offered by the operators and by proper refining, blending, and classifying furnish to the manufacturers any grade of material desired and of guaranteed quality.

Naturally these middlemen take advantage of any forced sales. On the whole, they have tended to stabilize the industry, as they are practically always ready to buy, and thus relieve the financial distress which a company may encounter, and they also are able to furnish a dependable supply to the manufacturer. Notwithstanding this, the operators have long complained that middlemen are receiving excessive profits and depriving the operators of their just returns. These same dealers are often also importers of foreign graphite, and have been accused by the operators of playing the foreign producer against the domestic producer, to beat down the price and purchase to the best advantage.

FUTURE OF THE DOMESTIC GRAPHITE INDUSTRY

The graphite industry of the United States is in a demoralized condition, although not hopeless. At present the chief efforts of the producers are being directed toward securing an import tariff on graphite and thus eliminating the present foreign competition. A more promising plan is to perfect the refining and concentrating methods and so reduce the costs that competition with the foreign producers is not detrimental. There are reasons to believe that this may be done.

A third hope is that the graphite crucible manufacturer may be shown that domestic flake graphite is not inferior to Ceylon lump. Some of the experiments of the Bureau of Mines give encouragement in this respect, but the matter is not settled. Among several operators the idea of the producer also becoming the manufacturer is gaining favor. The middlemen and the manufacturers may be receiving more than their share of the profits of the industry, yet the difficulties are so great that the day seems far distant when such a district as that of northern Alabama will be sending manufactured graphite articles into the market.

Twenty-three Million Dollars More From Alaska

The U. S. Geological Survey has made public figures for 1920 on the mineral resources of Alaska, prepared by Alfred H. Brooks.

The value of the mineral output of Alaska in 1920 was $23,307,757; in 1919 it was $19,620,913. The gain in 1920 was due entirely to the increase in the output of copper, which was 47,222,771 lb. in 1919 and 70,435,363 lb. in 1920. Eight Alaska copper mines were operated in 1920, eleven in 1919. The value of the total mineral output of the territory during forty years of mining is $461,474,789.

[illegible]

	1919	1920
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]

In 1920, seventeen gold lode mines and five prospects were operated and produced gold worth $1,17[illegible]. The Alaska gold placer mines have produced in all gold worth $217,[illegible],000. In the summer of 1920, [illegible] gold placer mines, large and small, employing 1,[illegible] men, were operated, and during the previous winter [illegible] mines employing 318 men.

The value of the output of gold from placers was $3,873,000 in 1920 and $4,970,000 in 1919.

The Role of Acid and Slimes In Flotation

Do Concentrate Slimes Flocculate and Act as a Carrier for the Larger Particles? Some Interesting Tests

By E. H. McLeod

Written for Engineering and Mining Journal

THE following flotation experiment, demonstrating what flocculation will do and what deflocculation will not do, may be of interest to flotation operators and experimenters:

A fresh sample of concentrates was taken from the head of a pneumatic machine, which was treating a feed running about 3 per cent copper, the minerals being chiefly chalcopyrite and pyrite. This sample of concentrates was then re-treated in a small experimental machine, with only the addition of sufficient pine oil. The tailings were discarded and the concentrates treated again in the same manner. The same percentage of solids was kept throughout, as far as possible. The concentrates from the second clean-up were carefully washed and all the slimes removed, so that the mineral left would remain on a 100-mesh screen. This coarse mineral was then placed in a machine with the addition of a small quantity of pine oil, and the machine started again. Much to my surprise, nothing happened; nothing floated at all. I added a little coal tar, with the same result; a little creosote—the same thing again. Finally a little of everything else handy gave only an oil scum, and I had to start all over.

The next time, after arriving at the point where I had spoiled things before, two drops of coal tar were added, the machine run for about two minutes to make sure that the oil was well mixed in, then about three drops of sulphuric acid, and up came the most beautiful golden froth instantly. (No slimes were present, as they had been previously washed away.)

In the original treatment of the ore no acid was used, and the pulp was neutral, so when the slimes were removed no acid was washed away, although it was possible that some salts that had caused it to float before were removed. To ascertain this a fresh sample of the concentrates was taken and washed by careful decantation, treated, and the same result was attained as before.

I then remembered that when first interested in flotation I was told that a certain quantity of sands and a certain quantity of slimes were necessary for successful operation. I never believed much in that "certain quantity," but this time I was tempted to see what would happen if the slimes were put back again. The result was the same as if acid had been added, except, of course, the slimes floated as well. Adding gangue slimes at this time was not tried, but it is doubtful if that would have brought up any concentrates.

It appears that after removing the slimes the oil will not flocculate the larger particles of mineral, but that on addition of acid [illegible] the mineral is immediately flocculated.

I would be pleased to know what others think about the addition of concentrate slimes: do they flocculate and act as a carrier for the larger particles or do they cause the larger particles themselves to flocculate?

Incidentally, the water [illegible] in floating with the addition of acid was only slightly turbid, and that obtained by the addition of slimes was fairly clear.

The Rare and Precious Metals Station Of the Bureau of Mines

Described for First Time in Its New Location at University Of Nevada, at Reno—Building Cost $40,000, Appropriated By State Legislature—Equipment Ample for All Purposes

Written for *Engineering and Mining Journal*

IN MARCH, 1919, the Legislature of Nevada voted bonds to the amount of $30,000, the proceeds from which could be used to house a station of the U. S. Bureau of Mines at any time that one might be placed in Reno, Nev., in conjunction with the University of Nevada. In July, 1920, the Bureau decided to accept an invitation to place one of its field stations at the university, and sketch plans for the building were drawn by Walter E. Clark, president of the university, and Dorsey A. Lyon and S. C. Lind, of the Bureau of Mines, and were placed at the disposal of the state architect.

In March, 1921, the Legislature voted an additional $10,000 for the completion of the building, which was turned over to the Bureau on April 13, 1921, since which time the installation of equipment and apparatus has proceeded to a point where the building is now completely occupied, and actual work has begun.

NEW BUILDING OF RARE AND PRECIOUS METALS STATION OF U. S. BUREAU OF MINES, AT RENO, NEV.

The building is on the campus, adjoining the Mackay School of Mines building on the north. It is a two-story brick structure, 68 by 43 ft., with a full basement.

On the main floor there is a general office, connected with which is a private office and laboratory for the superintendent. Directly across the hall from the main office is the library, which adjoins three other private offices.

On the second floor there are two large general laboratories for analytical and research work, each equipped with a private office and balance room. There is also a large technologic and metallurgical laboratory equipped with small porcelain mills, and Janney, Colburn, Ruth, Groch, and other mechanical-type flotation machines. In addition, there are two small private laboratories, one fitted up for special investigational work and the other for work in radioactivity. The laboratories are provided with alternating and direct current, and are equipped with electric heater, water still, hot plates, combustion furnace, muffle, and electric ovens. Hoods are provided to carry away all noxious fumes. All laboratory benches and hoods have Alberene stone tops.

A CORNER OF MAIN OFFICE, RARE AND PRECIOUS METALS STATION

A sampling and ore grinding room is in the basement. For the preliminary crushing of the largest sizes there is provided a Case crusher and a laboratory size gyratory crusher. For the next step Colorado Iron Works laboratory rolls are used; and the final reduction to finer sizes is done in a Braun disk pulverizer. Several sets of Jones sample splitters, a Tyler Ro-tap machine with complete set of screens, bucking boards, a large work table, and ample shelves for holding the various ore samples complete the equipment. In this room there are also two sets of line shafting, each directly

LIBRARY OF RARE AND PRECIOUS METALS STATION

connected to 2-hp. motors which are mounted on concrete piers.

The major part of the basement is taken up by a laboratory to be used for technologic and metallurgical work. The equipment consists of an experimental-type 6-in. belt Wetherill magnetic separator, small experimental hydraulic classifiers, an experimental-size Wilfley table, a small compressor, filter presses, leaching tanks, precipitating tanks, a Caron-Clevenger reduction furnace, and various other small apparatus. There are two sets of line shafting to supply power for the magnetic machines, concentrating tables, an Abbé silex-lined ball mill, and subsidiary small miscellaneous machinery.

In the basement there are also located an acid storage room fitted up with shelves and benches; a general storage room for surplus supplies; a dark room fitted up with a vault; a chemical assay room with hood and chemical benches; tool room; and furnace room in which are two oil-fired chemical furnaces and a 50-kw. single-phase electric furnace. The electrical equipment has a voltage range of from 20 to 85 volts, and is especially adapted for carrying out experiments on 100-lb. bullion charge.

The present staff of the station consists of Samuel C. Lind, superintendent; John Gross, metallurgist; John P. Bonardi, assistant chemist; Charles W. Davis, assistant chemist; D. C. Bardwell, assistant physical chemist; J. Walter Scott, junior chemist; Claude Gordon, senior clerk; Mattie J. Brown, junior clerk, and James T. Blake, janitor.

Gröndal Flotation Process Introduced Into German Concentrating Plants

During the war efforts to introduce flotation processes into German ore-dressing plants were abandoned, but after the Armistice more attention was paid to this modern method of concentrating. Several plants have experimented with the so-called Gröndal process, which is somewhat different from either the pneumatic or mechanically agitated cells used in America. Compressed air is admitted to the bottoms of the cells and is there broken up into fine bubbles, but just how this is done is not disclosed by A. Macco, the author of an article in *Metall und Erz*[1] from which this information was obtained. The illustration, however, gives an idea of the cell construction.

The Gröndal flotation machine consists of an agitation compartment from which the pulp flows through a slit into a settling chamber or spitzkasten. Here the froth, which carries most of the mineral, overflows, and the impoverished pulp slides down the sloping chamber floor to the next adjacent agitation chamber, where the process is repeated. The agitation compartments are about 2 m. high, rectangular, and of 0.15 to 0.25 sq.m. cross-sectional area. The floor converges toward the middle of the rear part of the chamber. At the lowest point the compressed air enters, the pressure being barely sufficient to overcome the 2 m. head of water. From eight to twelve units are used in each machine. Wood is used for construction, which is simple and cheap. The consumption of compressed air is between 0.6 and 1 cu.m. per minute for each unit, and the total power consumption is only about 6 hp.-hr. per machine. From 0.2 to 0.3 kg. per metric ton of domestic oil is used for floating the mineral.

Machines of this type have been used by the Boxbach Gewerkschaft at Breidenbach, Kries Biedenkopf; at the neighboring Gottesgabe tetrahedrite mine; by the Antweiler Erzgesellschaft at their Wilhelm mine in the upper Ahr valley, now under the control of the Wilhelm Gewerkschaft, and also by Beer, Sondheimer & Co. at the Friedrich-August-Hütte, Nordenham, on lead-zinc ore.

At Boxbach, from the crude ore, a pyrite carrying 1.56 per cent copper, over 90 per cent of the copper was recovered in the form of a 20 to 25 per cent concentrate, with 0.1 to 0.15 per cent of copper in the tailings. Similar results were obtained at the Wilhelm mine. At the Gottesgabe, manganese and iron caused some difficulty, the tailings running about 0.4 per cent copper, owing to the copper content of the "glasköpf," which had to be run to waste. At the Friedrich-August-Hütte, the zinc-lead ore contained about 37 per cent of barytes, which had to be reduced in the concentrates to less than 5 per cent. The following results were secured:

	Zinc, per Cent	Lead, per Cent	Silver, Grams per Ton	Barytes, per Cent
Crude ore	21	11	148	37
Concentrates	34	21	[illegible]	5
Tailings	4	1.5 to 2		45
Recovery	85 to 90	87 to 91	90 per cent	

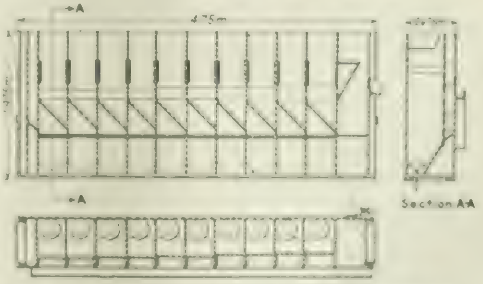


DIAGRAM OF GRÖNDAL FLOTATION MACHINE

The number of cells required was found to vary with the amount of concentrate made rather than with amount of ore treated. At the Gottesgabe and F-A-H plants, about 100 metric tons were treated per twenty-four hours, the former installation containing two machines of ten cells each, and the other, six machines of twelve cells each. The F-A-H plant, however, had eight times as much concentrate to handle per ton of ore treated as the other.

Production of Potash Increasing in Alsace Lorraine

All of the potash plants in Alsace Lorraine are at present being enlarged, so that the number of laborers employed in this industry had to be increased from 4,000 to 6,000. Up to May 31, 1921, the French Republic had spent for repair work and enlargement of the potash plants the amount of 75,000,000 fr. Of this sum, 15,000,000 fr. was for new buildings and 35,000,000 fr. for the purchase of modern machinery and tools. Since Jan. 1, 1920, the sale of the entire output of the mines is being handled by a special company formed for this purpose.

---

[1] Vol. 18, No. 9, page 197; May 8, 1921.

The Fatigue of Metals

Steel More Sensitive to Working Stresses Than Is Ordinarily Supposed — Continuous Vibration Produces a Weakened Condition Conducive To Sudden Fracture—Regular Periods of Rest Promote Recovery of The Equilibrium of Internal Forces and Restore Original Efficiency

BY PAUL KREUZPOINTNER
Written for *Engineering and Mining Journal*

C. M. CARTER, in *Engineering and Mining Journal* of May 14, describes his experience with fatigued and rested drill steel. Recently troubles of this nature have been frequently reported and it may be of interest to users of steel in mines to review certain facts regarding the phenomena of the fatigue of metals and the beneficial influences of rest.

As the fatigue of metals is the result of a complex condition of chemical constituents, mechanical mill work, heating and cooling, subsequent heat treatment and of the extraneous forces which tend to destroy the metal while in service, the time of the appearance of fatigue or the degree of its progress is reduced to mathematical calculations. However, starting with a well-defined chemical composition, knowledge of the effects of the mechanical forces tending to strengthen, or to weaken, the metal while it is being subjected to various mechanical forces, and the judicious application of this knowledge will aid considerably in avoiding disastrous consequences arising from unexpected breakages.

Steel under routine mechanical operations exhibits a propensity to become fatigued, which indicates a diseased condition of the metal. Speaking of a diseased, or pathological, condition of steel, it may be assumed that steel is not such a rigid, inanimate body of crystals as is generally imagined. However, metals even as hard as steel are not such lifeless substances as they appear to the average observer.

The sensitiveness of steel is considerable, and even moderate shocks or blows cause vibrations of all particles, or molecules, through its mass in almost the same manner in which sound is produced by vibrations on striking a bell.

REPETITION OF SHOCK-FORCE PRODUCES FATIGUE

As an illustration of this sensitiveness I was at one time preparing to take the elastic limit of a test piece of spring steel, but was interrupted. Someone pulling at the loose end of the test piece pulled hard enough with his hands to make a contact with the electric bells already set. Such sensitiveness was considered incredible, but after six persons had tried the trick, and each had succeeded in stretching the piece enough to make contact, there was no longer doubt of such sensitiveness. With high-power electro-telescopes movements in steel to 0.025 millimeter have been observed.

A frequent repetition of vibratory forces produces fatigue, and if no rest period intervenes and the steel is of good quality detail fracture will be the result, with final fracture. To the experienced eye the fineness of the part which broke in detail is indicative of the quality of the steel.

The limit of elasticity is the criterion of the ability to withstand fatigue and breakdown by detail fracture, always provided there are intervals of rest and remembering that high elastic limit means low ductility.

As in organic life heat is a determining factor in the nature of the organism, so is the resisting power of steel determined by the finishing heat to which the metal was subject, provided the previous treatment was normal. A diseased condition of steel is often induced by not taking into consideration the fact that steel is a composition of several elements, each of which has a different melting point. Thus, the heating should proceed sufficiently slowly to give each element time to melt and fuse intimately into the other elements according to their natural affinity. If this precaution is carefully observed, the steel will be healthy, with consequent greater resisting power to shock and vibrations and easier rearrangment of the molecules during periods of rest. Thus heat, that highly beneficial agency in promoting life, may also change the life of steel into one of usefulness or uselessness.

Experimenting in that direction, I have often succeeded in raising the strength and elongation of steel castings from 2,000 to 6,000 lb. per sq.in. and 4 to 8 per cent elongation, showing to what extent the careful application of heat can prevent as well as remedy diseased conditions of steel.

Briefly stated, then, steel is an agglomeration of molecules, arranged into crystalline form on the metal cooling from a fluid state, the hardness of the crystals and their cohesive power being determined by the proper proportion of chemical elements, freedom from foreign matter, and uniform heating, which permits the freest exchange and interchange of molecular activity while the metal is vibrated by shocks and by various strains and stresses. It is this vibration, this interchange and exchange of the molecules, composing the crystals, vibrated by shocks, which causes a condition of fatigue. If the movement of the molecules continues without intervals of rest, the crystals begin to slide, to disintegrate, to break up; microscopic cracks appear, and fracture in detail begins, resulting in breakage sooner or later, according to the physical condition of the steel and the circumstances with which the destructive forces are applied.

EFFECTS OF REST UPON FATIGUED STEEL

If the fatigue of steel (or other metals) is the result of too long-continued or too frequently repeated vibratory motions of the molecules forming crystals, and cessation of vibrations for a longer or shorter period postpones or prevents fatigue, what is the nature of the forces counteracting the effect of vibrations?

If steel is strained beyond the elastic limit, and the load is removed and the metal allowed to rest, a reaction sets in whereby the vibrations of the molecules cease their motion and restore the equilibrium of the internal forces that resist the extraneous forces at work to break the structure. Or, in other words, the elastic limit, which was lowered during the strain, reaches its former position, and, if the rest continues long enough, say for months or years, elastic limit may even be raised higher than it was originally. In that case, however, the ductility of the metal will be lowered. By repeated stretching and resting of test pieces during three years, in one instance I raised the elastic limit 6,000 lb. per sq.in. The object, then, of resting a tool or structural material is to give time for the disturbed and more or less dislocated molecules and crystals of the metal to rearrange and to relocate themselves into a state of equilibrium for increased resistance to the extraneous forces of destruction. However, in the case of tool and drill steels and steels which are hardened and tempered, this phenomena of fatigue and rest is more complicated than it is in non-hardened structural steel.

Steel is a solid solution of various elements, which, for the sake of symplifying the illustration, are in equilibrium and uniform in structure after annealing, and therefore there is uniform elasticity and plasticity in the structure. In steel which has been hardened and tempered there is no such equilibrium and uniformity. In non-hardened steel the cohesive force reacts uniformly through the solution; that is, the mass of the steel.

In hardened steel the solution is condensed in proportion to the degree of hardness. In addition, this density is not so uniform as to produce a difference of hardness, however slight, between the center and circumference. This presupposes a difference in structure, with consequent differences in elastic limit and variability of resisting power to fatigue.

Thus, in hardened steel there is maintained a more or less unstable solid solution, more sensitive to fatigue, hence more in need of intervals of rest. Steel is a solution of carbon in iron, and the instability in hardened steel arises from the incomplete change of the carbon into a hardened state. The process of tempering has freed some of the carbon from its solution with the iron. This difference in condition of the molecules produces a constant effort on the part of the softer and harder molecules to equalize, thereby making a pressure within the solid solution which is called the osmotic pressure. Thus, in addition to the cohesive power of the crystals in hardened and tempered tool steel, there is developed the osmotic pressure caused by the difference in their nature of the harder and less hard molecules of the solution of iron and carbon. It is obvious that under these circumstances hardened steel is more sensitive to fatigue than non-hardened steel, and requires more frequent periods of rest if such hardened steel is subjected to repetitive shocks like drill steel in a mine.

Filtering Flotation Concentrates At Mount Lyell

The following particulars of the work done by a drum filter on flotation concentrates at the Mount Lyell mill, in Tasmania, are taken from the *Proceedings* of the Australasian Institute of Mining and Metallurgy, No. 38. The filter used was an 8 x 8-ft. Oliver, having a filter area of 200 sq.ft. The concentrates contain chalcopyrite and pyrite, about 6 per cent remaining on a 65-mesh Tyler screen and about 77 per cent through a 150-mesh. The feed averages 52 per cent water; the cake, 11.5 per cent.; the thickness of the cake, [illegible] in.; the vacuum, 22 in.; the speed, one revolution in eight minutes; and the capacity, 600 lb. per sq.ft. per twenty-four hours. The depth of the pulp varies, submerging the drum up to 3 ft. 6 in., lower levels yielding a drier cake and higher levels, greater capacity. Raising the temperature of the pulp by steam has not been tried, but would no doubt yield a drier cake and increase capacity.

The filter drum is wound, over the canvas, with 14-gage copper-clad steel wire, the turns being about ½ in. apart. It takes about sixteen hours to re-canvas and re-wire the drum. The canvas lasts about eight months and the hessian under the canvas two years, one recent canvas handling 5,157 tons of concentrates. The canvas is occasionally hosed and scrubbed, and the scraper requires particular attention, it being periodically filed reversed, or renewed.

The air lifts and emergency air agitation pipes were not found satisfactory and were discarded. The speed of the mechanical agitators was increased to 74 r.p.m. The original agitator shaft consisted of a heavy 3-in. pipe flanged to stub shafts on each end, but it was soon found necessary to use a solid 3-in. shaft. Wrought-iron paddles spaced 9 in. apart, and alternately right and left hand to avoid thrust, have been used, but on account of the presence of copper in solution, cast-iron paddles are now being tried.

The flotation attendant also operates the filter, which requires a minimum of attention.

Anaconda's Accident Percentage Low

During the six years 1915 to 1920, inclusive, a total of 16,460,767.5 shifts were worked by employees at the mines of the Anaconda Copper Mining Co. in Montana. According to D. Harrington in the U. S. Bureau of Mines *Reports of Investigations*, in this period there were only 2,005 serious and fatal accidents. Of these, 200 were fatalities, leaving 1,805 serious accidents (a serious accident being one in which fourteen or more days' time is lost). This is at a rate of 9,120 shifts per serious accident and at a rate of 82,304 shifts per fatality.

The record includes accidents occurring not only at the company's copper mines, but also at mines whose chief product is gold ore, or silver ore or silver and lead, or zinc, or manganese. Some of the smaller mines are shallow (less than 1,000 ft. in depth), many of the mines are comparatively deep (over 2,000 ft.), and several have mined ore below the 3,000-ft. level. Some of the mines were heavy producers of ore, some were chiefly in the development stage; two (the Leonard and High Ore) have the main pumping plants for nearly all the mines of the Butte district, and at times also produce ore; the Reins is occupied wholly with fire fighting and slime filling of fire regions of the West Colusa, Leonard, and Tramway mines.

The accident rate for all the metal mines of the United States during the six-year period averages about 7.00 fatal plus serious accidents per 10,000 shifts. A table accompanying Mr. Harrington's report shows that for the six-year period only two of the thirty-odd mines operated by the Anaconda company in Montana have exceeded this average for the country, and one of these mines is a small one which had a total of nine accidents. Even the poorer records of these mines show comparatively few instances where individual mines have exceeded the country's average of approximately 7 serious plus fatal accidents per 10,000 actual working shifts.

BY THE WAY

A Matter of Ethics

Is scientific enthusiasm leading the Bureau of Mines astray at its Reno station, where, with the aid of radium, efforts are being made to give color to colorless gem stones, thereby improving their market value? If this can be done, it will increase the commercial value of gem stone material found largely in the West, it is said, which value is lessened because of the stone's lack of desirable tint. This is like putting soap into moonshine whiskey to give it a bead and tobacco juice to make it look like rye, tricks familiar to the hillbillies of the South. Will not all gem stones be discredited if these experiments be successful? Or will so much radium be consumed in the process of tinting a stone that the cost of production of the gem will be greatly increased? If the latter be true, we are reconciled, and the work may proceed. We are opposed, however, to anything that will lessen or tend to lessen the value of our own jewels in the slightest degree. The public must be protected against deception even by bureaucrats.

Always There

We are informed that the ether is ubiquitous, not the sleep-producing kind of ether, but that all-pervading something or other that even vacuums are full of. Nature abhors a vacuum, so she fills it up with ether, so they say. Very few things are ubiquitous. There are some things, however, that approach the ether in ubiquity. Of these the best known, of course, is the Ford, the creator of which is fast approaching his creation in the quality of being everywhere. Once upon a time Mr. Ford was content to turn out the flivvers and rake in the nickels, but now that is all past. So much wealth must be employed. We read of iron lands, timber lands, and a railroad that have been acquired by Ford, and now he is after the Government's nitrate plant at Muscle Shoals. It would be unfortunate were this interesting project allowed to come to nothing, especially after so much has been spent on it, and Mr. Ford is to be complimented on his nerve in venturing so far afield. Or is he merely rambling, seeking a multimillionaire's amusement as he goes? At any rate, if the Government accepts his proposal, we feel sure that he will be getting the nitrate out by Christmas.

An Interesting Fact

A. G. Walker and E. De Decker, British experts, find that a miner gives off 96 calories per hour per square meter of body surface and a shoemaker but 32; the miner works hardest of all men with his hands, they say, while cobbling is sedentary work. Such figures are very interesting, and the authors are to be congratulated on having contributed to the world's store of knowledge. In a measure it makes up for the burning of the Alexandrian library. But do miners burn the most calories? Are they the most energetic at their work? Does not their output of energy vary directly as the proximity of the shift boss? Or does it? Does not the rate of pay enter into the matter? They'll say it does, witness a hundred strikes. On the other hand, the calory output of those in sedentary pursuits is not a trifle. Much of earth's hot air comes from those seated at desks, "coral tinted ear," and dictaphones. We, of course, stand or walk at our work. Nevertheless, the conclusions of the British experts are interesting. They keep one guessing. In particular, how do they calculate the number of square inches of body surface?

Removal Notice

A thief has taken the platinum tips, valued at $400, from the tops of the four lightning "rods" on the 275-ft. stack of the International smelter at Miami, Ariz. It is rumored that the company will build a 12-ft. fence around the stack to prevent similar occurrences in the future. Had it not been that the ends of the conductors were bent downwards by the thief, the loss might still be unnoticed.

The Honest Salter

"I have 40 lb. of litharge going $10 in gold, some that was left at Delamar. It is good to fix up a claim if you know anyone." This from a practical miner to a custom assayer of our acquaintance in Nevada strikes us as being very practical. Anyone desiring to know how the salt shall be salted when it has lost its savor should get in touch with this gentleman. Truly such simple-minded folk as these are among the salt of the earth. Theirs not to deceive; nor are they mercenary souls. The honest gold digger long has known that the joy of discovery is the keenest pleasure to be had in mining. And, noble that he is, in entire innocence he puts gold where it has not been before, that others may share his pleasure.

Comin' h'off Shif'

By D. E. A. CHARLTON

We are 'eaded for tha landin' w'ere tha motor trains is standin',
There's a rumblin' soun' a-comin' from the stopes,
An' h'each one that's done 'is blastin' is a-'opin' that its lastin'
Till tha nex' shif' 'as a chance to go tha ropes.

There's a pushin' an' a runnin', from the stopes an' drif's they're comin',
There's tha landin' o' tha cage h'upon tha chair,
An' we're crowdin' for a footin', for a place w'ere we can put'en
An' then h'up we gaws to get a bit o' h'air.

Oh tha chap 'oo 'as tha lever in tha h'engine-'ouse is clever,
An' 'ee naws jus' 'ow to regulate 'is speed.
Firs' we starts h'out slow an' h'easy, then we 'its up pretty breezy,
An' tha nex' thee naws tha bloody top we've see'd.

Son, tha h'outside h'air is bracin', soon thee's steppin' forth an' facin'
Toward tha dry-'ouse that's a step across tha way,
There's tha shower if its 'andy, an' soon thee's slick an' dandy,
An' thee feels like startin' h'in h'another day.

There's tha gossip as we's walkin'. Min' you—never 'eard such talkin',
For we've got to tell h'each h'other w'ot we've done:
'Ow tha back ain't 'ardly breakin', an' 'ow many cars we've taken
From tha stope since firs' she started h'out to run.

Since the dry law there's no treatin', but thee's boun' to get a greetin'
From tha missus an' the young 'uns gathered roun',
An' its thanks to 'Im you're givin' for providin' o' tha livin',
For tha miner's work 's tha bes' that can be foun'.

HANDY KNOWLEDGE

Socketing Hoisting Ropes With Zinc

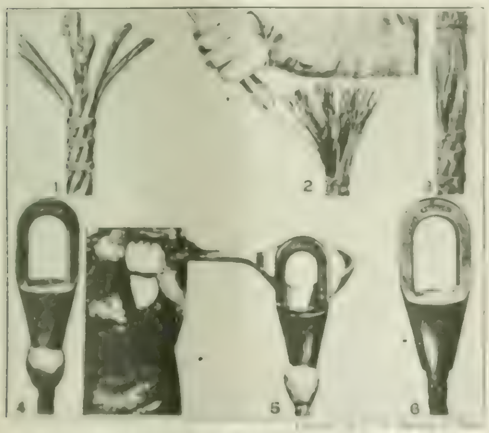
BY RICHARD V. AGETON

W[illegible] for Engineering and Mining Journal

THE "spelter" or zinc method of socketing hoisting ropes is gaining favor in the Lake Superior district. The Quincy Mining Co. has used this method on all ore skips and man cages for two years and has found it entirely satisfactory.

When first used, this method was tried on the smaller cables of from ¼ in. to ¾ in. diameter. At present the Quincy company is using the zinc method on a 1½-in. cable in one of its deep shafts, for hoisting a 9-ton skip up a 50-deg. incline from a depth of more than 6,000 ft. The zinc method has many advantages over the other methods of using babbitt or clamps.

Babbitt is not entirely satisfactory, because it is an anti-friction metal, and as such it is only a question of time before the wires will pull out through the babbitt in any socket attachment. This fact seems to be well known in the mining industry, and to overcome this disadvantage it has been the standard practice to bend the wires back to prevent them from pulling out through the babbitt. This is a questionable procedure, as the process of bending the wires back is quite difficult, unless the wires are annealed, and heating the wires may reduce their strength by 50 per cent.



[illegible]

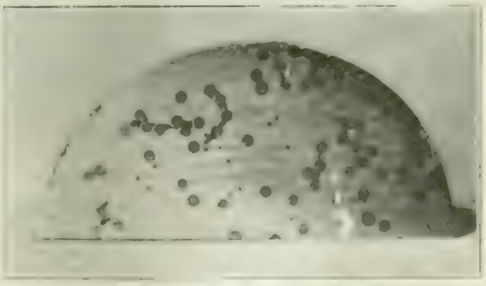
[illegible]

After the wires have been bent it is then necessary to drive this bunch of bent wires back into the socket, and as it is always easier to drive one strand farther than another, it is possible to get an unequal tension on the wires. Under this condition a hoisting rope may be operating with only two or three of the six strands carrying the load. It is not necessary to bend the wires when using the zinc method, as the individual wires in the cable are held in the zinc by amalgamation.

In both the babbitt method and the zinc method the fastening of the wires all takes place within the socket, and consequently is not open to inspection. However, with the zinc method the amalgamation of the zinc and steel wires is such that they cannot be separated.

The hoisting rope may also be attached to its load by means of a socket around which the whole rope is bent, the loose end of the rope being clamped to the main rope. This method of fastening develops, at most, only about 85 per cent of the strength of the rope, and also bruises and crushes the rope where the clamps are applied, thereby lessening its strength. In addition to this, clamps are likely to slip, especially when subjected to unusual strain. However, the clamp method has the decided advantage that it is easily applied, can be readily inspected, and requires little skill in making.

Rope makers recommend the zinc method of fastening sockets, as this method, if properly made, never fails. The zinc amalgamates with the individual wires to form an alloy similar to galvanized iron, and consequently it is not necessary to bend the wires back. Thus practically the full strength of the rope is obtained, for it is impossible for one strand to carry more than its due proportion of the load when the wires are properly distributed in the basket of the socket before pouring.



[illegible]

[illegible]

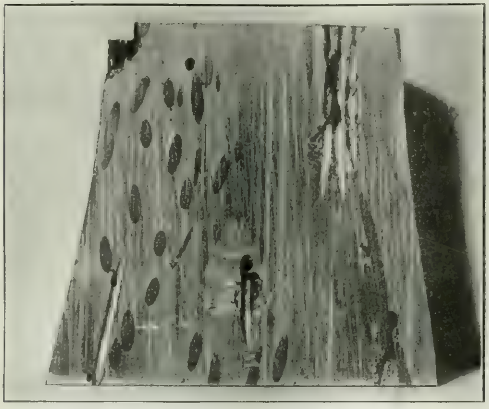
To socket hoisting ropes properly by the zinc method first serve or tie the end of the rope and cut off square. Next measure from the end of the rope a length equal to the basket of the socket, and serve or tie the rope (see Fig. 1) at this point with not less than three wraps. Remove the tie at the end of the rope, open up strands, and cut out the hemp center.

Next separate the individual wires in the strands and straighten them by means of an iron pipe, being careful (see Fig. 2) not to twist or bend any of the wires. Clean the wires thoroughly with kerosene, benzine, or gasoline, and then dry.

After the wires have been thoroughly cleaned and dried, dip the entire mass in 50 per cent muriatic (hydrochloric) acid solution, and keep the wires in there long enough to remove any particles of grease or dirt (twenty to sixty seconds). Dip into boiling water to which has been added a small amount of soda, to neutralize the effect of the acid, and wipe dry. Serve or tie the wires so that the socket may be slipped on over the end (Fig. 3).

After the cable has been placed in the socket, cut the tie wire at the end of the cable and distribute all wires evenly throughout the basket and even with the top of the basket. Next place the basket in an upright position and calk up the bottom of the socket with fire clay. If the atmospheric temperature is below 65 deg. F., the socket and rope must be warmed slightly to prevent the zinc from cooling too rapidly, as a too rapid cooling will retard the amalgamation of the zinc with the individual wires, and weaken the joint (Fig. 4).

The zinc is then heated to the melting point (that is to a temperature at which it will just char a piece of wood that is dipped into it) and is poured into the top of the socket basket until the socket is full (Fig. 5).



LONGITUDINAL SECTION OF SPELTER SOCKET, SHOWING AMALGAMATION OF WIRES AND ZINC

Wires were removed from the socket (upper right and lower left) to show how firmly they were imbedded in the spelter.

Lastly, remove all servings except the one nearest the socket and allow the socket to cool for a short time, after which it will be ready for use (Fig. 6). After socketing the rope and attaching it to the cage it should be tested by making several trips under a heavy load before men are allowed to ride, to be sure that the amalgamation has been thoroughly accomplished.

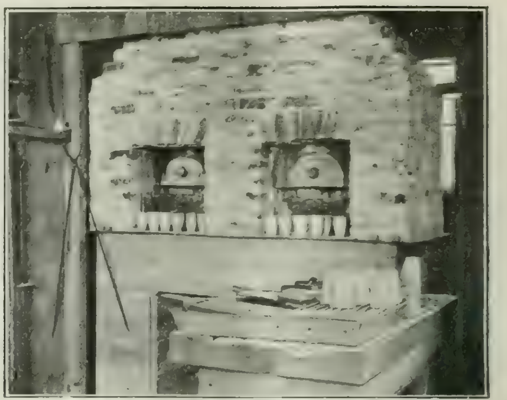
When the height of the sheave wheel above the surface landing permits, safety chains should be attached to the cage and to the cable a little above the socket.

Keeping the Assay Laboratory Cool

Written for *Engineering and Mining Journal*

Oil-fired muffle furnaces of the ordinary steel-incased type radiate a considerable amount of heat into the laboratory, and during hot weather the interior of the laboratory may reach an uncomfortable temperature. An outer shell of red brick can be readily built about the furnaces, as shown in the illustration, and the heat radiated can be confined within the brick housing.

To carry off the fumes at the front of the muffle a 2 in. open space is provided across the full width of the muffle between the outer flat arch and the inner brickwork. This communicates with the chimney, and the draft is sufficient to induce a constant current of air from the room. The two furnaces shown are supported on a concrete pier 42 in. high, a $\frac{1}{16}$-in. plate being placed on the top of the pier. The muffle height is 4 ft. 5 in. A ventilating pipe is placed in the roof above the furnace. The furnace shown is in use at the laboratory of the Carson Hill Gold Mining Co., Melones, Cal.

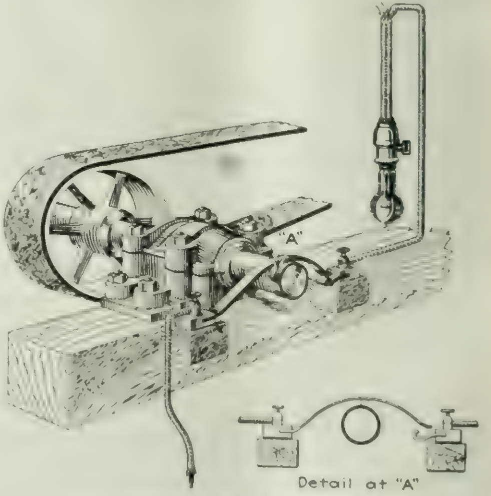


BRICK SHELL ABOUT MUFFLES TO KEEP LABORATORY COOL

Indicator for Belt Conveyor

Written for *Engineering and Mining Journal*

Where rock crushers feed directly upon a belt conveyor, the stoppage of the conveyor belt, unless it be known to the crusher man in time, results in considerable spillage before the feed to the crusher can be shut off. To give warning of such stoppage the device shown in the sketch is used at the mill of the Carson Hill Gold Mining Co., at Carson Hill, Cal. An electric light is suspended so as to be visible to the crusher man. In the lamp circuit is a make-and-break switch which is operated by a cam on the shaft of the drive pulley. The flickering of the light continues as long as the conveyor belt is running.



LAMP INDICATOR FOR BELT CONVEYOR

THE PETROLEUM INDUSTRY

Argentine Oil and Labor Conditions

Certain Drawbacks Handicap Oil-Seeking Traveler in Distant Comodoro Field—Labor Now Favors Open-Shop Practice, Following An Attempt by Leaders at Bolshevik Regime

BY MARK R. LAMB

Written for Engineering and Mining Journal

IN PLANNING A TRIP to the oil fields of Argentina be sure not to depend upon the railroad to deliver your car on time, nor with all the tools and spares—in fact, expect the same kind of deliveries that are made in the States, and plan for lost time and shortages.

The trip to Rio Colorado is made from Buenos Aires in eighteen hours by train. From here to Comodoro is 800 miles in auto, over desperately sandy roads. The brave, deliberate travelers take a large car with plenty of baggage; those in a hurry and those anxious to be sure of arriving take a Ford or two, besides a spare one in the tool box.

There are several rivers to cross, the largest being the Rio Negro. On account of the depth of the water, special arrangements must be made to prevent drowning the passengers and the engine. The drivers on this route have adopted the periscope from the moving pictures of the war, and only the tenderfeet find any difficulty in using it. There is a knack in keeping the tube in the mouth and holding it steady while the stream is trying to drag it away. As for the engine, it is only necessary to carry the suction high enough, and this rarely needs to exceed two meters. The periscope is to be taken down until another river must be crossed.

ARGENTINE FEARS STANDARD MONOPOLY

Parties are going through here with suspicious frequency. Suspicion also arises from the fact that expense is no object, and when no objection is made to a charge of $200 for an 800-mile trip we feel sure that it must be Standard Oil. You should be told, in order to realize what this means, that all Argentine is said to be afraid that Standard Oil will secure concessions in the oil fields, and will monopolize the oil industry in Argentina, and the people have Mexico before them as an unhappy example of oil difficulties. For this reason, "Standard" is a bugbear to be greatly feared.

The new well, No. 128, has made a fine showing, and is shut off only because there is not sufficient storage for its production. As fast as the steamers can take the oil away, the well is opened. Meantime, the gusher has aroused the cupidity of the other companies, with the result that much drilling machinery has been purchased. It is not arriving, and these companies will feel pretty poor from now on until they strike oil. It has been a fine field for well supplies until the last month.

So far there has been no co-operation among the private companies, with the result that all depend upon the government for their oil transportation. This means that until more tankers are available, the outlet for the oil of private companies is practically nil.

The journey to the field can be made by steamer, if the trip can be timed to correspond with the sailing date, but as there is nothing sure about the steamers, either coming or going, the auto is safer and surer—and much more expensive.

CONCERNING GEOLOGISTS AND GEOLOGICAL REPORTS

A member of the staff of the Commercial Attaché recently made a report on the field, which will soon be available at the Bureau of Foreign and Domestic Commerce. Many engineers and geologists in private employ have visited the field, but their reports will probably not be published. Recently, an Argentine capitalist, who is also an engineer and knows a little about geology, said something about geologists which is rich, and which you should not publish. He takes his geologists' reports, reads them carefully, understands them as much as possible, and then discusses them with the geologists. Observations and conclusions are discussed thoroughly, and then he goes to the field with the geologist and has the observed facts pointed out to him. Again the conclusions are discussed thoroughly and he finds that they have become contaminated with a considerable percentage of imagination. He finds that geologists are prone to form conclusions. In spite of this attitude, the gentleman uses geologists constantly and expensively.

ARGENTINE NOW OPEN SHOP

From being a labor-ridden country Argentine has changed overnight to a free-labor country as the result of the stand taken by the president of the republic. The labor unions have been very strong, not because the members have been unified, but because the leaders, who are said to be foreigners, have not permitted secret ballot and have ruled with an iron hand. The published edicts read like Soviet Russia. Some of these follow:

"Members of the union are advised that they must never recommend anyone to their employer, always referring him to the union!"

"By resolution of the assembly, all members who are working are assessed a day's pay per month for the benefit of those who are not working. A register has been opened in the office of the secretary of the union, in which will appear the names of the members who pay the assessment, as well as of those who do not pay it."

"Members are advised that the names of those in arrears for more than three months without just cause will be published in the [illegible] union organ."

"Members should obtain the required pass before leaving the city for the interior."

"Boycott—Laborers: if you do not wish to be exemtioners of your own brothers, do not smoke the cigarettes made by Picardo y Cia, or of the Tobacco Trust of the following brands: 43 Reina Victoria, Ideales, Goal, H. P., Excelsior, Barrilete, and Caras y Caretoas. (Signed) Blockage committee against Picardo y Cia and Cia Argentine de Tabacos."

"Important—Members are instructed to call for their copies of the *Centinela*."

And all of the above in a single advertisement in the daily paper. At present, the city is in revolt against the unions, and these are singing very low. Anyone can work on the docks and drive a taxi, and as a result of an anti-patriotic proclamation of the taxi drivers' union, the public is insisting upon a flag appearing on every taxi for a week. This unexpected freedom from unionism has had a very favorable reaction on business. Business men are gaining confidence, and are now able to move their goods.

GERMAN COMPETITION OVERESTIMATED

Items in many lines of goods are running short, with a resulting sudden rise in prices, as no one is at present brave enough to order from abroad. German competition is a myth, so far as concerns any of the items in which I am interested, and I will give you one example, as follows: Tanks quoted by Reeves, $21,000, delivery one month; tanks quoted by Krupp, $26,000, delivery beginning with two months and completed in six. No one should be permitted to talk of European competition without having concrete examples with authentic data, and *all* the terms and conditions. In the above case, the Krupp offer was conditional upon Allied permission and upon the buyer taking the risk of the export.

Daily Average Petroleum Production Shows Decrease During June

Stocks of petroleum were increased by more than 7,000,000 bbl. during June, according to the U. S. Geological Survey, despite decreased daily average production and increased consumption. Pipe-line and tank-farm stocks, plus stocks of Mexican petroleum held in the United States by importers at the end of the month, amounted to the new record figure of 161,000,000 bbl., a quantity sufficient to meet consumption at the current rate for 112.8 days.

The first decrease in production of petroleum since January is reported for June, the daily average of the month, 1,346,833 bbl., being 9,393 bbl. less than that for May. Decreased daily production is reported for Texas, Louisiana, Wyoming, Kentucky, Illinois, West Virginia, Montana, New York, and Colorado. California, Oklahoma, Kansas, Arkansas, Ohio, Indiana, and Tennessee are credited with increased daily production. Arkansas, during its fourth month as a commercially producing state, with a yield of 880,000 bbl., jumped in rank from twelfth to seventh place, surpassing Illinois and ranking next below Wyoming.

The estimated value of the wells of the oil produced during June, $52,900,000, is considerably less than half of the value of the production for the month of June, 1920, which amounted to $116,200,000, although the production in June, 1920, was 3,000,000 bbl. less than in June, 1921.

Imports during June, amounting to 10,205,000 bbl., increased more than 1,000,000 bbl., but exports of crude oil decreased 279,000 bbl., almost 50 per cent of the month's total.

During the first six months of 1921 production amounted to 236,675,000 bbl. (an annual rate of more than 473,000,000 bbl.), as contrasted with a production of 211,360,000 bbl. during the first half of 1920; imports increased more than 27,000,000 bbl.; exports increased 412,000 bbl., and consumption increased 12,500,000 bbl. During the first half of 1921 more than 38,000,000 bbl. of petroleum was added to stocks, whereas, in the similar period of 1920, 868,000 bbl. was withdrawn from storage.

The accompanying figures, compiled from company reports to the U. S. Geological Survey, show the quantity of petroleum removed from producing properties. Oil consumed on the leases is not included. This item and net changes in producers' stocks at the beginning and end of the year are obtained by annual canvass and are included in the final statistics of production.

PETROLEUM PRODUCED IN THE UNITED STATES IN MAY, 1921, JUNE, 1921, AND JUNE, 1920

(Barrels of 42 U. S. Gallons)

	May, 1921 (a)		June, 1921		June, 1920	
	Total	Daily Average	Total	Daily Average	Total	Daily Average
California	10,448,000	337,032	10,120,000	337,333	8,190,000	273,000
Oklahoma	10,048,000	324,129	9,736,000	324,534	9,049,000	301,633
Central and North Texas	6,228,000	200,903	5,848,000	194,933	5,888,000	196,267
Coastal Texas	2,669,000	86,097	2,448,000	81,600	1,908,000	63,600
Kansas	3,505,000	113,065	3,480,000	116,000	3,468,000	115,600
North Louisiana	2,391,000	77,129	2,131,000	71,033	3,116,000	103,867
Coastal Louisiana	152,000	4,903	146,000	4,867	134,000	4,466
Wyoming:						
Salt Creek	1,185,000	38,226	1,180,000	39,333	944,000	31,467
Big Muddy	176,000	5,677	164,000	5,467	174,000	5,800
Rock Creek	205,000	6,613	147,000	4,900	72,000	2,400
Grass Creek	182,000	5,871	130,000	4,333	130,000	4,333
Elk Basin	69,000	2,226	59,000	1,967	65,000	2,167
Other districts	159,000	5,129	177,000	5,900	240,000	8,000
Total Wyoming	1,976,000	63,742	1,857,000	61,900	1,625,000	54,1677
Arkansas	550,000	17,742	880,000	29,333		
Illinois	863,000	27,839	815,000	27,167	931,000	31,033
Kentucky	826,300	26,655	735,000	24,500	753,000	25,100
Central and Eastern Ohio	466,000	15,032	463,000	15,433	463,000	15,433
Northwestern Ohio	191,000	6,161	191,000	6,367	191,000	6,367
West Virginia	712,000	22,968	633,000	21,100	695,000	23,167
Pennsylvania	678,000	21,871	615,000	20,500	648,000	21,600
Montana	118,000	3,806	114,000	3,800	7,000	233
Southwestern Indiana	81,000	2,613	80,000	2,667	53,000	1,767
Northeastern Indiana	26,000	839	25,000	833	27,000	900
New York	104,000	3,355	78,000	2,600	89,000	2,967
Colorado	10,000	323	9,000	300	10,000	333
Tennessee	700	22	1,000	33	1,000	33
Total	42,043,000	1,356,226	40,405,000	1,346,833	36,946,000	1,231,533

(a) Revised. [illegible] and Independent Oil Producers' Agency.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

International Chamber of Commerce Considers Political and Business Obstacles to World Trade Resumption

[illegible] leaders from Sweden, Holland, Japan and Italy, Poland and Czecho-Slovakia, France and England, Belgium and Denmark, Australia and America, [illegible] the [illegible] of the world situation, worked, at the first Congress of the International Chamber of Commerce at London, to bring about "a common document, a common law, a common practice, which will be accepted by all the nations, and which will make it easier for commercial men to carry on international business," says Merle Thorpe, editor of *The Nation's Business*.

Upon scrutiny, the obstacles in the way of a restoration of the world's commerce fell into two classes—those political, and those purely of the business world.

Attacking the first, the delegates reached the following conclusions: The most important factor in the resumption of normal trade is the restoration of confidence. A conviction that governments will endure and peoples will work and pay will beget adequate credit and financial resources. Financial reform of governmental expenditures is urgent if state bankruptcy is to be avoided. It should be apparent that confidence and prosperity cannot be restored until all governments, without delay, remove burdens so largely responsible for widespread unemployment and paralysis of industry.

If governments sincerely wish the [illegible] of business men on this business subject, it may be summarized as follows: Drive the knife deep into governmental expenses; stop printing paper money; study carefully the effect which the Inter-Allied debts and the payment and use of the German reparations will have on [illegible], according to the treaties, and thereby reduce budgetary expenses; support export credit organizations, but let private enterprise create and run them; to governments with depreciated rate of exchange: don't contract new external loans; grant the greatest possible liberty to all commercial and financial transactions; remove the system of double taxation; support the Ter Meulen plan of export credits; don't harass a foreign firm; don't make it so hard for commercial travelers with [illegible], complicated, and [illegible] [illegible] as to their samples, and the [illegible] and irritating procedure of [illegible]; simplify passports, abolish [illegible], fix moderate fees for entrance and transit visas, and prevent government control or operation of business that renders trade conditions uncertain and artificial.

The following [illegible] business may do without the help of government in clearing away obstructions: Arrange for a combined rail and ship bill of lading, and for a uniform ocean bill of lading; interpret f.o.b. and other trade terms to importers, exporters, bankers, forwarding agents, ship owners and underwriters of each and every country; reduce waste in the production and use of raw materials; learn definitely the status of construction in each country; secure accurate statistics on materials essential to the world's economic life, and make them promptly available; set up machinery to settle trade disputes by arbitration, thus eliminating the law's delay and the fear of the law's delay; confer with science and religion in an effort to adopt un unchangeable calendar; standardize in factories and eliminate multifarious parts; establish on great international traffic routes through freight trains; work together for improvement of international telegraph, cable, telephone, and wireless communications; create free zones for re-exportation of goods; restore and extend pre-war international postal services; pay losses promptly, and extend to all countries the system of declared values.

Ore-Dressing Methods Discussed at Co-operative Meeting of Coeur d'Alene District

An important technical conference between mine operators of the Coeur d'Alene district and officials of the U. S. Bureau of Mines and of the Idaho State Bureau of Mines and Geology took place at Wallace on July 21. Francis A. Thomson, dean of the University of Idaho School of Mines and ex-officio secretary and director of the State Bureau of Mines and Geology, reviewed the work in ore-dressing which has been done at the University by the various co-operating agencies during the past four years. Following this A. W. Fahrenwald, metallurgical engineer in charge of the Federal work at Moscow, explained briefly the present attempt in the application of surface tension measurements to the determination of the adsorptive capacities of certain minerals for different oils. This exposition led to a good deal of discussion by different operators and millmen, who expressed themselves as feeling that this line of work will be of great assistance to flotation metallurgists everywhere.

E. B. [illegible], of the Bureau of Mines staff, spoke briefly of the results secured by a method of decontaminating creek slimes before flotation, the "decontaminator" affording a pre-flotation treatment by bubbling and elutriating, [illegible] removing from the slime certain surface-tension lowering constituents prejudicial to flotation. Thomas Varley, of the U. S. Bureau of Mines station at Salt Lake, discussed the volatilization process and its applicability to Coeur d'Alene ores.

Messrs. Stanly A. Easton and J. F. McCarthy, speaking for the operators, expressed themselves as well pleased with the progress being made and urged a continuance of the present program. Mr. Easton took occasion to point out that flotation, though a fruitful field for research, is by no means the only one, and urged that some attention be given to other ore-dressing problems, such as classification, in which, as R. S. Handy remarked, much remains yet to be done despite the great work of Prof. R. H. Richards. Rush J. White commended the fundamental and scientific nature of the work being done.

About twenty persons, including managers and representatives of all the producing mines, were present at the meeting, which by courtesy of Mr. McCarthy was held in the Hecla offices.

Charleston, W. Va., Section of A. I. M. E. To Be Organized

A meeting of a committee appointed to arrange for the formation of the Charleston Section of the American Institute of Mining and Metallurgical Engineers was held in the office of Carl Scholz, chairman, Professional Building, Charleston, W. Va., on June [illegible], at which the following members were present: Carl Scholz, J. S. Cunningham, [illegible], O. Cartlidge and J. M. Clark, resident members, and Thomas H. Claggett, from Bluefield, W. Va. It was decided to arrange for a meeting to organize the Charleston Section on Sept. [illegible], 1921, at which time officers for the remainder of the current year will be elected and bylaws adopted, with a banquet served at the close of the meeting.

Alabama University Offers Research Fellowships in Mining and Metallurgy

The School of Mines of the College of Engineering of the University of Alabama offers five fellowships in mining and metallurgical research in co-operation with the U. S. Bureau of Mines. The fellowships are open to graduates of universities and engineering schools who have the proper qualifications to undertake research investigation. The value of each fellowship for 1921-1922 is $540 per year of nine months, beginning Oct. 1. Fellowship holders will be required to register as graduate students and to become candidates for the degree of master of science in mining engineering or metallurgical engineering unless an equivalent degree has previously been received. The fellowships have been established primarily for the purpose of undertaking the solution of various problems being studied by the U. S. Bureau of Mines that are of especial importance to the State of Alabama and the Southern states. The investigations consist primarily of laboratory work directed by the Bureau technologists and School of Mines staff.

The following subjects have been selected for investigation for the year 1921-1922:

1. Beneficiation of Iron Ores.
    a. The crushing, grinding and concentration of iron ores preparatory to smelting.
    b. The metallurgical treatment of iron ores, especially the fundamental reactions involved in the blast furnace smelting.
2. The preparation, treatment and uses of non-metallic minerals such as barite and ochre in the industries other than ceramics or chemical industry.
3. Metallurgical coke.
    a. Relation of cell structure of coke to combustibility, or
    b. Relation of cell structure of coke to solubility in carbon dioxide.

Applicants should send a copy of their collegiate records from the registrar's office of the institution where they have graduated. They should also state their professional experience and give names and addresses of at least three persons who are familiar with the training and ability of the applicant. Applications are due not later than Sept. 1 and should be addressed to H. D. Pallister, Professor of Mining Engineering, School of Mines, University of Alabama, University, Ala.

MEN YOU SHOULD KNOW ABOUT

M. G. Gulley is examining the geologic structure in the Elk Basin oil field of Wyoming.

Henry H. Armstead, president of Armstead Mines, Inc., is in New York for a few weeks.

Charles A. Richardson, manager of the Chambers-Ferland mine, Cobalt, recently sailed for London.

Forest Rutherford has returned to New York after completing mine examinations in northern Ontario, Canada.

Sidney Paige, of the U. S. Geological Survey, is making an inspection visit to various of the geologic field parties doing work in the West.

Alfred H. Brooks, head of the Alaskan Division of the U. S. Geological Survey, will sail from Seattle on Aug. 12 for Seward, Alaska.

L. C. Mosburg has been assigned by the U. S. Geological Survey to the Eldorado oil field of Arkansas, where he will make geologic studies.

W. Forster Browne, who has been examining Canadian properties of the British Empire Steel Corporation, recently returned to London.

John Borg, president of the Callahan Zinc-Lead Co., is spending a month's outing at the mine near Wallace, Idaho. He is accompanied by his family.

F. W. Bradley, president of the Bunker Hill & Sullivan Mining & Concentrating Co., is at Kellogg, Idaho, inspecting the company's operations.

S. L. Mather, secretary of the Cleveland-Cliffs Iron Co., Cleveland, Ohio, recently made a tour of inspection of the various properties of that company on the Mesabi Range. He later inspected the company's mines in Michigan.

J. D. Northrop, who has been engaged in private petroleum geological work for the last two years, has resumed his connection with the U. S. Geological Survey and has been assigned to the mineral division of the Land Classification Board.

E. F. Neiman, general superintendent of the Harmony Mines Co., Baker, Idaho, and J. F. Inglis have opened an office at Salmon City, Idaho, under the name of Neiman & Inglis. The firm will conduct general consulting work in geology, mining, metallurgy, and mill design.

Cleveland Abbe, Jr., for the past two years assistant editor on the staff of *Engineering and Mining Journal*, has resigned to accept a position on the teaching staff in the Economics Department of the College of the City of New York. Mr. Abbe is a graduate of Harvard and Johns Hopkins universities and was also a student at the Imperial University, Vienna. Directly previous to his connection with the *Journal*, Mr. Abbe was associate editor in charge of the *Scientific American Supplement*, New York. Mr. Abbe's association with the *Journal* has been mutually enjoyable, and he leaves with the heartiest wishes of the staff for success in his new undertaking.

Mining engineers and metallurgists recently in New York City included: **Harry M. Wilten**, Chicago, Ill:; **H. S. Emlaw**, Trona, Cal.; **Harrison Souder**, Cornwall, Pa.; **E. A. Strout**, Guadaloupe, Zac., Mexico; **Alexander Grosberg**, La Paz, Bolivia; **W. George Waring**, Webb City, Mo.; **L. D. T. Greery**, Chuquicamata, Chile; **Sherwin F. Kelly**, Lawrence, Kan.; **R. A. Walter**, Reading, Pa., and **Oscar Lachmund**, Spokane, Wash.

SOCIETY MEETINGS ANNOUNCED

The American Institute of Mining and Metallurgical Engineers holds its 124th meeting at Wilkes-Barre, Pa., Sept. 12, 13, 14 and 15. The local committee, under the chairmanship of R. V. Norris, has arranged an interesting program of technical sessions and excursions. The latter, as well as the banquet, will be given to the members as a compliment from the members of the local committee and from the anthracite region. A meeting of the Society of Economic Geologists will be held at Wilkes-Barre in conjunction with the Institute meeting. This society has extended an invitation to all Institute members to attend its sessions. Among the interesting discussions expected during the Institute meeting may be mentioned a paper on "The Stratigraphy of the Anthracite Region," which is to be discussed by Prof. J. F. Kemp. A paper on the "Lynch Plant of the United States Coal and Coke Co.," which is illustrated by lantern slides and moving pictures, is to be present by Howard Eavenson. The control and prevention of mine fires as practiced in the coal districts will be fully described.

The Industrial Relations Committee will hold a session under the chairmanship of Robert Linton. A visit to the Ashley planes, discussed in the paper of C. H. Stein, will be one of the interesting events. Irem Temple has been reserved as the Institute headquarters in Wilkes-Barre. The Women's Auxiliary, through its local committee, has arranged an elaborate program, including various excursions and visits through the districts. Further details will be announced later.

OBITUARY

John J. Keating, superintendent of the Comstock Exploration mine at Virginia City, Nev., died suddenly on July 21. He was a son of the late R. P. Keating, a noted Comstock mining engineer of pioneer days.

General M. V. Woodhull, former head of the Consular Bureau of the State Department, died at Watkins, N. Y., on July 22. He was a director of the Utah Consolidated Mining Co. and of the Old Dominion Copper Co.

Tito A. Parroci, assayer and mine operator, died at Torreon, Coahuila, Mexico, on July 25. The greater part of Mr. Parroci's life was spent in Mapimi, where he was connected with the Penoles Mining Co. He was owner of the Hidalgo mines, in the San Diego district, near Velardena, and was shipping ore up to a few months ago.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorde .

LEADING EVENTS

Power Users in Utah Protest Against High Rates

Called "Excessive and Unjust" by Operators in Petition to State Public Utilities Commission

Users of electric power numbering more than [illegible] in the State of Utah petitioned the Utah Public Utilities Commission on July 26, protesting the present high power rates. The petition states that the rates, rules, and regulations charged and imposed by the Utah Power & Light Co. are excessive and unjust, and specifically sets forth that "the rates upon which the defendant is basing the charges it is exacting from the complainants and others for electrical power and energy supplied to them are unreasonable, unjust, and excessive as a whole, and are greater than the value of the service rendered, as well as greater than the reasonable cost to the defendant for furnishing such service, and are producing and will produce a greater revenue and profit to the defendant than the defendant is required or entitled to receive upon the value of its plant."

It is also alleged that the rates are higher than those for similar service in effect in adjoining states; that the methods of computing power bills are arbitrary, unreasonable, and unjust, and that rule 43-A of the defendant company is discriminatory in that it provides a different rate for different classes of industries using the same amount of power.

New Smelting Rates Announced by Bunker Hill Smelter

Frank M. Smith, smelter director of Bunker Hill & Sullivan Mining & Concentrating Co., has announced a change in custom smelting rates for ore handled at the Bunker Hill smelter at Bradley, near Kellogg, Idaho, following concessions made by the Great Northern Railway on ore freight rates. The revised rates provide for a freight charge of $3.75 for $30 ore from Nelson, B. C., ranging to $[illegible] on $100 ore. Libby, Mont., and [illegible], Idaho, will pay a smelting rate of $[illegible] minimum and $5 maximum. Boundary and Ymir, B. C., and [illegible], Wash., take rates of $[illegible] minimum and $[illegible] maximum. Troy, Mont., will have a rate of $3 to $[illegible]; Nighthawk, Wash., $[illegible] to $[illegible]; Oroville, Wash., $[illegible] to $6.60; Ruby, Wash., $[illegible] to $[illegible], and Tonasket and Okanogan, Wash., $[illegible] to $[illegible].

WEEKLY RÉSUMÉ

[illegible] of them are to be recommended. No [illegible] bill are reported.

[illegible] Public Utilities Commission that the [illegible] Light Co. are unwarrantably high. [illegible] mines on the Mother Lode and the [illegible]. Conditions at Tonopah and Divide are reported to be improving; the Tonopah-Divide Mining Co. has [illegible] & Copper Co. is reported to have filed [illegible] Trust Co. of New York, securing the payment of certain debentures. On [illegible] mission began its hearing on iron ore freight rates in force in the Lake Superior district.

[illegible] the International Nickel Co. has made [illegible] in the Cobalt district are reported more optimistic over the prevailing situation. A consular report states [illegible].

Lawyers' Fees Fixed in Utah in Compensation Cases

The State Industrial Commission of Utah on July [illegible] fixed attorneys' fees in workingmen's compensation cases. The [illegible] reserving the right, however, to ignore the 5 per cent clause at its discretion. [illegible]

Belgian Metal Market Affected By German Competition

[illegible]

Brussels, July 27—German competition is becoming disastrous in Belgium, accentuating the uneasiness now being felt in the metal market.

Cornish Tin Company To Sink New Shaft

[illegible]

London, Aug. 2—The [illegible] & Agar, Ltd., a tin mining company of Cornwall, has decided to sink a new shaft on its property at a cost of £60,000. Work in this connection will be started at once.

Spain May Increase Duties on Lead and Iron Ores

[illegible]

Madrid, July 29—Owners of lead mines in Cartagena and Linares are protesting against the proposal to increase the export duties on lead ores. Some anxiety is also felt in regard to the consequences of the proposed export duties on iron ores, as it may involve the closing down of some mines.

International Nickel Co. Cuts Wages Again

The International Nickel Co., Sudbury, Ont., put another wage cut into effect on July 15, when surface labor was reduced from $3.80 to $3.50 a day. In addition the working force was still further reduced and between thirty and forty men were laid off. Only half of the matte produced is being shipped to the refinery. The company has about [illegible] of nickel on hand and in process, including that in the roast [illegible]

Boleo Copper Company To Build Converter Plant

[illegible]

Co-operating in Experiments With "Gunite"

Three Mother Lode Mines and United Comstock To Work With Bureau of Mines in Testing and Investigating

Four mines, the Plymouth, the North Star and the Empire, in California, and the Gold Hill mine of the United Comstock Mines Co., Gold Hill, Nev., have entered into an agreement with the U. S. Bureau of Mines for co-operative research in the use of "Gunite" under the conditions present in the respective mines. The cement gun is being furnished by the Cement-Gun Co., Inc. The experiments will be in charge of B. O. Pickard, of the Bureau of Mines, Berkeley Station. L. K. Freeman, of the mining department at the University of California, will have charge of the details of the application of the "Gunite." He will be assisted by E. D. Gardner and Mr. Pickard, of the Bureau. The expenses for the cement-gun operator, labor, and materials used will be paid by the respective mining companies and other expense by the U. S. Bureau of Mines.

The proposed investigation is planned to cover such points as fire prevention, timber preservation, prevention of slabbing and control of swelling ground, protection of permanent haulage, bulkheading, and minor operations. An inquiry into the effectiveness and cost of "guniting" is also to be made. The details of the most economical use of "Gunite" are to be especially studied.

Stanley L. Arnot, superintendent of the Plymouth; R. A. Hardy, superintendent of the United Comstock Mines; A. B. Foote, manager of the North Star mines; and F. W. Nobs, superintendent of Empire Mines, will co-operate with the Bureau's officials in the work.

Arizona & Sonora Ry. Project Still Under Consideration

No decision has been reached yet regarding the construction of the proposed Arizona & Sonora railway, a route for which has been surveyed from Ajo, Ariz., to Rocky Point, Sonora, on the Gulf of California, a distance of not quite 100 miles. It is said that a man prominent in San Francisco shipping circles is now making a report on the dock site, shipping rates and other matters connected with the project and has two months in which to complete his work.

Iron-Ore Rate Hearing Begun

The iron-ore rate hearing before the Interstate Commerce Commission, affecting all independent mining companies and all iron-ore carrying railroads of the Lake Superior district, began July 25. The date of the hearing has been advanced many times, owing to the volume of business before the commission. It is believed that no order of the commission will be effective during the present shipping season, as the testimony will not be completed for many months. The mining companies are prepared to present evidence to uphold their contentions that the rates are too high and in some instances discriminatory.

Oliver Iron Mining Co. Cuts Wages Again

The Oliver Iron Mining Co. further cut the wages of mine employees 10 per cent Aug. 1. At present it is employing about 10,000 men, but not all on full time. Various working schedules are in force on the different ranges. These schedules are devised to provide as much employment for as many of their employees as possible.

Hecla Stockholders To Hold Special Meeting

Important Matters To Be Considered—Report on Property by Fred Searls, Jr., To Be Read

A meeting of the stockholders of the Hecla Mining Co. will be held in Spokane on Aug. 18, at which matters of unusual interest and importance will be acted upon, according to the official notice calling the meeting. The stockholders will be asked to ratify the action of the trustees in settling the apex litigation with the Federal and Marsh companies, through which the company acquired the old Tiger-Poorman property, and all of which involved a payment by the Hecla company of $750,000. The stockholders will also be asked to ratify the action of the trustees in joining the Bunker Hill & Sullivan in the purchase, development and operation of the Star mine. The purchase price is given at about $875,000, payment of which will be shared by the Hecla and the Bunker Hill on a 50-50 basis. The call states that $150,000 is now due and that $100,000 is payable by Nov. 1, 1923. The balance, $625.000, is payable in annual installments of $175,000 beginning in three years. The Star will receive a royalty of 25 per cent on net returns for all ore shipped, which will apply on the purchase price, and it is expected that shipments from the Star will meet all deferred payments. All the details of the Star deal will be submitted at the meeting, and the stockholders will be asked to approve them.

A highly interesting feature of the meeting will be the report of Fred Searls, Jr., on the physical condition of the Hecla mine. The examination of the mine is now being made, Mr. Searls having been engaged in the work for several weeks.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Assessment Work Bill, Amended, Passes House

Measure Provides That Annual Period Shall End July 1 at Noon—Allows Six Months Longer for 1921 Work

The bill providing that annual assessment work on mining claims may be performed during the fiscal year rather than during the calendar year has been passed by the House of Representatives with the amendment that the annual period ending Dec. 31, 1921, shall continue to twelve o'clock meridian, July 1, 1922. The change in making the annual period expire at noon rather than at midnight will add greatly to the convenience of those taking up claims and will avoid confusion and misunderstanding, it was argued.

During the course of the debate it was pointed out that the change to the fiscal year will make it possible to do two years' assessment work in a single season. The 1921 work, for instance, could be done in June and the 1922 work in July. This will make for important economies, it was declared, as materials need not be transported twice to the claim and the work for two years can be made practically a continuing operation. Another important saving will be made in many cases, in that road repair will be reduced. In many instances roads are washed away during the winter. If the present bill should become a law, the road will have to be made passable each second year only. In this way effort and money will be saved.

Hayden Against High-Tariff Wall

Fordney Bill Cannot Help Copper Industry, He Holds—Will Only Raise Costs for Arizona Mine Owners

Representative Hayden, of Arizona, in the course of a speech in the House on the tariff bill, among other things, said:

"Since there is no way in which the copper-mining industry can be directly benefited by tariff legislation it follows that the industry is injured if a high-tariff wall is erected, which has the effect of increasing the price of the materials or commodities that are used in mining operations. And that is exactly what this bill does as reported to the House. The Committee on Ways and Means has recommended that an import duty be collected on fuel oil. The tariff rates are materially increased on all articles such as pipe, rails, drills, machinery, and so forth, made of iron and steel, vast quantities of which are used in the metal-mining industry. The same is true of almost everything used in the way of mine supplies, except explosives and mine timbers, which remain on the free list. But, worst of all, this bill is especially designed to keep up the cost of living for the men employed by the mining companies of Arizona, for most of the things they and their families eat or wear are to be taxed even higher than under the Payne-Aldrich law.

"The copper-mining industry of my state could probably survive the handicaps that I have just stated, but this bill, which is avowedly designed to reduce importations, deals it a much more serious blow. The only way to restore prosperity in the copper camps is to find a market for all the copper that can be produced. The demand in the United State does not equal more than half the supply. How are the people of other nations to pay for the other half which must be sold if our copper mines are to have full payrolls and the smelters are to be operated to their capacity? They have no gold, and we will not take their depreciated paper money. They can only pay by sending us manufactured products for our raw materials, yet this bill is expressly designed to prevent such an exchange. No nation can long export a large volume of exports without imports. The world over, the two must balance or commerce dwindles and prosperity departs. There can be no other conclusion than that the enactment of this bill into law, with its high rates of duty on all manufactured products, postpones the time when the copper-mining communities of Arizona will again enjoy real prosperity."

Government's Silver Purchases

Purchases of silver under the Pittman Act during the week ended July 30 totaled 2,079,000 fine ounces. This brings the total purchases under this act to 65,390,816 fine ounces.

Tariff Schedule Displeases Representative Rhodes

Wants Higher Rate on Barytes and Cobalt Compounds Produced in His State

Representative Rhodes, chairman of the Committee on Mines and Mining of the House of Representatives, is far from being satisfied with the Fordney Tariff Bill, as passed by the House, for the reason that cobalt and cobalt ore are on the free list, and barytes ore is dutiable at only $4 per ton. Mr. Rhodes believes there should be a duty of 1c. per lb. on barytes ore. Though he is pleased that the bill carries a duty of 20c. per lb. on cobalt oxide and a 25 per cent ad valorem duty on cobalt sulphate and other cobalt compounds, he favors a higher rate for cobalt sulphate. If American valuations are allowed to apply, he believes the 25 per cent ad valorem duty will be very beneficial to the American industry. In support of his contention as to barytes, Mr. Rhodes said:

"We should have a duty of one-half of 1c. per lb. on the crude ore; a duty of 1c. per lb. on ground barytes or barium sulphate; a duty of 1¾c. per lb. on all sodium sulphite crystals; a duty of 1½c. per lb. on all barium sulphide; a duty of 2c. per lb. on barium carbonate; a duty of 2c. on precipitated barium sulphate; a duty of 2½c. per lb. on barium hydrate; a duty of 2½c. per lb. on barium chloride; 2½c. per lb. on all lithopone; a duty of 2½c. per lb. on all concentrated sodium sulphide; a duty of 5c. per lb. on barium nitrate; a duty of 8c. per lb. on all barium peroxide, and a 50 per cent ad valorem on each and every other barium compound and barium chemical. We should also have the same duty on witherite that we ask on the crude barytes ore, because it is used in competition with certain barium products.

"The district I represent in Congress has for the last fifty years prior to the late war produced more barytes ore than all the rest of the United States combined. During that period the total American production was from 30,000 to 89,000 tons of crude ore annually, with an annual importation of from 10,000 to 35,000 tons of crude ore.

"The average freight rate from southeast Missouri points, including war tax, to New York is $10 per ton, making it cost the Missouri shipper $20 per ton to deliver his ore to the New York market, thus permitting the German importer to undersell the Missouri producer about $11 per ton. In addition to this difference in favor of the German importer, he gets the benefit of the high value of our money as against the low value of the German mark. It should also be remembered that our prices are based upon the short ton of 2,000 lb., and that the German prices are quoted upon the long ton basis of 2,240 lb. So, it is evident that nothing less than one-half of 1c. per lb. will afford us any protection on the crude ore. The situation six months ago in Missouri with regard to ground barytes was as follows: At St. Louis the price was $27.50 per short ton f.o.b., with freight rate added, which made it cost $37.50 delivered f.o.b. New York. The German importer now offers to sell the same product for $15 per long ton f.o.b. New York, making the difference of $21.50 per ton. The present difference in exchange and the difference of 240 lb. on each ton entitled us to at least 1c. per lb. on the ground ore, in order to cover the difference and give us any protection at all."

Amendments to War Mineral Act Discussed in Secret

Amendments to the War Minerals Relief Act were discussed at a closed meeting of the Committee on Mines and Mining of the House of Representatives on July 29. A number of amendments are said to have been agreed to by the committee, but pending the submission of the committee's formal recommendation to the House, all announcement as to their scope is being withheld.

NEWS BY MINING DISTRICTS

London Letter

General Mining & Finance Corporation's Showing Improved—Rhodesia Broken Hill To Pay 10 Per Cent Dividend

By W. A. Doman

London, July 19.—While the General Mining & Finance Corporation makes a much better exhibit for the last calendar year than for a long time past, it is still a somewhat dismal document that the directors present. The disappointement of course is in the huge item of depreciation. For the past three years the share and stock and debenture holdings and depreciation have stood as shown in the accompanying table.

It will be seen that securities on which [illegible] has been expended have had written off approximately two-thirds of their original value. In the [illegible]

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible] loss; but [illegible] "any material i[illegible] [illegible]

With the exception of the [illegible] & [illegible] [illegible] as follows:

	1918	1919	1920
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]

[illegible]

approximately at £2,246,000. On the capital employed therefore the income is less than 5 per cent. After allowing for expenses the following surpluses are shown as profit: 1918, £25,434; 1919, £5,116; and 1920, £53,913. Last year's profit was equal to about 2.4 per cent on the capital employed. This profit, added to the sum brought from 1919, and totaling £133,701 is carried forward, so that for a full decade shareholders have received no dividend. Apart from the Meyer & Charlton the General Mining group of gold mines is dependent upon the gold premium. What appears to be a substantial and promising asset is Transvaal Silver & Base Metals, Ltd. This is the old Transvaal Silver Mine on which operations ceased some years ago. The old shaft has been reopened, and a second shaft is being sunk about 3,000 ft. to the east. So far 124,534 tons of ore is developed, of which 2,595 tons is proved unpayable, and 54,500 tons is not yet valued. The balance shows thus: 67,439 tons; 11 per cent lead; 10.5 oz. silver; width 44 in.; value per ton unsorted, 75/6. This is on a farm named Dwarsfontein. On the neighboring Brakfontein the lode has been proved by surface trenching for a distance on the strike of approximately 5,000 ft. The first unit of a concentrating and smelting plant to produce 750 tons of bullion monthly is being erected.

Last year the Rhodesia Broken Hill Development Co. smelted 42,806 tons of ore for a production of 14,602 tons of lead. In ten months of 1919 11,213 tons of lead was produced from 33,084 tons of ore. The average price obtained is not stated in the report, but the profit and loss account shows for last year "sales of lead" £461,677 and for 1919 £366,851. Costs have risen very considerably as can be seen in the following:

	Working Expenses £	Shipping Expenses £	Royalty £	Profit £
1919	113,464	125,957	9,856	100,889
1920	191,202	154,161	12,952	89,949

A dividend of 10 per cent is to be paid the same as a year ago. Apparently less in the nature of exploring was done in 1920, because the only reference in the report is that the works which were in operation in the previous year were continued "and valuable information was obtained in regard to the mode of occurrence of the ore-bodies." It is interesting to note the definite statement that the cementation process has proved successful, and that shafts can be sunk through the water-bearing dolomite country. The dolomite was at first regarded as a great drawback.

Gold at Bourkes Station

A discovery of rich gold ore is reported about two miles from Bourkes Station, in Ontario. Some spectacular samples have been brought to Cobalt, but the vein is understood to be quite narrow.

JAPAN

Copper Output of Kwansai District Drops — Manufacturers Discuss Question of Regulating Copper Market

Reuter Service (By Mail From Japan)

Osaka, June 29th—The following is the copper production in the Kwansai district classified according to prefecture within the jurisdiction of the Osaka Government Mining Bureau during the fiscal year 1920-21:

	Quantity, Lb.	Value, Yen
Hyogo	4,272,522	1,598,264
Ishikawa	3,793,468	1,418,057
Shimane	694,974	259,695
Okayama	953,672	356,673
Kagawa	3,624,515	1,355,568
Ehime	18,991,617	8,014,462
Kochi	19,192	7,167
Totals	32,349,960	13,209,856

The output compared with that during the previous year shows a decrease of 2,209,880 lb.

The "Wednesday" meeting of the Osaka copper manufacturers, for the purpose of mutual protection by adopting a united policy, was held on June 22, when the question of regulating the movements of the domestic copper market was the main topic of discussion. The arsenal, which has, up to now, been using domestic copper almost exclusively, now uses imported material. Production in Japan is on the decrease while the demand is increasing. Under these circumstances, the meeting discussed the question of regulating the market and production. The question of imports was also discussed. The Furukawa, Fujita, and Kuhara firms do not regard imports as menacing to their interests to any great extent, but the Mitsubishi company strongly objects to it. The Sumitono company, one of the most influencial copper makers in the country, has withdrawn from the conference and is acting independently.

MEXICO

Coahuila

Tin Discovered Near Muzquiz—Shareholders' Meetings in Saltillo

Saltillo.—Native miners of the village of Acuna are reported to have discovered tin near Muzquiz. The ore is said to carry silver. A group of nine claims has been filed on under the name of El Consuelo, and development work is to be done.

The Negociacion Minera Jesus Maria, a mining company in which the Madero brothers are largely interested, is to hold a general meeting of stockholders at the offices of Ernesto Madero & Bro. in Saltillo this month. The object of the meeting is to elect new directors, to review the business transactions for the last year and decide on plans for the future.

A number of other mining companies are to hold general shareholders' meetings in Saltillo this month. An effort is being made by these home companies to keep up the payment of their taxes and carry on development work to avoid being compelled to abandon their properties during the dull period. Some of them have been obliged to levy light assessments to meet these expenses.

Chilhuahua

Erupcion Mining Co. To Have Rail Connection

Chihuahua—Engineers have recently been engaged in surveying a railway route from the Mexican Central Ry. to the property of the Ahumada Lead Co. and the Erupcion Mining Co. in the Sierra de los Lamentos in northern Chihuahua. This road, for which the Mexican government has granted a concession, will be about fifty miles long. Stockholders of the Erupcion company will vote Aug. 8 on a proposal to increase the capital stock from 1,000,000 to 1,500,000 shares. If this increase is authorized, sufficient stock will be offered at intervals to stockholders at $1 per share to enable the Erupcion company to pay its share, which is two-thirds of the cost of the road.

CANADA

British Columbia

Premier Mine Rushing Work on Aerial Tramway—Dolly Varden Shipping

Invermere.—A prospectus has just issued announcing the organization of the East Kootenay Prospectors' Development Co., Ltd., the head office of which is to be at Cranbrook, B. C. The provisional directors are Major Clement Hungerford Pollen, engineer; Walter Van Arsdalen, prospector; John Foster Huchcroft, prospector; John Leask, police magistrate; Eric Herbert McPhee, merchant, all of Cranbrook, and Charles G. and Evan William Evans, prospectors, of Marysville, B. C. J. F. Huchcroft is the provisional secretary. The capital asked for is $10,000, divided into shares to the number of ten thousand at one dollar each. The chief objects of the company are to hold and assist in the development of likely mining properties throughout the East Kootenay district.

Slocan City—Indications are that the balance of the season will be fairly active in this district. Initial runs of the small mill put in for handling the product of the Ottawa mine by Biggar, MacGuire & MacPhee, who have a lease and bond from the Consolidated M. & S. Co., were made the middle of July. The plant will have a capacity of 50 tons per day, and will be connected with the mine by a 2-bucket tram, 2,000 ft. long. From the storage bin the material passes over a grizzly, the plus 1½-in. product going to a 7 x 10-in. Blake crusher and passing to a 50-ton storage bin. Crushed ore is automatically fed to a 5 x 22-ft. tube mill, thence going to a drag classifier, the minus 200-mesh slimes being elevated by bucket to a 9-cell Minerals Separation machine. Sands from the classifier are returned to the tube mill. The mill tonnage in sight at the Ottawa is estimated at 35,000 and runs 10 to 20 oz. silver.

Other property to be worked this season includes the V. and M. group at the head of Lemon Creek; the Black Prince, at the head of the north fork of Lemon Creek; the Anna group, adjoining the Ottawa; the L. T. and the Arlington.

Greenwood—Operations may be resumed soon at the Jewel mine, a gold property near Greenwood.

Edgewood—The crosscut tunnel on the Rampolla group of claims, in the Lightning Peak district, is now in about 460 ft. and is reported to be nearing the vein. Other mining activity around Lightning Peak this season is noted at the Lompy and Lighting Peak (leased). Waterloo and Detector are likely to be active before the season ends and a number of prospectors are doing assessment work.

Trail—Ore shipments received at the Consolidated smelter during the week ended July 21 were as follows:

Mine Location	Tons
Anna, Slocan City	20
Gold Hill, Taghum	42
Knob Hill, Republic	47
Surprise, Republic	283
White Water, Retallack	36
Company Mines	7,977

The proposed incorporation of Tadanac, where the Consolidated M. & S. smelter is situated, as a municipality, is the cause of considerable discussion locally. A joint committee representing the Trail Board of Trade, the city council and the school board has been in session a number of times with officials of the smelting company regarding the matter.

Stewart.—Work on the tramway to the Premier mine is being hastened at all high level points, in order that a possible early snowfall will not retard progress. With this finished, what is to be done at lower points along the line will receive attention. About seventy of the ore buckets to be used have arrived. Almost forty-six miles of cable will be used. Much of it is on hand and has been distributed along the line.

The Lake View group, in Glacier Creek, in the Bear River section, is being reopened. The old workings are being cleaned out, and it is possible that a shipment of high-grade silver bearing ore will be made soon.

On the Silverado, in the same district, a 40-ft. tunnel has been driven, and from two to three tons of high-grade ore is being sacked each week.

A tunnel has been started on the Montana and Waterloo claims of the [illegible].

Alice Arm—Shipments have begun from the Dolly Varden mine. There is about 3,000 tons to be brought to [illegible] and [illegible] shipped to the smelter. Development, meanwhile, is to be pushed.

Ashcroft—Gold is reported to have been taken from placer ground situated on the Douglas Lake Indian Reserve. As Indian lands are now open to location on the securing of a permit from the Indian Agent, and as gold and silver may be taken from such locations, considerable local interest is evinced in the recently staked diggings.

Manitoba

Gold Samples Brought From Elbow Lake

The Murray brothers, who recently made an important discovery of gold at Elbow Lake, Manitoba, have arrived at The Pas with spectacular free gold samples, the display of which has caused some excitement. These samples, it is claimed, were taken from various parts of an extensive quartz porphyry body.

Ontario

Cobalt Operators More Optimistic—Coniagas Passes Dividend—Wright-Hargraves at Kirkland Lake To Treat 175 Tons Daily

Cobalt—During June 276 tons of ore was shipped from Cobalt by the following mines: Coniagas, 156 tons; Bailey, 47; La Rose, 41; and O'Brien, 32. Of this 185 tons was shipped to Canadian smelters and 91 tons to United States smelters.

During the week ended July 15 there were shipped from Cobalt three cars containing 226,500 lb. of flotation concentrates. The Coniagas shipped two cars and the La Rose one car.

The continued strength of silver in London and generally improved conditions throughout the world as regards the metal, together with the small annual production, is giving rise to a more optimistic feeling in the Cobalt district. Though a considerably higher price of silver would have to be realized to permit of the reopening of any of the mines now closed, the present price does minimize the possibility of further shutdowns and will permit ore unprofitable at the lower prices recently prevailing to be treated.

The Coniagas has passed the quarterly dividend due Aug. 1. During the year the company has paid 20 per cent, 15 per cent of which was from former projects, or a total of $800,000. The mine is producing more silver, at a lower price, than last year, but the market is not as favorable, so the directors think it would be better to maintain a strong cash position.

The Casey Mountain syndicate is pushing development on its property, about fifteen miles from Cobalt, and has a shaft down [illegible] ft. The formation in this section is similar to that at Cobalt, but the country is largely covered with a heavy clay overburden. So far only one vein has been discovered, but this was a good producer.

[illegible]

15,000 tons of 8-oz. ore on the dumps, and about 1,200,000 oz. in tailings. The dumps and tailings cannot be treated profitably at the present silver price.

The financial statement of the Nipissing, as of July 2, shows cash and investments of $3,076,210, and ore and bullion on hand in transit $706,098, or a total of $3,773,309. The Canadian income tax for 1919, amounting to $146,000, was paid in June.

During June the Bailey custom mill treated 4,250 tons, of which 3,250 came from La Rose mines and 1,000 from the Bailey mine.

The Crown Reserve is sampling some of its old surface dumps with a view to treatment.

It is understood that the new vein on the McIntyre, located some time ago by diamond drilling, has been proven by a crosscut on the lower level, which shows 30 ft. of $20 ore. The main shaft is being deepened and a station is being cut at 1,625 ft. When this is completed the shaft will be continued to 2,000 ft. At present ore is sent by aërial tram from the main shaft to the mill across the lake. The company is planning to move its crushers, ball mills and tube mills to a new location adjoining the shaft, and pump the pulp to the present building. This would permit of a considerable increase in capacity without any addition to the present mill building, in addition to effecting a substantial saving over the present system.

Kirkland Lake—The Wright-Hargraves mine in Kirkland Lake will soon be treating 175 tons of ore a day, a larger tonnage than that handled by any mill in the camp. Development is progressing satisfactorily, and the property is in good condition. Mill heads are about $13 a ton.

The Teck Hughes will install additional grinding and classifying machinery to bring its mill capacity up to 160 tons a day. The ore is averaging over $10 a ton, with costs below $6. No further information is available regarding the proposed reorganization, but the proposal to increase the mill capacity indicates that the affairs of the company are in good order.

The Lake Shore has [illegible] the dividend-paying class by the declaration of a [illegible] per cent dividend, payable Aug. 10. Total dividends to date are [illegible].

Surface work on the West Kirkland is being continued, and to date [illegible] veins have been found.

[illegible]

[illegible]

[illegible]

[illegible]

chinery should begin to arrive on the ground within a few days.

American and English interests will unite in the underwriting of the stock of the Sylvanite. This company has 400,000 shares of $5 par, of which 320,000 shares have been issued. The syndicate will underwrite the remaining treasury stock, and the company will then be reorganized and will have a capital of $3,000,000, of which $2,000,000 will be issued.

Porcupine—Hollinger has declared the usual four-weekly dividend of 1 per cent, payable Aug. 12, which brings the disbursements for the present year up to $1,958,000, or at the rate of $3,198,000 for the full year.

The Hollinger continues treating between 3,200 and 3,300 tons a day. Good progress is being made in the building of additional houses for workmen, the construction of 150 of which has been contracted for.

A development report has just been received to the effect that the main vein of the Keora has just been crosscut on the 250 level, about 250 ft. from the shaft, where it has a width of at least 8 ft. with the face of the crosscut still in ore.

The Dome is now producing at the rate of about $225,000 a month. Development work on the 10th level is on a large scale, and is producing satisfactory results. With the earnings running at the present rate, the company should soon be able to start on the scheme of capital reduction, which officials have been considering for some time.

Arrangements are being made to complete the consolidation of the West Dome and the Dome Lake properties.

The Allied Porcupine is the name of a new company which has taken over the Three Nations, La Palme, and other adjoining properties. The workings are being dewatered, and development will start as soon as possible.

Sudbury.—The merchants of Sudbury, Ont., who have lost a good deal of business owing to the closing down of the nickel companies, are endeavoring to revive trade by encouraging prospecting for gold. They have organized under the title of the Mines Service Corporation, with a membership of about one hundred, each contributing $100, and have engaged a prospector to make explorations. It is claimed that the district should produce gold as well as nickel-copper, and it is stated that a promising prospect has already been found a few miles to the northeast of Sudbury.

Goudreau.—The Ontario Department of Mines has received a report from A. G. Burrows on the showings of gold near Goudreau, a station on the Algoma Central Ry. north of Sault Ste. Marie. The discovery was made by Thomas Murphy last April, and a number of claims have been staked. The report states that a number of samples obtained from points along the vein showed gold ranging from a few cents to $28 per ton. In addition, two assays were made of specimen quartz, carrying a high percentage of sulphide, from a pit a few feet west of the rich gold showings, which gave $31.20 and $48.80 in gold. The main vein shows high-grade ore for at least 40 ft. near the discovery, but extensive work will be required to determine the possible ore shoots along the vein, as the large portions of the vein are concealed by drift.

South Lorrain.—The electric motor which drives the twenty-stamp mill of the Keeley silver mine has been burned out, and the plant is temporarily closed.

WASHINGTON

Four Metals Co.'s Mill Ready in August —Caaba May Sink 200-Ft. Shaft

Nighthawk—The Four Metals Co., which is installing a 50-ton mill on its property, three miles north of Nighthawk, is employing twelve men on mill construction and outside work. It is planned to have the mill ready for operation in August. Equipment will consist of ball mills, two jigs, five tables and flotation machines.

Caaba mine, which has attained a depth of 300 ft. vertically, may be developed by shaft an additional 200 ft. Two cars of concentrates have been accumulated since milling was started at the Ruby mine concentrator. The ore is said to run about 80 oz. per ton.

Northport.—Gorien and Harris, who have been operating the Maki zinc mine for the last year, are now installing a small concentrator to treat their ore. The yard of the Northport smelter is being used for this temporary installation to take advantage of power and water facilities. The deposit was discovered only a year ago. It is a small deposit of high-grade smithsonite, and during the relatively short period of operation it has yielded a number of cars of ore which were shipped to Mineral Springs, Wis. The orebody along the strike is about 100 ft. long and averages 2 ft. in thickness. A shaft has now been sunk on the deposit to a depth of 180 ft.

OREGON

New Body of Quicksilver Ore Cut in Force Property Near Gold Hill— Norling Mine in New Hands

Gold Hill.—A large body of cinnabar ore running 40 to 60 per cent quicksilver has been uncovered in the Force group of quicksilver mines in the Gold Hill district. This mine is owned and operated by David Force, of Gold Hill, and is situated twelve miles north of the town. Like all other quicksilver mines in the district it has closed down its furnaces owing to the low price of quicksilver. Several of these mines are going ahead with development work.

This mine, with the Chisholm group and the War Eagle group, two adjoining mercury properties, has been a steady producer since 1916, operating on ore that averages about 17 per cent mercury. The War Eagle group is equipped with a twenty-five ton Scott furnace and two 12-pipe furnaces, and the Force and Chisholm groups are each equipped with a twelve-pipe furnace.

The War Eagle group, consisting of thirty-five claims, was formerly owned and operated by a Utah mining company. It was equipped and developed at an expense of about $60,000. Recent development shows that that the ore carries many byproducts, including a large percentage of arsenic, also gold, silver, zinc, nickel, and cobalt. The present company, composed of local investors and with its main office at Medford, announces that it will add equipment to recover several of these byproducts before resuming.

Medford.—Discoveries of rich ore at the Norling mine, three miles west of Jacksonville on Jackson Creek, has aroused interest locally. A new company recently organized by C. C. Clark and Etha Wall, of Medford, has acquired the property and will resume operations at once. This company is known as the Medford Mining & Milling Association, with its head office at Medford. C. C. Clark is president and M. P. Schmitt secretary and treasurer. Both are of Medford. The main adit of the mine is at an elevation of 3,130 ft. The gold is chiefly in the quartz. The country rock is a dark massive andesite; and pyrite is more abundant in the rock adjoining the vein than in the vein itself.

IDAHO

Cœur d'Alene District
Chicago-Boston Finds Long Sought Ore Shoot—Sunshine Mill Nearing Completion

Wallace—The long sought ore shoot in the Chicago-Boston has been found in drifting from the top of a raise from the 400 to the 200 level. A large ore shoot on the 200 was not found as expected on the 400. The drift in which the shoot was found shows 18 in. of high-grade lead-silver ore on the foot wall and about 6 in. on the hanging wall side, with about 3 ft. of milling ore between. Its position indicates that the ore rakes strongly to the east, which carries it beyond the end of the drift on the 400 level. Control of the Chicago-Boston is owned by the Callahan Zinc-Lead Co.

Kellogg—The 100-ton mill being constructed by the Sunshine Mining Co. on Big Creek is nearing completion. The company controls what is familiarly known as the Yankee Boy mine, locally famous as a producer of high-grade silver ore. About thirty-five men are employed in leasing operations on the property. The lessees are said to have left a large amount of good milling ore after sorting the high grade, and this will be available for the mill while new ground is being opened in tunnel No. 5, the lowest level.

Murray—H. A. Morse, a mining engineer of San Francisco, has secured a bond for $80,000 on the Terrible-Edith, a property which has a record of extensive shipments of lead and zinc ore, but which has been idle for several years.

The North Side Railway Co. has filed articles of incorporation, the purpose of the company being to reconstruct the Prichard Creek branch of the O. W. R. & N. company's line. The total length of the branch is about fourteen miles, and it is estimated that [illegible] miles will have to be rebuilt. It was washed out by the high water of the winter of 1917.

Other Districts

Sandpoint—The [illegible] Mining Co., operating a property near Talache, Pend Oreille Lake, plans to drive a 200-ft. tunnel, which will give a depth of about [illegible] ft.

Cabinet—It is announced that the Carpie Mining Co., which is developing a property with values chiefly in copper, will sink an additional 200 ft., from the 300 to 500 level.

Mackay—A car of hand-sorted ore, averaging about 30 per cent copper, has been shipped from the Valley View claim of the old Weimer Copper Co.'s property, in Skull Canyon, Birch Creek. The output has to be hauled 40 miles to Dubois for shipment. Operations at the Empire Copper Co.'s property, also in this vicinity, are being conducted principally by 60 lessees. The output for June was 30 cars, the largest in any month this year. Development on the 900-level has been gratifying, with an orebody opening up showing from 18.5 to 29.5 per cent copper.

MONTANA

Tuolumne Copper Co. Cuts Spread Delight Vein—Reported Anselmo Company Has Cut Body of Copper Ore

The Anaconda company is reported to have opened a body of high-grade copper ore at a depth of 2,800 ft. in a section of the district somewhat north of what has been understood to be the general copper zone.

The Tuolumne Copper Mining Co. has cut the Spread Delight vein on the 1,600 level of the Main Range mine. From the well-mineralized condition of the quartz found it is believed that when a point is reached [illegible] which was to be had on the 1,200, a commercial tonnage will be disclosed. The face of the crosscut has been improving, and assays of the breast run up to 46 oz. of silver.

The Davis-Daly company is continuing to open up more new ore than is being mined in the Colorado mine, and is shipping more than [illegible] tons daily. Crosscutting is under way on the [illegible] level for another vein, the position of which has been worked out by the geological department. This fissure already has been opened on the upper levels.

Butte & Superior is daily expecting to cut on the [illegible] level the copper vein encountered on the [illegible] level of the Black Rock mine.

The East Butte Mining Co. has practically got out of the oil business so far as direct participation in the future is concerned, according to officials' reports. This deal is said to have cost the company about a quarter of a million dollars. A moderate amount of development work is under way at the Pittsmont properties.

The Hesperus Mining Co. will sink from the 250 level to the 450 level with the development of the Hesperus vein of the Davis-Daly's Colorado mine in view. The Hesperus is operating through the old Butte-New England shaft, and is situated just to the southeast of the Colorado mine, with a number of the Davis-Daly fissures striking through. An orebody of mixed milling and first-class ore 6 ft. wide has been opened on the 250 level, and a crosscut is being driven to open three other ledges. An electrical hoisting plant, good for 750 ft., and a larger air compressor are being installed.

Butte & Western has opened its Stanislaus vein on the 500 level.

The Anselmo Mining Co. has opened a body of copper ore on the 1,200 level, according to unofficial reports. The property of this company, which is backed by the Beer Sondheimer interests, is somewhat on the western edge of the Butte district proper and to the northwest.

The Barnes-King Development Co. produced bullion in June to the amount of $30,052.09, as compared with $21,587.02 the preceding month.

UTAH

Work on Silver King Coalition Mill Progressing — Centennial Eureka and Bullion Beck Mines Resume

Alta — The South Hecla is making shipments of good fluxing lead carbonate ore. Between fifty-five and sixty tons a day has been shipped since July 1. Most of this ore comes from the No. 2 west stope about 1,600 ft. in on the Dwyer tunnel level.

The Sells, adjoining the South Hecla, is mining ore and making shipments of approximately fifteen tons a day. A new cable has been laid on the Michigan-Utah's aerial tramway, and shipments of lead ore have been started. A considerable tonnage has been stored in the mine awaiting the completion of the cable installation.

The Wasatch, at Alta, is building a short road to connect with the Little Cottonwood Transportation Co.'s railroad.

The Woodlawn, in Big Cottonwood, near the head of [illegible] Fork and adjoining the Prince of Wales, now owned by the Michigan-Utah, has recently made a strike of good silver-lead ore. The ore was opened 1,200 ft. in from the portal of the main tunnel and has been followed by a winze for 20 ft. It is [illegible] ft. wide in places. W. J. [illegible] is manager.

Eureka — The shipments from the Tintic district for the week ended July [illegible] amounted to [illegible] cars, the same as in the week preceding. The shippers were: Tintic Standard, [illegible]; Chief Consolidated, [illegible]; Iron King, [illegible]; Iron Blossom, [illegible]; Victoria, [illegible]; Dragon, [illegible]; Eagle & Blue Bell, [illegible]; Swansea, [illegible]; Gemini, 3; Colorado, 3; Mammoth, 3; Eureka Mines, 1, and Sunbeam, 1.

The Centennial Eureka and Bullion Beck mines, controlled by the U. S. Smelting, Refining & Mining Co., resumed operations last week. About seventy lessees were working at these properties when they shut down a few months ago.

Some ore has been opened at the Iron Blossom in new territory. The Dragon is shipping a regular tonnage of iron fluxing ore, and the Tintic Milling Co., at Silver City, controlled by the Knight interests, is treating low-grade siliceous silver ores from this property and from other mines. At the Little May, in South Tintic, a new electrically driven compressor and hoist is being installed. Ore carrying silver, copper, and gold is being mined on the 200 level.

The Eureka Lilly, in East Tintic, is drifting on the 500 and on the 1,400 levels. On the 500 level the face is in mineralized ground, and some high-grade bunches of silver lead copper ore have been cut on the 1,400 level. This work is being done to prospect for the continuation of an orebody which was opened from the surface to the 300 level in the early history of the property.

The Iron King, in East Tintic, is mining 500 to 600 tons of fluxing ore a week, and a small amount of lead-silver ore. Thirty-two men are employed, eight of them on company account and twenty-four for the A. S. & R., under the direction of Alfred Frank. At the Grand Central, at Mammoth, lessees are working and are making shipments. It is understood that operations on company account are to be resumed soon.

Park City—Ore shipments for the week ended July 22 amounted to 1,273 tons, as compared with 1,475 tons the week preceding. The shippers were: Silver-King Coalition, 565 tons; Judge allied companies, 390, and Ontario, 318.

Good progress is being made by the Silver King Coalition Mines Co. on the erection of the new mill, steel for which has begun to arrive. About [illegible] men are employed by the contractor, building concrete foundation and other work. Construction will soon be started. Mine development continues good, and further ore has been opened in new territory. About [illegible] men are employed.

The recent cave-in at the Judge Mining & Smelting Co. on the [illegible] level, which partly blocked the shaft for a short time, has been cleaned up and operations are being carried on.

George H. [illegible] and other [illegible] have been making a trip of inspection to the American Flag mine, with a view to resuming operations.

A bond and lease has been taken on the Park City King, adjoining the Silver King Coalition and Silver King Consolidated on the [illegible], and near the head of Thaynes Canyon, by [illegible]. The bond was given by the estate of James [illegible] and by [illegible].

COLORADO

Eurades Mining Co. Shuts Down—Road Construction Under Way in Red Mountain District

Ouray — The Eurades Mining Co., after operating for eighteen months, closed down suddenly. A small amount of high-grade ore was discovered not long ago and a shipment is now being made. The cause of shutdown is given as the closing of a prominent Chicago bank, one of whose officers was the principal backer of the mine.

Pickering Bros., of the Utah Construction Co., have been awarded the contract to build the new highway between Red Mountain and the Joker Tunnel, and are in the market for road machinery and are advertising for men. This is a fairly large contract and will mean lively activity in the Red Mountain district. The district is now practically abandoned but the new road will mean improved transportation facilities and prospecting will undoubtedly be stimulated. L. M. Spencer, of Del Norte, has been awarded the contract for the stretch between Bear Creek and State Bridge along the same highway and is advertising for men and machinery also. Both these projects, involving nearly $100,000, are Federal aid projects and will mean a vast improvement to the road between Ouray and Silverton, cutting hauling costs on ore and stimulating mine operations.

ARIZONA

Duncan Mining & Milling Co.'s Property Sold to J. M. White—Shattuck-Arizona Drops Men

Kingman—Development work has been started in the Katherine district on a large dike on the Nevada side of the Colorado River on what is believed a continuation of the Katherine vein. The property, known as the Homestake group, has been located for years. It has been renamed the Katherine-Nevada, and is being operated by Shaw, Cashman, Cushman & Chaffey.

Prescott—The Howard Copper Co., in the Black Canyon district, is installing a hoist and compressor, with the intention of sinking the shaft from the present 200-ft. depth to 500 ft.

The former property of the Verde Apex Copper Co., including seven claims and surface equipment, has been finally transferred on sheriff's deed to C. M. Raible, of Prescott, following judgment of $28,000.

Bisbee—Shattuck-Arizona has completed a program of development work entered upon last November and has dropped sixty men, after pulling its pumps.

Work of concreting the Dallas shaft of the Copper Queen from the 1,300 to the 1,800 level has been started. It is expected to take three months.

Clifton—The property of the Duncan Mining & Milling Co., situated about ten miles east of Duncan, has been sold at receiver's sale to James M. White, of El Paso, former manager of the property. It is stated that the receiver will pay all claims against the old corporation.

CALIFORNIA

Yankee Gold Dredging Co. Bankrupt—Shasta Zinc & Copper Co. Secures Payment of Debentures

San Francisco — The Yukon Gold Co. has shipped a dredge hull and superstructure for a 7½-cu.ft. dredge to its tin-mining properties in the Federated Malay States. Another dredge will be shipped later in August. The hydro-electric plant at Dawson has already been sent there.

Grass Valley — Operations are reported as rapidly reaching normal. Almost a full crew was put on at the Empire, and the number at work is being gradually increased at the North Star after a month's cessation of mining, although pumping was continued. At the Idaho-Maryland the water has been removed from almost the lowest workings, and encouraging results are being obtained in development.

Redding—According to local reports, the Shasta Zinc & Copper Co. has filed a $600,000 mortgage to the Equitable Trust Co., of New York, to secure payment of debenture bonds. Bonds bear 8 per cent interest and run four years. The company is now producing and is embarking on an active campaign of mine and smelter operations. The Tom Head mine, forty miles west of Red Bluff, has been taken over by a new company organized by N. A. Goyot.

Mercer — The Yankee Hill Gold Dredging Co. was declared bankrupt July 14. This company lost its dredge in a flood. Dredging was being done in the Stanislaus River near Knights Ferry at the time.

NEVADA

Conditions at Tonopah Improving—Tonopah Divide Resumes—Gold Discovered South of Mina

Mina—What may prove to be an important strike has recently been made in the Gold Range Mountains about nine miles southwest of Mina. The values are in gold. The vein has been traced and prospected for over 600 ft. by shallow shafts and trenches, and commercial values have been found for this entire distance. The vein is at times as much as 100 ft. in width.

Round Mountain—The Round Mountani Mining Co. shipped $8,000 in gold bullion on July 12. This was produced by lode lessees. Results of the placer clean-up have not as yet been announced.

Tonopah—Conditions in the Tonopah district are improving. There are at present 290 men working at the Belmont, out of a normal crew of 340, and 180 at the Tonopah Extension, out of a normal crew of 235. The Tonopah Mining Co. has made no attempt to resume operations. The Belmont is milling 300 tons of ore per day and the Tonopah Extension 200. Recent bullion shipments reported are: Tonopah Extension $26,000; and West End, $60,000, representing clean-up of operations for the first half of July.

Divide—The Tonopah Divide mine resumed operations July 20 with part of its crew, paying the reduced scale of wages. The crew will be increased as operations become normal. This is the first work done in the mine since April 16. The regular development campaign is to be followed and ore shipments made to the Belmont mill at Tonopah.

The south crosscut on the 900 level of the Kernick shaft is reported by the management to have cut stringers carrying values for the last 100 ft. No drifting has been done, as the crosscut has not yet reached the objective in Hasbrouck ground. The Hasbrouck company has entered into an agreement with the Western Divide and the Hasbrouck Annex, whose ground it was necessary to cross with the crosscut from the Kernick shaft in order to reach the Hasbrouck ground, that in exchange for the development of the two properties by the crosscut each company grants it a three-year lease on a strip of territory 100 ft. on each side of the crosscut, and without royalty.

MINNESOTA

Mesabi Range

La Rue Mine at Ely Renamed Armstrong Bay—Albany and Utica Stockpiles Being Shipped

Chisholm—A further reduction of operations by the Oliver Iron Mining Co. has been announced, which effects the Fraser and Wellington mines. At the Fraser, which is a new open pit, all stripping has been discontinued, effecting about 110 men. All underground operations have been suspended at the Wellington mine, a new underground property which became a shipper this season, but it has been announced that the miners affected will be taken care of at other properties on a curtailed schedule.

Hibbing—Ore loading at the Mahoning mine, operated by the Mahoning Ore & Steel Co., has stopped for this season. About 275,000 tons of ore has been forwarded to the docks, but this is only a small tonnage in comparison with that which could have been shipped by working at full capacity and for the whole season.

The stockpiles at the Albany and Utica mines, operated by Pickands Mather, are being loaded, and shipments made daily to the docks. The removal of any stockpile on the range during the existing depression is always accepted as a good sign, as it would permit the mine to operate this winter should conditions sufficiently improve to warrant underground work.

Ely—The La Rue mine, operated by the Chippewa Iron Mining Co., has been renamed the Armstrong Bay, to avoid confusion with a mine of the same name on the west end of the Mesabi Range operated by the M. A. Hanna Ore Co.

THE MARKET REPORT

Daily Prices of Metals

July	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
28	11.75	25[illegible]	26.50	4.35@4.40	4.20	4.20
29	11.75	25.625	26.50	4.35@4.40	4.20	4.20
30	11.75	25.625	[illegible]	[illegible]	[illegible]	4.20
Aug 1	11.75	25.875	26.75	[illegible]	[illegible]	4.20
2	11.75	25.50	26.375	4.35	4.15@4.20	4.20
3	11.75	25.00	25.75	4.35	4.15@4.20	4.20

*[illegible] 1[illegible] for [illegible]

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

July	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
28	70	70[illegible]	75	159[illegible]	161[illegible]	[illegible]	[illegible]	25[illegible]	26[illegible]
29	70[illegible]	70[illegible]	75	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26[illegible]
30			..						
Aug 1									
2	70[illegible]	70[illegible]	74[illegible]	158[illegible]	[illegible]	[illegible]	[illegible]	25[illegible]	26[illegible]
3	70[illegible]	70[illegible]	74[illegible]	157[illegible]	159[illegible]	[illegible]	[illegible]	25	[illegible]

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

July	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	Aug.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
28	3[illegible]	99[illegible]	62[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	
29	[illegible]	99[illegible]	61[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	38[illegible]
30	3[illegible]	99[illegible]	61[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	38[illegible]

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, Aug. 3, 1921

General business conditions seem to be slightly improved, but the non-ferrous metal market has not yet been affected.

Copper

The demand has been of fair volume for the last week, at the 1[illegible]c. level generally quoted for August deliveries by producers. We have heard of no large orders being placed, and consumers continue to buy merely for near-by requirements. Some of the more anxious sellers are willing to sell September copper at the 1[illegible]c. price, but there seems little disposition to cut under this figure. On a firm bid for a good tonnage of spot copper where a low freight rate applies, 11[illegible]c. delivered might be done, but this is not the general price. The [illegible] lot of [illegible] wire bars is not yet all sold and is offered at 11[illegible]c. f.o.b. warehouse, with apparently no takers. It may have to be sold at [illegible] lower price. Foreign demand has been quiet, sales being made largely to Germany and [illegible] through the Copper Export Association, whose European price is reported to be [illegible].

Domestic and foreign sales for July were [illegible] in the neighborhood of [illegible], which represents a gain of [illegible] and is considerably below the figure reached in May. It is [illegible] production in North and South America, but, even so, the copper surplus is disappearing but slowly.

Monthly Average Prices for July	
Copper:	
New York Electrolytic	12.170
London Standard	71.155
London Electrolytic	75.286
Lead:	
New York	4.440
St. Louis	4.260
London	2[illegible]
Silver:	
New York, foreign	6[illegible]
New York, domestic	99.[illegible]
London	[illegible]
Sterling Exchange	362.565
Zinc:	
St. Louis	4.239
London	[illegible]
Tin:	
99 per cent	[illegible]
Straits	[illegible]
London	164.530
Antimony	[illegible]
Quicksilver	[illegible]
Platinum	[illegible]

Lead

The American Smelting & Refining Co. is continuing its official contract price of 4.40c., and no early change is likely.

Demand for the last week has been quiet, but not entirely absent. Every day has seen a few inquiries and several orders for one or two hundred tons have been placed. One lot of 1,000 tons was marketed. The storage-battery and paint business continues satisfactory, and these lines form the principal outlet for the metal. It is likely that producers are accumulating small stocks under present conditions, but they are not sufficiently large to cause them worry; nor are they expected to be [illegible] lead is selling for [illegible] 4.50c., Chicago.

Zinc

The market is unchanged, almost all [illegible] on a [illegible] St. Louis basis. No [illegible] in demand is noticeable, although reports [illegible] in the [illegible] trade. Production has been cut severely by the large [illegible]. It is the [illegible]

Tin

[illegible] Banka tin, [illegible]

Bolivian ores in storage, 10,000 tons; and in consumers' hands, 4,000 tons. These figures are of course partly guesses, but they are believed to be an intelligent estimation.

Tin for forward delivery is nominal at the same prices as for spot.

Arrivals of tin, in long tons: Total for July, 1,500; Aug. 1st, London, 100; Rotterdam, 50; Straits, 30; China, 5.

Gold

Gold in London: July 28th, 114s. 10d.; 29th, 115s. 2d.; Aug. 2d, 115s. 5d.; 3d, 115s. 5d.

Foreign Exchange

The exchange market has been generally inactive during the last week. Sterling "cables" continue to be quoted one-half cent above the "demand" figures given in the table on page 233. On Tuesday, Aug. 2d, francs were quoted at 7.6275c.; lire, 4.2275c.; and marks, 1.22c. New York funds in Montreal, 11⅜ per cent premium.

Silver

The New York market has been quiet, and prices obtainable in Frisco, based on the China exchanges, were well below the London parity. As a result the Frisco market has been a purely nominal one. The Mexican government has placed a tax, effective Aug. 1, on silver exports at the following rates:

5 % on silver valued at 60c. or under
5½% " " " " 60c. to 70c.
6 % " " " " 70c. to 80c.

At current prices, the new rate means an increased tax of 5 per cent, or about 3c. per ounce. Efforts are being made to have this tax law repealed or the rate reduced.

Mexican Dollars—July 28th, 47¾; 29th, 47; 30th, 47⅜; Aug. 1, 47⅜; 2d, 47; 3d, 46¾.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 21@23c. per lb.; 22½c. for imports, duty paid.

Antimony—Chinese and Japanese brands, 4.60@4.65c.; market dull. W.C.C. brand, 5⅜@5⅝c. per lb. Cookson's "C" grade, spot 9@9¼c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500-lb. lots.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $3@$3.25 per lb.; black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $165@$185 per oz.

[1]**Molybdenum Metal**—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz. Nominal $70, Los Angeles, Cal.

Palladium—Nominally, $48@$52 per oz.

Platinum—Nominally, $65 per oz. The market has held steady, and the decline of last week has been arrested.

Quicksilver—Nominally, $43.50@$45 per 75-lb. flask. San Francisco wires $46.25.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—22c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., July 30—Zinc blende, per ton, high, $24.25; basis 60 per cent zinc, premium, $21; Prime Western, $21@$20; fines and slimes, $19@$18; average settling price, all grades of zinc, $20.62.

Lead, high, $51.70; basis 80 per cent lead, $45@$50; average settling price, all grades of lead, $46.24 per ton.

Shipments for the week: Blende, 4,024; lead, 1,317 tons. Value, all ores the week, $143,850. Shipments for seven months, 157,269 tons blende, 102 tons calamine, 35,355 tons lead. Value, all ores seven months, $5,597,780.

Waco ore, which was selling $1 above Oklahoma prices on account of 80c. freight differential, was dropped this week to $20 and the freight, or $20.80 per ton. Oklahoma prices continued on $21 basis, with total district sales for the week of 4,600 tons, the largest purchase in one week since June 18.

Lead offerings were advanced to $50 basis this week by one purchasing company, short on its supply of ore.

Platteville, Wis., July 30—No market for zinc or lead ore. Shipments for the week, none. Shipments for the year: Blende, 11,461; lead ore, 978 tons. Shipped during the week to separating plants, 168 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1, $1,700@$2,000; No. 2, $1,200@$1,500; spinning fibers, $400@$800; magnesia and compressed sheet fibres, $275@$400; shingle stock, $95@$150; paper stock, $60@$75; cement stock, $17.50@$30; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada; 5 per cent to be added as export sales tax.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga.

Bauxite—French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $6.50@$8.50; washed, $9@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

---

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Feldspar—No. 1 soap grade, $7@$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, $6@$6.50; No. 2, $5@$5.50. Market dull. Large stocks are available and quotations are nominal. Producers report cancellations of orders. No. 1, Canadian, ground, $26 f.o.b. cars.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $13.50, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, ¾@2½c. Market exceedingly dull and reflects general business conditions. When manufacturing plants are idle there is no demand for graphite.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $45@$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60. Temporarily dull market on account of building stagnation.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity), ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, quoted $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $11.65; 75 per cent, $10.65; 75@74 per cent, $10.15; 70 per cent, $6.25; 68 per cent, $5.75; 68@66 per cent, $5.50.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 12c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines. Market quiet.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $7.50@$11 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—Prices have been reduced and are now about 6c. per lb. It is reported that Japanese arsenic in 100-ton lots has been sold recently as low as 5c. per lb.

Sodium Nitrate—$2.30@$2.50 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $16@$18 per ton, f.o.b. Western mines, spot and six months' contract; $33@$35 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.35 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 14c. per lb. of chromium contained; 4 to 6 per cent carbon, 15c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $[illegible]@$70, f.o.b. furnace; resale, $[illegible] [illegible]. English, $[illegible]@$70, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $[illegible]@$[illegible], f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from [illegible] to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works. Imported material, $1 [illegible].

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $40; 50 per cent, $6[illegible]; [illegible] per cent, $[illegible].

Ferrotungsten—Domestic, 70 to 80 per cent W, [illegible] per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$4.25@$4.50 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 20½c. per lb.; wire, 14@14½c.

Lead Sheets—Full lead sheets, 8.25c.; cut lead sheets, 8½c. in quantity, mill lots.

Nickel Silver — 31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets 16⅞c.; sheathing, 16⅛c.; rods, ⅜ to 3 in., 13⅞c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $35@$50 per ton, f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—Straights, $60@$65 per net ton, shipping point; arches, keys, wedges, $66; splits, soaps, $84.

Fire Brick—First quality, 9-in. shapes $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $70@$75 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Aug. 2, 1921

The increase in demand upon the steel mills that began about July 15 has continued. The gains are slight, but they are plainly marked in sheets, standard steel pipe, merchant bars and a few other commodities.

As formerly, the demand experienced is wholly for prompt shipment. Single carload [illegible] the [illegible] and [illegible] sheets are estimated to represent more than 90 per cent of the total volume of business [illegible] [illegible] and specifications from the automobile trade and [illegible] car [illegible]. Steel production is now approximately [illegible] per cent of capacity.

On the average, prices have been declining by less than a dollar a ton a week. [illegible]

Pig Iron—[illegible] at $1[illegible], Valley, [illegible] market. [illegible] Valley [illegible]. Foundry remains at $[illegible].

Coke

Connellsville — Furnace, $2.75@$3; foundry, $4@$4.[illegible].

---

[1] Foote Mineral Co., Philadelphia, Pa.

Foreign Zinc Industry Unsettled

American Zinc Institute Reports Conditions Affecting the Production and Marketing of the Metal Unchanged in England, Unprosperous in France, Costly in Belgium, and Chaotic in Germany—Scandinavian Production Low, and Australian Works Closed

THE secretary of the American Zinc Institute has received the following communication respecting the world production and marketing of zinc from the honorary foreign correspondent of the Institute:

The quotations on the London Metal Exchange continue to vary between £26 and £28, and since the date of my latest report the actual demand by the consumers has been so light as to have no impression on the market. Now that the three months' strike of the English and Scottish coal miners is at an end and all other strikes in Britain have been amicably settled, it is reasonable to expect an improvement in trade conditions. None of the Continental producers shows any anxiety to sell much slab zinc at present prices, and, as far as Belgium is concerned, the appreciation in the franc exchange has necessarily caused a corresponding increase in the sterling quotations for metal from that country.

United Kingdom—The position in the English zinc industry is entirely without change, inasmuch as it is still a physical impossibility for British smelters to produce zinc at anything like the present market price. In the past it has been customary for all virgin zinc to be classified as "G. O. B." (i.e., Good Ordinary Brands), with the result that metal of 99 per cent purity failed to command the premium to which it was entitled, except from those consumers who had found it necessary to restrict their dealings to certain brands which possessed characteristics suitable for the purposes intended. Thus the roller of sheets was satisfied to pay a premium varying from 2s. 6d. to 10s. a ton for slab zinc containing a minimum of cadmium and of otherwise good rolling quality, and he limited his brands to those which he found by experience would meet these conditions uniformly. There is no reason why the grades of higher purity zinc than G. O. B. or Prime Western should not carry the same "spread" as in America, and, in view of the fact that all the zinc which the British Board of Trade will receive under its long-term purchase agreement with Australia will be of a purity of 99.95 per cent, one would think that the board would enter upon an educative campaign among all consumers in the country for the purpose of satisfying various users that in many cases it is economical to pay premium for specific qualities. The government would be well advised to arrange for its agents to enter upon such a campaign at the earliest moment, notwithstanding that it would probably involve the earmarking of several thousand tons for distribution among all consumers by means of trial parcels at the G. O. B. price.

France—In France, the zinc industry is not prospering, and there is no object in output being increased even at the rebuilt smelters at Montagne-du-Nord. In any case France is not likely to produce more than her own requirements.

Belgium—The Federation of Zinc Smelters in Belgium is maintaining its production at about 4,500 tons per month, and a welcome revival of late in the Continental consumption has prevented any marked augmentation of stocks. Slab zinc on hand in Belgium today is 11,000 tons, but the stocks of rolled zinc sheets still remain at over 40,000 tons, mainly the property of the Vieille Montagne. The demand for ore is exceedingly light, for the reason that the Belgian smelters have sufficient calamine and blende on hand to carry them along until February, 1922, at the present rate of zinc production. The smelters have still to take delivery of a considerable quantity of Australian concentrates under contract, and the treatment of these at the price paid represents a substantial loss at the current market price of the metal. Today, under existing circumstances, Belgium can hardly afford to pay more than £4 15s. a ton for Broken Hill concentrates of the standard grade of 47 per cent Zn, 6 per cent Pb, and 10 oz. Ag.

Germany—Notwithstanding the obscurity of the German zinc situation, two factors stand out clearly: (1) The current production is very light, and (2) the unsold stocks are not excessive. The total production today does not exceed 4,000 tons a month, as smelting in Silesia is paralyzed pending a definite decision on the fate of Upper Silesia. The Inter-Allied Commission has found that the settlement of this question bristles with difficulties, and has not yet reached any solution of the problem. In the meantime, its task is not made easier by the active propaganda carried on by both Germany and Poland. Zinc, in common with all manufactured goods in the disputed area, is to all intents and purposes immobolized for the time being. Owners of merchandise there can only offer on the promise of delivery when transportation from Upper Silesia is resumed, and, far from any decision by the Allies being imminent, the commission only last week called in experts to investigate and report upon the position. In Germany itself the consumption of zinc is poor, and the low production is sufficient to take care of it. The unsold stocks of virgin zinc in the country are computed to be 16,000 tons, and the holders show no desire to offer this on the London market; indeed, the German government has hinted to the owners that the export of this comparatively small stock of zinc is undesirable. The British government has reduced the tax under the Reparations Act on German goods entering the United Kingdom from 50 per cent to 26 per cent, but in order to remove this disability to German exporters the German government has agreed to bear such burden itself. Were Germany, however, a seller of zinc today, there is nothing to prevent her selling to a neutral country for resale to Great Britain, as German zinc so dealt in escapes the terms of the Reparations Act. This is a fact known to few if any of the English importers of Continental metals.

Scandinavia—In both Norway and Sweden the zinc smelters are operating at very low capacity, which may be easily understood when it is explained that the producing costs at the hydrothermic works are certainly not less than the Belgian distillation works' cost today of £30. Although Scandinavia produces about 98.5 per cent zinc, the main quantity runs from 99 per cent to 99.9 per cent. Generally speaking, European trade has been in such a condition during the last nine months that zinc of higher purity than Prime Western has been difficult to place except in small quantities; hence, it has been no uncommon occurrence for the Norwegian and Swedish sellers of late to deliver 99 per cent purity metal against G. O. B. sales on London.

Australia—Both the distillation works in South Australia and the hydro-electrolytic works in Tasmania remain closed, and operations are confined to the erection of further units at the latter plant.

Galvanized Sheets—The British makers of galvanized sheets have lately been booking orders on the basis of delivery in four to six weeks after the termination of the coal strike, and they are now engaged in hurrying supplies of coal to their works, so by the middle of September the production of galvanized sheets should again be in full swing. The English galvanizers have, through their association, tried to fix selling prices, but any efforts to this end are doomed to failure, as certain members are always ready to undercut the basis quotation. One such attempt at price fixing was made in June, and this was defeated as much by German competition as anything else. Indeed, the British galvanizers are face to face today with stern German competition for really the first time in the history of the trade, and it is a fact that 24 and 26 gages, which Britain cannot profitably sell below £22 a ton f.o.b., are obtainable from Germany at 15s. a ton cheaper, f.o.b. Hamburg.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York 1920	New York 1921	London 1920	London 1921	Sterling Exchange 1920	Sterling Exchange 1921
January	132 827	65 [illegible]	[illegible]	[illegible]	367 082	372 650
February	131 295	59 [illegible]	[illegible]	34 745	337 466	385 932
March	125 551	[illegible]	74 [illegible]	32 479	370 870	[illegible] 806
April	119 779	[illegible]	[illegible]	34 250	392 438	391 784
May	102 585	[illegible]	60 010	[illegible]	383 360	396 580
June	90 957	[illegible]	[illegible]	[illegible]	393 663	377 236
July	91 971	[illegible]	[illegible]	[illegible]	385 538	362 565
August	96 168		59 875		[illegible]	
September	93 675		[illegible]		[illegible]	
October	83 480		54 197		[illegible]	
November	77 734		50 952		[illegible]	
December	64 774		41 845		348 101	
Year	100 900		61 [illegible]		364 84[illegible]	

New York quotations cents per ounce troy, [illegible] London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic 1920	New York Electrolytic 1921	London Standard 1920	London Standard 1921	London Electrolytic 1920	London Electrolytic 1921
January	18 918	12.597	[illegible]	70 964	123 238	[illegible]
February	18 569	12 55[illegible]	[illegible]	[illegible]	126 950	75 [illegible]
March	18 331	11 976	[illegible]	[illegible]	[illegible]	[illegible]
April	18 660	12 43[illegible]	103 [illegible]	[illegible]	111 500	[illegible]
May	18 484	12 742	[illegible]	[illegible]	109 200	74 298
June	18 065	12 697	87 [illegible]	[illegible]	101 909	75 682
July	18 576	12 170	[illegible]	[illegible]	106 455	75 286
August	18 346		[illegible]		111 143	
September	18 144		[illegible]		111 905	
October	15 934		[illegible]		104 905	
November	14 257		84 [illegible]		94 614	
December	13 188		[illegible]		85 905	
Year	17 456		[illegible]		[illegible]	

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York 1920	New York 1921	St. Louis 1920	St. Louis 1921	London 1920	London 1921
January	8 561	4 821	[illegible]	4 747	47 [illegible]	23 [illegible]
February	8 814	4 3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
March	9 145	4 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
April	8 902	4 3[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
May	8 576	4 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June	8 323	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
July	8 338	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
August	8 687		8 725		[illegible]	
September	8 177		[illegible]		[illegible]	
October	7 070		[illegible]		[illegible]	
November	6 159		[illegible]		[illegible]	
December	4 727		[illegible]		[illegible]	
Year	7 957		7 830		[illegible]	

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York 99% 1920	New York 99% 1921	New York Straits 1920	New York Straits 1921	London 1920	London 1921
January	61 596	36 000		[illegible]	[illegible]	[illegible]
February	58 466	28 534	59 932	[illegible]	[illegible]	[illegible]
March	61 037	27 2[illegible]	61 926	28 [illegible]	[illegible]	[illegible]
April	61 120	[illegible]	62 115	[illegible]	[illegible]	[illegible]
May	53 230	[illegible]	55 100	[illegible]	[illegible]	[illegible]
June	46 125	[illegible]	48 327	[illegible]	[illegible]	[illegible]
July	45 798	[illegible]	47 154	[illegible]	[illegible]	[illegible]
August	43 856		47 620		[illegible]	
September	41 940		44 4[illegible]		[illegible]	
October	37 310		40 [illegible]		[illegible]	
November	35 667		36 [illegible]		[illegible]	
December	31 133		34 [illegible]		[illegible]	
Year	48 273		49 101		[illegible]	

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	St. Louis 1920	St. Louis 1921	London 1920	London 1921
January	9 133	5 413	58 643	[illegible]
February	8 708	4 [illegible]	[illegible]	[illegible]
March	8 [illegible]	4 737	[illegible]	[illegible]
April	8 184	4 747	[illegible]	[illegible]
May	7 588	4 848	[illegible]	[illegible]
June	7 465	4 4[illegible]	41 [illegible]	[illegible]
July	7 720	4 [illegible]	41 [illegible]	[illegible]
August	7 8[illegible]		41 [illegible]	
September	7 661		[illegible]	
October	7 150		39 736	
November	6 247		[illegible]	
December	5 824		[illegible]	
Year	7 671		44 [illegible]	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York 1920	Antimony (a) New York 1921	Quicksilver (b) New York 1920	Quicksilver (b) New York 1921	Platinum (c) New York 1920	Platinum (c) New York 1921
January	10 577	[illegible]	[illegible]	48 440	154 23	73 400
February	11 [illegible]	[illegible]	[illegible]	49 545	151 59	70 227
March	11 [illegible]	[illegible]	[illegible]	46 796	138 56	72 463
April	10 [illegible]	[illegible]	[illegible]	45 423	127 04	73 404
May	[illegible]	[illegible]	[illegible]	47 000	97 50	73 740
June	8 289	[illegible]	90 154	46 846	85 19	74 942
July	7 500	4 735	[illegible]	44 950	83 94	70 440
August	7 177		83 806		[illegible] 44	
September	7 113		75 000		[illegible]	
October	6 723		67 200		[illegible]	
November	6 109		58 417		[illegible]	
December	5.534		49 577		[illegible]	
Year	8 485		81 123		[illegible]	

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer 1920	Bessemer 1921	Basic 1920	Basic 1921	No. 2 Foundry 1920	No. 2 Foundry 1921
January	$40 47	33 96	$[illegible]	[illegible]	$[illegible]	[illegible]
February	42.95	28 96	42 [illegible]	[illegible]	43 [illegible]	[illegible]
March	43 40	28 1[illegible]	42 [illegible]	[illegible]	43 [illegible]	[illegible]
April	43 72	[illegible]	44 22	24 [illegible]	[illegible]	[illegible]
May	44 00	[illegible]	44 [illegible]	[illegible]	[illegible]	[illegible]
June	44 89	24 [illegible]	45 41	[illegible]	[illegible]	[illegible]
July	47 21	22 [illegible]	47 42	[illegible]	[illegible]	[illegible]
August	48 90		49 [illegible]		[illegible]	
September	50 46		50 4[illegible]		[illegible]	
October	49 21		44 38		[illegible]	
November	41 26		39 20		42 [illegible]	
December	36 96	..	34 90		37 73	
Year	44 45		43 85		44 93	

In dollars per long ton.

Monthly Crude Copper Production

	1921 March	1921 April	1921 May	1921 June
Alaska shipments	4,985 259	5,615,500	4,216,920	[illegible]
Arizona Copper	2,000,000	2 000 000	2,000 000	[illegible]
Calumet & Arizona	3,455,672	2 204 000	(a)	[illegible]
Cons. Ariz. Smelting	[illegible]	[illegible]	[illegible]	[illegible]
Inspiration	5,000 000	[illegible]	[illegible]	[illegible]
Magma	[illegible]	[illegible]	[illegible]	[illegible]
Miami	4 [illegible]	4 262 [illegible]	[illegible]	[illegible]
New Cornelia	2,220 186	1 864 [illegible]	[illegible]	[illegible]
Old Dominion	2,199 000	984 [illegible]	[illegible]	[illegible]
Phelps Dodge	6,959 000	[illegible]	[illegible]	[illegible]
Shattuck Arizona	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	2 940 000	[illegible]	[illegible]	[illegible]
United Verde	4 [illegible]	2 600 000	[illegible]	[illegible]
United Verde Extension	2,951 390	3 092 746	[illegible]	[illegible]
Calumet & Hecla	9,147 000	[illegible]	[illegible]	[illegible]
Other Lake Superior	5 000 000	5 000 000	4 500 000	[illegible]
Anaconda	11 600 000	[illegible]	(a)	[illegible]
East Butte	1 000 000	1 047 140	[illegible]	1 350 000
[illegible]	3,100 000	[illegible]	[illegible]	(a)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Eastern Smelters	1 500 000	[illegible]	1 500 000	1 500 000
Others, estimated	7,100 000	10 900 000	5 500 000	[illegible]
Total United States	91 046 345	45 946 523	[illegible]	[illegible]
Imports: Ore and concentrates, [illegible]	9 865 917	[illegible]	3 072 707	[illegible]
Imports of blister, unrefined	12 448 823	[illegible]	[illegible]	[illegible]
Imports of refined, etc.	359 572	19 459 418	7 517 134	[illegible]
Grand total	113 720 657	[illegible]	41 072 014	[illegible]
British Columbia				
Granby Cons.	2 617 702	2 459 250	2 539 000	[illegible]
Mexico				
Boleo	618 222	[illegible]	[illegible]	[illegible]
Cananea	[illegible]	[illegible]	[illegible]	[illegible]
Phelps Dodge Mexican properties	[illegible]	407 000	[illegible]	(a)
Other Foreign				
Cerro de Pasco	[illegible]	[illegible]	[illegible]	[illegible]
Chile	[illegible]	[illegible]	[illegible]	[illegible]
Katanga	[illegible]	[illegible]	[illegible]	[illegible]
Backus & Johnston	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mount Lyell	[illegible]	[illegible]	[illegible]	[illegible]
Mount Morgan	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(a) No copper produced [illegible]

Comparative Annual Copper Production

	1919	1920	1921
January	[illegible]	[illegible]	[illegible]
February	[illegible]	[illegible]	[illegible]
March	[illegible]	[illegible]	[illegible]
April	[illegible]	[illegible]	[illegible]
May	[illegible]	[illegible]	[illegible]
June	[illegible]	[illegible]	[illegible]
July	[illegible]	[illegible]	
August	[illegible]	[illegible]	
September	[illegible]	[illegible]	
October	[illegible]	[illegible]	
November	[illegible]	[illegible]	
December	102 [illegible]	[illegible]	

MINING STOCKS

Week Ended July 30, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Ahmeek	Boston	47¼	47¼	47½	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*39	*35	*35	....	
Allouez	Boston	*20	*18	*20	Mar. '19	1.00
Anaconda	New York	38¼	37¼	37⅝	Nov. '20, Q	1.00
Arcadian Consol	Boston	2 1/16	2	2	....	
Ariz. Com'l.	Boston	....	.	8	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*27	*23	*25	....	
Bingham Mines	Boston	9¼	9	9½	Sept. '19, Q	.25
Calumet & Arizona	Boston	48¾	46½	47	June '21, Q	.50
Calumet & Hecla	Boston	224	220	220	June '20, Q	5.00
Canada Copper	N. Y. Curb	*33	*27	*33	....	
Centennial	Boston	....	....	7½	Dec. '18, SA	1.00
Cerro de Pasco	New York	27	26	26⅝	Mar. '21, Q	.50
Chile Copper	New York	10¾	10½	10½	....	
Chino	New York	23⅜	22¾	23⅜	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*29	*28	*28	....	
Con. Arizona	N. Y. Curb	....	.	*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1⅜	1¼	1¼	....	
Copper Range	Boston	32¾	31½	31½	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*34	*32	*34	....	
Davis-Daly	Boston	6½	6¼	6½	Mar. '20, Q	.25
East Butte	Boston	8¼	7⅞	8	Dec. '19, A	.50
First National	Boston Curb	....	....	*50	Feb. '19, SA	.15
Franklin	Boston	1⅞	1½	1⅞	....	
Gadsden Copper	N. Y. Curb	....	....	*25	....	
Granby Consol	New York	18⅛	17½	17½	May '19, Q	1.25
Greene-Cananea	New York	20	19⅝	20	Nov. '20, Q	.50
Hancock	Boston	2½	2½	2½	....	
Howe Sound	N. Y. Curb	2½	2	2⅛	Jan. '21, Q	.05
Inspiration Consol	New York	34⅜	33⅜	33⅜	Oct. '20, Q	1.00
Iron Cap	Boston Curb	5⅝	5½	5⅝	Sept. '20, K	.25
Isle Royale	Boston	....	....	20½	Sept. '19, SA	.50
Kennecott	New York	19⅝	19⅛	19⅛	Dec. '20, Q	.50
Keweenaw	Boston	....	....	1¼	....	
Lake Copper	Boston	....	....	2½	....	
La Salle	Boston	1⅜	1½	1⅜	....	
Magma Chief	N. Y. Curb	*8	*8	8	....	
Magma Copper	N. Y. Curb	18¼	17½	17½	Jan. '19, Q	.50
Majestic	Boston Curb	5	5	5	....	
Mason Valley	Boston	1¾	1¼	1½	....	
Mass Consolidated	Boston	1⅞	1½	1½	Nov. '17, Q	1.00
Miami Copper	New York	21½	21	21	May '21, Q	.50
Michigan	Boston	..		1½	....	
Mohawk	Boston	49	47	47½	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	5⅜	5⅛	5¼	....	
Nevada Consol	New York	10¾	10¼	10⅜	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3	....	
New Cornelia	Boston	14	13½	13¼	Aug. '20, K	.25
Nixon Nevada	N. Y. Curb	....	....	*5	....	
North Butte	Boston	9½	9	9½	Oct. '18, Q	.25
North Lake	Boston	....	....	*25	....	
Ohio Copper	N. Y. Curb	*12	*6	*12	....	
Old Dominion	Boston	23	22	23	Dec. '18, Q	1.00
Osceola	Boston	27	27	27	June '20, Q	.50
Phelps Dodge	Open Mar.	†160	†145		July '21, Q	1 00
Quincy	Boston	37	37	37	Mar. '20, Q	1 00
Ray Consolidated	New York	12¾	12½	12½	Dec. '20, Q	.25
Ray Hercules	Boston Curb	....	....	*24	....	
St. Mary's Min. Ld.	Boston	32	31	31	June '20, K	2 00
Seneca Copper	Boston	16	15¾	16	....	
Shannon	Boston	*82	*82	*82	Nov. '17, Q	.25
Shattuck Arizona	New York	7	7	7	Jan. '20, Q	.25
South Lake	Boston	....		1½	....	
Superior Copper	Boston	3	3	3	Apr. '17,	1.00
Superior & Boston	Boston	1¼	1¼	1¼	....	
Tenn. C. & C. cfs.	New York	8	7⅛	7½	May '18, I	1 00
Tuolumne	Boston	*53	*50	*53	May '13,	.10
United Verde Ex.	Boston Curb	24	22½	24	May '21, Q	.25
Utah Consol	Boston	....	..	3½	Sept. '18,	.25
Utah Copper	New York	49¾	47½	47½	June '21, Q	.50
Utah Metal & T.	Boston	1 1/16	1	1	Dec. '17,	.30
Victoria	Boston	....	....	1½	....	
Winona	Boston	*40	*40	*40	....	
Wolverine	Boston	11	10	10	....	
		NICKEL-COPPER				
Internat. Nickel	New York	14½	14	14½	Mar. '19	.50
Internat. Nickel, pf.	New York	....		84	May '21, Q	1 50
		LEAD				
National Lead	New York	76½	67¾	73½	June '21, Q	1 50
National Lead, pfd.	New York	103¼	102¾	103½	June '21, Q	1 75
St. Joseph Lead	New York	.		11½	June '21, Q	.25
		QUICKSILVER				
New Idria	Boston	....	..	*50	....	
		ZINC				
Am. Z. L. & S.	New York	9	8	8½	[illegible] '20	1 00
Am. Z. L. & S. pfd.	New York	25½	25½	25	[illegible] '20, Q	1 50
Butte C. & Z.	New York	4½	4½	4	[illegible] '18	.50
Butte & Superior	New York	13	12½	12½	Sept. '20	1 25
Callahan Zn-Ld.	New York	4½	4	4½	[illegible] '20, Q	.50
New Jersey Zn.	N. Y. Curb	119	114	116	[illegible] '21, Q	2 00
[illegible]	N. Y. Curb			*[illegible]	[illegible]	.03
Yellow Pine	Los Angeles			*55	Sept. '20, Q	.03

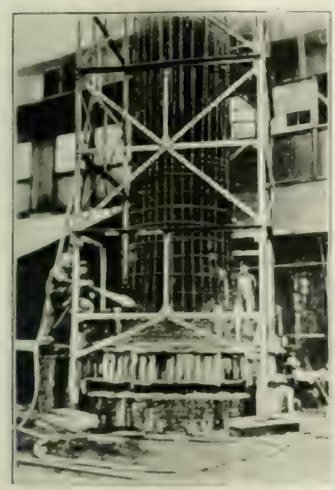
*Cents per share. † Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	½	½	½	....	
Alaska Juneau	New York	1¾	1⅝	1¾	....	
Carson Hill	N. Y. Curb	....	...	13½	....	
Cresson Consol. G.	N. Y. Curb	1⅞	1¾	1 13/16	June '20, Q	$0.10
Dome Extension	Toronto	*65	*65	*65	....	
Dome Mines	New York	17¾	17¼	17¾	July '21, Q	.25
Florence Goldfield	N.Y. Curb	*40	*37	*40	....	
Golden Cycle	Colo. Springs	*65	*65	*65	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*8	*6	*7	Dec. '19,	.05
Hollinger Consol.	Toronto	7 10	7 05	....	July '21, M	.05
Homestake Mining	New York	....	....	55½	June '21, M	.25
Kirkland Lake	Toronto	*37½	*35	....	....	
Lake Shore	Toronto	1.20	1 15	...	Jan. '21, K	.02
McIntyre-Porcupine	Toronto	1.93	1 90	....	May '21, K	.05
Porcupine Crown	Toronto	*14½	*13½	..	July '17,	.03
Portland	Colo. Springs	*48	*48	*48	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	. .	...	*4	May '19,	.05
Silver Pick	N. Y. Curb	*16	*10	*15	....	
Teck Hughes	Toronto	*11½	*11	..	....	
Tom Reed	Los Angeles	....	....	*71	Dec. '19,	.02
United Eastern	N. Y. Curb	2½	2 5/16	2⅜	July '21, Q	.15
Vindicator Consol.	Colo. Springs	*30	*30	*30	Jan. '20, Q	.01
West Dome Consol.	Toronto	*7	*6	.	....	
White Caps Mining	N. Y. Curb	*5	*5	*5	....	
Yukon Gold	N. Y. Curb	*95	*95	*95	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*20	*19	*19	Apr. '20, M	.03
Batopilas Mining	New York	⅜	⅜	⅜	Dec. '07, I	.12½
Beaver Consol.	Toronto	*25	*25	....	May '20, K	.03
Coniagas	Toronto	1 65	1 65	....	May '21, Q	.12½
Crown Reserve	Toronto	*9½	*8	....	Jan. '17,	.05
Kerr Lake	Boston	3⅜	3¼	3⅜	July '21, Q	.12½
La Rose	Toronto	*19	*18	...	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*18	*12	..	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.25	1 15	. .	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4⅜	4¼	4⅜	July '21, Q	.15
Ontario Silver	New York	..	...	4	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	.		*17	Jan. '12,	.10
Peterson Lake	Toronto	*5	4½	....	Jan. '17,	.01½
Temiskaming	Toronto	*21½	*21	....	Jan. '20, K	.04
Trethewey	Toronto	*16	*14	....	Jan. '19,	.05
		GOLD AND SILVER				
Barnes-King	Butte		.	*60	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*75	*67	*74	....	
Cash Boy	N. Y. Curb	*6	*5	*6	....	
Consol. Virginia	N. Y. Curb	. .		*24	....	
Dolores Esperanza	N. Y. Curb	2¼	2	2¼	....	
El Salvador	N. Y. Curb	*31	*18	*20	....	
Jim Butler	N. Y. Curb	*7	7	*7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb			*4	June '16,	.05
Louisiana Con.	N. Y. Curb		. .	¼	....	
MacNamara M. & M.	N. Y. Curb	*18½	*16	*16	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	‡		....	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 1/16	*99	1 1/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*82	*78	*81	....	
Tonopah-Extension	N. Y. Curb	1½	1⅜	1 7/16	July '21, Q	.05
Tonopah Mining	N. Y. Curb	1¼	1¼	1¼	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	*80	*75	*75	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N. Y. Curb	*10	*9	*10	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1.20	1 20	1 20	Dec. '21,	.15
Chief Consol.	Boston Curb	2½	2½	2½	May '21, Q	.05
Consol. M. & S.	Montreal			14	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†2.50	...	....	July '20, Q	.10
Daly-West	Boston	.		2½	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	.		2	Apr. '21, K	.05
Electric Point	Spokane	*5	*3	*5	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*53	*39	*39	....	
Federal M. & S.	New York	.		7	Jan. '09,	1.50
Federal M. & S., pfd.	New York	22	22	21½	June '21, Q	1.00
Florence Silver	Spokane	*11	*10	*11	Apr. '19,	.01½
Grand Central	Salt Lake	†*29		....	June '20, K	.03
Hecla Mining	N. Y. Curb	4½	4¼	4½	June '21, Q	.08
Iron Blossom	N. Y. Curb			*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†3 00		. .	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*4	*3	*3	June '21, I	.02
Prince Consol.	N. Y. Curb	..		*26	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*4	*3½	*3½	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*11	*8	*8	....	
South Hecla	Salt Lake	†44	†35		Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*12	*12	*12	Oct. '17,	.05
Stewart Mining	Boston Curb			*6	Dec. '15	.05
Tamarack-Custer	Spokane	1 80	1 75	1 80	Jan. '21, K	.04
Tintic Standard	Salt Lake	2 52½	2 40	2 50	July '21, Q	.05
Utah Apex	Boston	2	1 15/16	2	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	....	.	*1	Nov. '17,	.01
		VANADIUM				
Vanadium Corp.	New York	29½	28	28½	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	48	48	48	July '21, Q	1 50
Asbestos Corp., pfd.	Montreal	....		76½	July '21, Q	1.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	37½	37	37	Mar. '21, Q	1 00
Amer. Sm. & Ref. pf.	New York	72	72	72	June '21, Q	1 75
Am. Sm. pf. A	New York			67½	July '21, Q	1 50
U. S. Sm. R. & M.	New York	31½	30	30½	Jan. '21, Q	.50
U. S. Sm. R. & M. pf.	Boston	39	38	38½	July '21, Q	.87½

INDUSTRIAL NOTES

Conservation of Steel Stacks Weakened by Corrosion

The conservation of self-supporting steel stacks, which have corroded to the danger point, by incasing them with concrete, has become a well-established practice. Engineers and owners of power plants should be familiar with the method of achieving this result. To demolish an otherwise serviceable stack simply because the steel shell has lost its strength by corrosion, when at comparatively small expense and without even shutting down the boilers it may be converted into a permanent concrete stack, would in the light of present knowledge be a serious mistake.



GUNCRETE REPLACING WEAKENED STACK

Rather than tear down a steel stack which was in condition requiring renewal, causing a shutdown of the pumping station at South Works Illinois Steel Co., South Chicago, it was decided to use the Cement-Gun in reconstructing the stack. By coating the outside with reinforced Cement-Gun concrete, a new self-supporting stack has been built upon the existing foundation.

This steel stack was 175 ft. high by 9 ft. in diameter. A reinforcing network of sufficient strength to make the new stack self-supporting without any help from the existing stack was built up of rods and wire mesh, and secured to the existing foundation bolts. A Cement-Gun was then used to shoot concrete or Guncrete, as it is technically called, through the reinforcing mesh against the existing steel shell. A mixture of sand and cement hydrated in the nozzle was applied with an air pressure of about 35 lb. The Guncrete is 18 in. thick at the base, and tapers rapidly to 6 in. just above the bell base.

All the work was done without interrupting the use of the stack. The Guncrete was applied when the stack was too hot to permit holding the hand against it. The breeching extending from the side of the boiler house to the stack was also incased with 3 in. of Guncrete while it was so hot that water thrown against it boiled. The Guncrete was kept thoroughly sprinkled until set. The effect of the hot stack seemed to be that of steam curing, and after being in use for nearly three years the Guncrete is everywhere sound and shows no cracks.

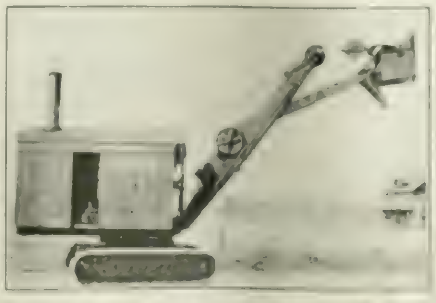
Seventeen stacks treated in this way are in daily use. Eight of them have gone through two winters. None of them show any cracks, except a few surface craze cracks, which do not penetrate perhaps more than one-eighth of an inch. Some were incased while cold, some while hot.

The photograph shows one of two stacks 68 in. in diameter and 110 ft. high done in December, 1918, with weather so cold that work had to be protected against freezing. Both stacks were in regular service. The view shows the reinforcement in place and shooting just begun.

The Woodward Iron Co. of Woodward, Ala., has just installed a new 12-in. Krogh sand pump to handle water containing coal fines. This pump is stated to be the largest sand pump ever built by the Krogh Pump & Machinery Co. of San Francisco.

New Osgood Shovel Has Continuous-Tread Mounting

A successful continuous-tread mounting for the company's Osgood 29, one-yard revolving steam shoved has been developed by the Osgood Co., Marion, Ohio. The caterpillar mounting enables it to travel over soft or uneven ground with ease, and as the tread belts extend but a short distance beyond the truck frame they afford a minimum of interference with operations of the dipper. The treads are of three-piece construction, of open-hearth annealed steel casting, to which is bolted a heavy steel pan, reinforced by heavy maple blocks, which forms a firm and smooth tread for hard use. The tread belts are constructed to permit either side to be easily and quickly adjusted independently of the other side. The shovel is so constructed that it may be equipped with steel boom, extra drums, and other parts for converting into a crane, clamshell, or dragline outfit.



NEW OSGOOD SHOVEL ON [illegible]

A New Colloidal Flotation Reagent, Not an Oil, Is Good Frother and Selector

Authorities on oil flotation have always believed that colloids were undesirable in the flotation of minerals. Royer Luckenbach, of Brooklyn, N. Y., the inventor of a new reagent known as "Rex," has proved by commercial tests that their contentions were erroneous, and, as one well-known writer remarked, after he had seen a demonstration, "they will all have to rewrite their books on flotation."

In the oil flotation process, as is well known, the oil is usually violently agitated with the pulp before it is in the required minutely divided condition to reach the particles of mineral. In this new reagent, there is the advantage of using an easily emulsified element that instantly breaks up in the pulp to a minute subdivision and attaches itself to every particle of mineral without any pre-mixing. Extremely high-grade concentrates are produced in the first cell, together with a high recovery.

Either an acid, alkali, or neutral circuit may be used, and as the process is entirely chemical it is at all times under the control of the operator. Good results have been secured on copper and lead carbonate without sulphidizing, as well as on sulphides and on metallic copper and silver. It will produce an unusually clean concentrate on sulphides containing gold, which can afterward be cyanided, as no interfering oil is present. The cost will average 8c. a ton. No changes in mills now using oils are necessary when this reagent is adopted.

The Canadian government made exhaustive tests at Ottawa in 1920 on ore high in iron pyrite and pyrrhotite and containing about 3 per cent of copper as chalcopyrite. A 94 per cent copper recovery was made with practically complete elimination of the iron pyrite. Demonstrations of this process are given at the laboratory of the Luckenbach Processes, [illegible] Liberty Ave., Brooklyn, N. Y.

The reagent is both a good frother and good selector in distinction to oils which are usually good frothers and poor selectors, or the reverse. An ample, inexpensive, vigorous froth is produced which gives a minimum of trouble to handle.

"Caterpillar" Matches Dog Team and Railway

By E. M. Lagron

Freight rates which have been absolutely prohibitive to interior Alaskan points will soon be reduced from $350 a ton to approximately $25 a ton. This is a direct result of the advance of the new government railroad. The new rate will be effective, it is believed, with the completion of the railroad from tidewater to the interior.

Increased activities will result, and mining machinery can soon be shipped to Fairbanks, Nenana, Fort Gibbon, Ruby and other interior points. At present most of the freight to these places is sent by dog teams or "mush" over trails from the seaport towns of Valdez and Cordova.

"CATERPILLAR" TRACTOR HAULING SUPPLIES IN ALASKA

One of the most marked improvements in transportation is shown here, the big, powerful "Caterpillar" train which operates on a sixty mile haul. These tractors are manufactured by the Holt Manufacturing Co., and haul approximately fifty ton of perishable foodstuffs and supplies over the snow and ice. They operate at times with the thermometer at 40 deg. below zero.

The recently perfected radiator frost pad enables this outfit to operate regardless of weather. Another asset of this particular machine is the articulated roller frame and the equalizer bar which join the two portions of the tractor truck and supporting roller. This latter feature enables the tractor to conform to the unevenness of the ground and assures perfect traction without slipping.

This novel means of transportation presents a practical solution of the problems which have confronted the engineers in this district for many years. This means assures the railway construction camps, in some cases isolated in the interior, a systematic replenishment of commissary stores at all times. Another great factor is that the "caterpillar" train can carry freight across Broad Pass, which is not feasible for railroads and can only be carried by dog teams or "caterpillars."

The New Ross Rapid Computer Is Handy, Easily Read, and Accurate

An improved type of the Ross Rapid Computer has recently been perfected. It provides an all-metal, circular computer, on the principle of the polyphase-duplex rule, but is built like a transit or compass having longer and more complete trigonometric scales, is unaffected by climatic conditions, and is convertible and will be found convenient for desk or pocket use.

The computer consists of four parts. The computer proper, 5 in. in diameter, has two dials graduated directly on heavy metal. The inner dial sets flush inside of the outer dial, and both are read by a radial hair-line, engraved under the arm, which is controlled by a thumb lock. The key to operation is given on the arm, in plain sight of the user. The magnifier sets in the hollow conical center of the computer. It is adjustable in focus, radius, and direction. When direct, less precise readings are desired, a touch of the finger turns the magnifier aside, and it is instantly detachable for separate use. Even without the magnifier the scales are plainer than seconds on a watch, but the magnifier makes the interpolations more accurate and easy. An aluminum clamp, for desk attachment, is similar to the tripod on a compass. This not only increases the personal accuracy by relieving the strain on the hand and eyes, but also permits figuring with one hand while writing with the other. A loose-leaf case contains the computer, with the magnifier and 100 standard sheets, 3¾ in. x 6¾ in., for personal notes.

The scales, designed on the polyphase-duplex principle, carry in addition a 360 deg. protractor, a scale of radians, cubes, and complete trigonometric scales, all of which are conveniently arranged.

The computer was invented and designed by Louis Ross, civil engineer, San Francisco, and is made by the Computer Manufacturing Co., 25 California St., San Francisco, Cal.

TRADE CATALOGS

Carbide Lights—The Macleod Co., Bogen St., Cincinnati, Ohio, has issued a bulletin descriptive of several types of "Buckeye" carbide hand lights and head lights which are suitable for various purposes. Many of the lights described are particularly adapted to underground and open-pit mining.

Valve Gears — The Baldwin Locomotive Works, Philadelphia, Pa., has issued a well-printed and illustrated pamphlet discussing the performance of the Walscherts valve gear. The publication is described as "Record No. 100," and is indispensable to one who needs to understand this improved gear.

Wood Pipe—Redwood Manufacturers Co., Hobart Building, San Francisco, Cal., has issued Catalog X, "Remco Redwood Pipe." This publication, though dealing mainly with the many uses of Remco Pipe, is also a handbook of information for hydraulic engineers and contains much valuable data relating to several fields.

Belt Conveyor Idler—The C. W. Hunt Engineering Corporation, New York City, is sending out a folder which describes the company's all-steel, self-aligning belt-conveyor idler. The leading feature claimed is that the rotating part of the bearing is strictly self-aligning, so that all pulleys rotate freely under any conditions of operation. Other admirable features are also pointed out by the circular.

Refractories — Harbison-Walker Refractories Co., Pittsburgh, Pa., have sent out a small illustrated folder "A" introducing that company's "metalkase" magnesite brick for openhearth furnace bulkheads. This ingenious device of packing dead-burned magnesite into steel containers is said to greatly increase the life of the bulkhead, decrease waste, and to be superior to water-cooled installations. Other folders are to be issued.

Ingersoll-Rand Products—The Ingersoll-Rand Co., 11 Broadway, N. Y., has issued in loose-leaf form, with a post binder, a descriptive catalog setting forth the various products of the company. The illustrations are carefully selected and specifications and other data given are most comprehensive. Most of the Ingersoll-Rand products are too well known to warrant discussion in this column, but the convenient form of the catalog merits special mention. The various products are grouped in their respective sections under compressors, vacuum pumps, condensers, oil and steam engines, Cameron pumps, air-lift pumps, rock drills, drill sharpeners, pneumatic tools, tie tampers, and miscellaneous. In addition a section containing engineering data is included.

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, August 13, 1921 *Number* 7

New York & Honduras Rosario Mining Co.

OCCASIONALLY a company report arrives at our desk that is as interesting to read as a well-written technical article; sometimes more so. Frequently it tells in a matter-of-fact uncolored way how a mining company has struggled against exasperating adverse conditions, financial, physical, and whatnot. The New York & Honduras Rosario Mining Co.'s recently issued annual report, a document of fifty pages, falls in this class. It treats comprehensively, yet concisely, of silver mining in Central America, and is so complete and such an exception to the general run of American mining reports that it deserves especial mention. The statement shows the creditable record of the company during the thirty-eight years of its existence and the fight it has had to make to decrease costs in the face of a declining silver market, a fight that was given up last June when productive operations ceased.

During 1920 the company had to contend with the biggest flood in its history, a fire which destroyed a mill and assay office, and the robbery of $35,000 in bullion. Such is the romance of mining in Honduras! The lease of the company granted by the Honduran government expired on Dec. 31, 1920, and it was renewed by the national congress for another twenty years, at a convocation for that especial purpose. The terms are unique. The company is exempted from the payment of federal import taxes on its mining machinery, road tax, and export charges on its product. In return for these concessions it is obligated to purchase and install, within a period of two years after the plans are approved by the government, a water conduit and distributing system for the capital of Honduras, Tegucigalpa. Admirably pleasant relations are reported to exist between the government and the company.

To anyone interested in milling and mining costs, ore reserves, production, and other operating details, many instructive tables will be found in the report, admitting ready comparison with the record of previous years. The financial statements are compact, yet they do not lack the important essential of clarity and preciseness. They remind us somewhat of the statement of a New York bank which appears occasionally in the advertising columns of the New York papers with the heading "A Bank Statement That Any Man or Woman Can Understand." It means much to a stockholder or an outsider to have a frank unclouded account set before him, and such a report or statement cannot help but inspire confidence in the management of any corporation.

The manager of the New York & Honduras Rosario Mining Co., Mr A. R. Gordon, and the officers and directors who have made the report public, can well take pride in the presentation of their record for 1920. The accounts are virtually a contribution to the economics of silver mining in the tropics. It is helpful to the student, mining engineer, economist, and last, but not least, the investor. We hope the trying period through which the company has passed and which has forced it to stop work is only a temporary setback in the progress of this mining enterprise.

The Imperial Mineral Resources Bureau

THE SECOND ANNUAL REPORT of the Imperial Mineral Resources Bureau is interesting chiefly on account of the complete and systematic way in which it is organized. The object of the Bureau is evidently a complete grasp of the mineral resources of the British Empire, and the prosecution and co-ordination of those mineral problems necessary to the most intelligent imperial and international mineral policy. England herself has never had necessity for a very elaborate geological survey, as has the United States, a new and undeveloped country; but the dominions and colonies of the empire, such as Canada, Australia, and New Zealand, have maintained active and efficient geological surveys and mining bureaus. Without much in the way of new machinery, and very little, we should judge, in the way of fresh expenditures, the power of all these organizations is now assembled in the Imperial Mineral Resources Bureau.

The control of the Bureau is in a Board of Governors, of whom there are fourteen, the chairman being Sir Richard Redmayne, past president of the Institution of Mining and Metallurgy. The governor nominated by Canada is Dr. Willet G. Miller. Corresponding members are tributary to the governors: for example, for Canada they comprise the Deputy Minister of Mines, at Ottawa; Chief of Division of Mineral Resources and Statistics, at Ottawa; the Provincial Mineralogist of British Columbia; the Deputy Minister of Mines for Toronto; the Superintendent of Mines for Quebec; the heads of the departments of mines of Nova Scotia and New Brunswick; and so on for each province.

Under the governors, the Bureau is organized into an Intelligence and Publications Section, a Legal Section, a General Purposes and Finance Section, and an Investigation and Development Section. The latter is the most inclusive, and comprises separate technical advisory committees on the following subjects: Publications, Libraries, and Abstracts; Iron and Steel, Copper; Tin and Tungsten; Lead and Zinc; Arsenic, Antimony and Bismuth; Nickel and Cobalt; Aluminum, Magnesium, Potassium and Sodium; Coal, Coke and By-products; Petroleum, Asphalt, and Natural Gas, Gold, Silver, Platinum and Mercury; the Minor Metals; Chemical Industries, Refractories and Building Materials, and Miscellaneous Minerals.

When we come to examine the personnel of these different committees, we find that they are not nominal but elaborate, carefully planned, and inclusive. For example, the chairman of the copper committee is Dr. Frederick H. Hatch, past president of the Institution of

Mining and Metallurgy, and the twelve other members of the committee include a distinguished representative, or sometimes two, from each of the following organizations: the Institution of Electrical Engineers, the Institution of Mining and Metallurgy, the Institute of Metals, the British Metal Corporation, Ltd., The United Alkali Company, the British Non-Ferrous Metals Research Association, the Air Ministry, the National Physical Laboratory, and the British Insulated and Helsby Cables, Ltd.

This typical example of one of the committees shows the breadth of the scope of the organization, like an imperial mineral resources chamber of commerce, under direct government guidance. Surely, with such an organization, the imperial government and those of the dominions will not fail to be provided with the best available and the most tangible advice looking toward intelligent and efficient national, imperial, and international mineral and metal policies.

We applaud the organization and hope it will be fully supported as to funds and contributed services.

The Bureau will take charge of a Mineral Exhibit at the British Empire Exhibition to be held in 1923. One of its immediate objects is the obtaining of a unified system of mining and metallurgical statistics, with standardization of weights and measures. The matter will first be considered with the Home and Dominion governments, after which the foreign governments will be approached "with the object of securing their concurrence in the adoption of a unified system of mineral statistics."

The Alaska Gastineau Mining Co.

IN OUR ISSUE of June 4, 1921, we noted the closing down of the Alaska Gastineau Mining Co. and the permanent cessation of operations of this company upon its mining property at Thane, Alaska. The date of closing down was June 1, 1921. According to the announced intention of the company, it will become an industrial operation, engaging in the manufacture and sale of paper pulp.

The Alaska Gold Mining Co. was organized as a holding company in 1912 to finance the Alaska Gastineau, which represented the consolidation of a number of separate properties. Active development was started about the middle of 1912. On Jan. 1, 1915, according to *The Mines Handbook*, there was a fully developed tonnage estimated at 21,000,000 tons of an average assay value of $1.75. Including partly developed and probable ore, the estimate exceeded 75,000,000 tons "having a recoverable value of $1.50." Operating costs were then estimated at 75c. per ton and tailing loss was computed at 25c. per ton. The apparently comfortable margin at that time appeared to be a reasonable assurance of a prosperous campaign. On the strength of this and the over-optimism of the investing public, shares sold up to $40 in 1915.

Operations in 1915 showed a recovery of $0.937 out of a gross value of $1.156 per ton. Operating expenses were $0.688 per ton. Excess of recovery over operating expenses was $0.249 per ton. Operating profit was less in 1916 and 1917, and losses accrued in 1918, 1919, and 1920. The mill was started March 1, 1915, and to date a total of 11,711,314 tons has been milled, yielding a gross of $9,508,168. During the years 1915, 1916, and 1917 the prices of materials used had not been affected to a great extent, but in 1918 the effects of the war began to be apparent. A scarcity of labor caused a reduction in tonnage. Increased cost of supplies also played its part. Conditions in the mine became such that hope of profit in mining the harder ores dwindled, and the predicted shutdown announced in the 1920 annual report of the company became an eventuality. The manager, G. T. Jackson, states that "had the 1915 prices for materials, supplies, and labor been maintained throughout the six years of operations, the actual operating costs would have been reduced over 15c., which would have resulted in a gain of $1,800,000 on the tonnage milled."

The failure of this company is worth analysis. It begins with a failure of the sampling methods used at the time, which did not give accurate results. The average assay value proved to be unduly high. Next was the fact that in the mining operations there was an unexpected dilution of the ore with barren rock. Lastly was the unexpected trend of economic disturbances due to the war.

In so far as plant, equipment, operation, and administration are concerned, Alaska Gastineau has many splendid lessons for the mining industry. The technical staff consistently held down costs. The full story of the struggle to keep the outgo below the income has yet to be told. Good metallurgical results were attained, the costs, omitting the increases in labor and supplies due to the war, were kept within reason, but the expected richness of ore was not realized.

The period when the Alaska Gastineau was started off on its career represented a peak in mining history. Mining on a great scale, "wholesale mining," as it was termed by some, attracted the attention of many engineers. It was equally attractive to financiers, and capital for such enterprises was not difficult to obtain. The success of the Alaska Treadwell group and of a number of the "porphyry" coppers was in the air, and no doubt contributed to the optimism of the time. Failure appeared improbable, and, as it has since turned out, "success had a close run for its money." A slight additional margin would have turned Alaska Gastineau into a success.

We do not wish to record this failure as an indictment of large-scale mining operations, but we do speak for a more careful consideration of the limitations of ambitious and extensive mining projects. The initial determination of margins by exhaustive sampling methods is an element of safety in every mining enterprise. It is, needless to say, critical in the larger enterprises. A greater risk is permissible in smaller operations. The obvious lessons to mining engineers and financiers are probably worth what it cost to find them out.

Mine Superintendents' Meetings In California

A HIGHLY COMMENDABLE PRACTICE was introduced some time ago among the managers and superintendents of the Mother Lode mines in California. It consists of monthly meetings held successively at the different mines. A visit is usually made underground and through the surface and ore-treatment plants. This is usually a feature of the forenoon. After a luncheon courageously handled by the Dutch method, a conference meeting is held. Many topics are discussed and handed back and forth over the cigars. Details of mining methods, of equipment, management, the purchase of supplies, welfare and labor conditions are reviewed both broadly and in detail. The meetings are interesting. We have had the privilege of attendance, and can so state.

An important factor in making such meetings practicable is the automobile. Almost every superintendent has some kind of a machine, and forty or fifty miles, or even more, are feasible with but little loss in time. The telephone keeps each one in touch with his particular operation. Usually only a day, or at most two days, are required for a meeting. Not all of the superintendents attend each meeting, but there are always a sufficient number to make the gathering interesting and profitable. Not infrequently the superintendent brings his foreman.

Owing in part to a preponderance of private ownership or control of Mother Lode mining properties, there has been prevalent an extreme conservatism, which has found expression in closely guarding costs and other data. To such an extent has conservatism operated that it can be justly said that this important mining region is one of the least known in the United States. As a consequence of the lack of publicity there has been a surprising absence of interest in the mining possibilities of one of the oldest gold-mining districts in the West. Important geological information concerning ore shoots that should have been given out to encourage and stimulate discussion on this subtle phase of mining has been withheld. Helpful data on ore treatment have in only a few instances been given freely.

Other mining districts have shown notable progress, because of the encouragement given to discussion and publicity of technical details. As a whole, the success of the mining industries is due to the resultant thought of many technical as well as practical men. Publicity is the only broad avenue through which this can safely operate.

The superintendents' meetings are significant of a change which is gradually taking place in the conservative point of view so long held. We look upon it as the entering wedge which will in a relatively short time revitalize the Mother Lode and increase the mining interest in its future. To Edwin Higgins' foresight in initiating these meetings due credit should be given. Other districts may find in a similar plan desired advantages.

Lower Costs the Way Out

AN AUTHORITY states succinctly, and afterward proves, that the chief reason why the United States is losing export trade is because of the higher prices charged by American manufacturers compared with those in England, Germany, and other countries. We do not believe that the American manufacturer is seeking to make an excessive profit under present conditions, and, if he is not, then his costs must be higher than those which obtain in foreign countries. Ultimately labor is the principal factor in costs, and until wages are radically reduced from the present level it would appear that our foreign trade is destined to dwindle.

Most basic commodities, for example, [illegible] lead, petroleum, [illegible] are practically at pre-war levels or below, and there is reason to believe that the price of other commodities and wages will be forced there by [illegible] conditions. The alternative will be that the business stagnation will continue, though probably in a lessened degree as domestic demand improves. Still, even now, domestic demand is not as absent as some people think. The New York department stores, for example, are reported to be selling a larger quantity of merchandise than before the war. But the foreign business is decidedly disappointing, and this is normally so large that it must be considered. With a foreign trade of four billion dollars before the war, and of ten billions in 1919, we are not an independent nation economically.

As wages fall, so will the cost of living, so that the wage-earner will not suffer unduly. His standard of living will be maintained higher than that of his foreign brothers because of the natural advantages and resources of the country and the use of efficient machinery and methods which permit more work per man-day. These are the reasons why the American workman is better off than others. No man-made tariff, fluctuating up and down according to which administration is in power, is, in general, responsible.

As far as metals and minerals are concerned, prices are not likely to drop further, for they are already at pre-war levels. Compared with June, 1914, copper is 14 per cent cheaper; lead, 12 per cent dearer; silver, 9 per cent dearer; and zinc, 16 per cent cheaper. Neither may we expect to see metal prices rise much above present levels for a considerable period. The world has become used to doing without things, and it will be some time before it is economically able to indulge itself in a normal manner. But costs will come down, and in that way will our metal and mineral industries return to prosperity.

Wanted—A Hoist Engineer

NEW YORK CITY and its environs is a great field for mining and metallurgical study. As we have stated repeatedly, much mining, milling, smelting, and refining are going on within commuting distance of New York. At the same time, tunneling under local rivers, and drilling and blasting of foundations for structures of all sorts, put into practice particular branches of mining.

Carrying the analogy a little further, the efficient and speedy elevators found in some of our tall skyscrapers may be likened to the hoists in a mine, with, of course, the difference in the refinements required in that service. Hoisting in buildings, however, has lately shown several defects, the daily press occasionally reporting the failure of an elevator rope, the plunging of the elevator down the shaft, and the consequent killing or serious injury of the unfortunate occupants of the "cage." Accidents such as these we would classify as being avoidable. Mining practice [illegible] us that the use of safety [illegible], careful inspection of hoisting ropes, and the general use of safety devices make [illegible] of this nature of rare occurrence.

The elevators in New York are inspected regularly both by city officials and insurance companies, yet accidents happen regardless. We don't doubt that the [illegible] are on the job and [illegible] all the safety devices possible, but [illegible] is wrong in the repetition of the failure of hoisting ropes and the [illegible] of elevator cars. There is room for a good mining engineer to work on New York's "hoisting" problems and introduce some of the ideas now considered essential in mining practice.

WHAT OTHERS THINK

Our Error, Our Error

You have the right name but the wrong "loidy." I am not the *political* Anne H. Martin, with all her brilliancy and honorable career, but *Annie* H. Martin, resident of Carson City since 1863 and never of Reno—much as I like the riverside burg and thoroughly enjoy visiting there. I have been a school teacher—thirteen years of it, and liked it—editor, manager, publisher, type-setter, society reporter, and bill collector on *The Carson News* for four years; have successfully managed a drygoods store and a stationery store; been church organist for forty years in addition to the weekly duties; and have taken personal interest in the entertainment of the inmates of the state prison on holidays and special occasions. J. Proctor Knott, of Kentucky (Congressman for many years and Governor of Kentucky for one term), was my uncle; Mark Twain was a personal friend of the family, and my last corporal punishment was received because I remained at his brother's house one evening over the time set by my mother to hear "Uncle Sam's" wonderful fairy stories, related to his niece, Jennie Clemens, and myself.

ANNIE H. MARTIN

I have been a life-long Republican, but I have never taken any active part in politics. I have been with the Mint here since 1908, first clerk until 1913, when I automatically became chief clerk when the appropriation was reduced, thus abolishing the clerkship. This year a further reduction in the appropriation, and the combination of the duties of the chief clerk with those of the assayer in charge, abolished the office of chief clerk, and I was left "high and dry" (not that the *dry* particularly mattered in my case). Good friends in Carson City and in Congress were successful in obtaining the appointment of assayer in charge for me, and I am still in Uncle Sam's service.

A great deal of explaining, perhaps, but I do like to be known for my own merits not those of somebody else. I could not qualify in so many of the "other Ann's" accomplishments that I like to set myself straight with those who have been so kind as to give such creditable notices.

With best wishes for the prosperity of the *Journal* and its staff, I am

Yours very sincerely,
Carson City, Nev. ANNIE H. MARTIN.

[In our issue of July 16, on page 106, we published a personal paragraph concerning the appointment of Annie H. Martin as assayer in charge of the U. S. Branch Mint at Carson City, Nev. Wishing to supplement the mere announcement, our informant added a short biographical sketch obtained from *Who's Who in America*. But the subject of the latter is Anne H. Martin, the similarity of names causing the mistake in identity.—EDITOR.]

Further Air Receiver Calculations

As none of the problems presented in Mr. Weeks' paper in the June 11 issue of *Engineering and Mining Journal* require a knowledge of the weight or temperature of the air, the formulas may be deduced in a simpler manner as follows:

Let V = volume of air receiver in cu.ft.
P_1 = initial absolute pressure of air in receiver
V_{at} = volume of free air withdrawn during t minutes
P_2 = abs. pressure of air remaining in receiver
P_3 = atmospheric pressure

Then, from Boyle's law, volume V_1, the free air occupied in the receiver before being withdrawn is

$$V_1 = \frac{V_{at} P_3}{P_1} \qquad (1)$$

The volume ($V - V_1$) remaining in receiver now expands to volume V and assumes a pressure P_2. According to Boyle's law:

$$\frac{V - V_1}{V} = \frac{P_2}{P_1} \text{ whence } V_1 = \frac{V(P_1 - P_2)}{P_1} \qquad (2)$$

Combining (1) and (2) gives

$$V_{at} = \frac{V(P_1 - P_2)}{P_3} \qquad (3)$$

The pressure P of the air mixture from tanks A and B is found as follows: When the valve is opened, volumes V_1 and V_2 expand or contract to volumes V_3 and V_4 respectively.

From Boyle's law:

$$V_1P_1 = V_3P \qquad (4)$$

and

$$V_2P_2 = V_4P \qquad (5)$$

Adding $V_1P_1 + V_2P_2 = P(V_3 + V_4)$

As $(V_3 + V_4)$ must be equal to $(V_1 + V_2)$

$$P = \frac{V_1P_1 + V_2P_2}{V_1 + V_2} \qquad (6)$$

Applying equation (6) to compressed-air haulage, gives

$$V_1 = \frac{V_2(P - P_2)}{P_1 - P} \qquad (7)$$

in which V_1 = required capacity of air storage
V_2 = volume of locomotive tank
P = required pressure in locomotive tank after charging
P_2 = pressure in tank before charging
P_1 = initial pressure of air in storage

This presumes that no air is supplied to the storage system while locomotives are being charged, a condition that does not obtain in practice, except when there has been an accident to the compressor. In that event no amount of storage will keep up the pressure long enough for practical operations. Receiver or storage capacities are therefore not calculated according to the above formulas.

Receivers are usually dimensioned so that the demand of the air engines may exceed the supply from the compressors for a specified time without reducing the pressure below a permissible minimum.

Let V = required volume of receiver or receivers
V_2 = volume of compressed air withdrawn during a specified time t
V_1 = volume of compressed air supplied during the same time
P = initial absolute pressure of air
P_1 = permissible minimum pressure at end of specified time

Then at end of period t, volume of compressed air remaining in receiver is: $(V - V_2 + V_1)$ which expands to a volume V and thereby reduces the pressure from P to P_1.

According to Boyle's law:

$$\frac{V - V_2 + V_1}{V} = \frac{P_1}{P}$$

whence

$$V = \frac{P - P_1}{P(V_2 - V_1)} \qquad (8)$$

It happens at times that at three of the largest mines in Butte, hoisting is in progress at the same time for thirty-six consecutive minutes, resulting in a consumption of compressed air of V_2 = 108,900 cu.ft., while three compressors furnish compressed air each at the rate of 880 cu.ft. per minute, or a total of, say, V_1 = 95,000 cu.ft. during the thirty-six minutes. The initial pressure P is 102 lb. abs. The permissible drop is 13 lb., making P_1 = 89 lb. abs.

Introducing these values in equation (8)

$$V = \frac{102 \times (108{,}900 - 95{,}000)}{102 - 89}$$

whence V = 109,000 cu.ft.

Fifty-two receivers with a capacity of 2,100 cu.ft. each, or a total of 109,200 cu.ft., have been actually provided for this particular emergency.

Butte, Mont. THEODORE [illegible]

Work Better Than Rainbow Chasing

Regarding the communication of M. F. Graupner in July 9, 1921, issue, permit me to take exception to some interesting remarks which the author makes and which I believe are misleading if not injurious to the well-being of young mining engineers.

Your correspondent trusts his observations will put ambition into some really educated engineers to do more than seek and hold down a mediocre salary job; and he recommends that such men get out and prospect.

I hold that this advice to young engineers is misleading. It might even work hardship and cause injury. Prospecting is one thing; engineering is another. Shiftlessness and inclination to take chances are permissible and rather necessary for a prospector. He should be and generally is a restless spirit, who would rather have his little mite than punch a clock day in and day out. He is ambitious and ever optimistic. With a big goal in mind, he can never condescend to routine, and even if he did he is a failure because he is a misfit. These men are necessary parts of the society in general and mining industry in particular. It is a game, however, that does not satisfy the shrewd modern engineer. In it, success is rare, and, when accomplished, the remuneration is not always written in six figures, as in the instance cited by our friend.

The first fifteen or twenty years of an average mining engineer with a technical education may bring nothing more than a salary job. The position might be mediocre but not necessarily. In fact, after ten or twelve years of steady and conscientious effort it is rare to associate the positions these men hold with anything like mediocrity. The homely parable of the tortoise and the rabbit applies in mining engineering, too. Out of a hundred engineers who started their careers twenty years ago and devoted themselves to it few need be in financial straits. But out of the same number of prospectors only an insignificant percentage are at all independent. The remaining large majority are eternally after that goal which it is the luck of only one or two to reach. They grubstake, and disdain the man who sticks to a job.

My advice to the young mining engineer is to hold on to whatever job he has until he has a clear vision of something better. For a person with the proclivities of a prospector or a promoter, a regular technical training is unnecessary and a waste of time. But the man who wants to go to a technical school must hesitate to enter the threshold of such an institution if he is to look down to a salary job and is lacking in stick-to-itiveness. DJEVAD EYOUB

Brooklyn, N. Y.

A Seven-Year Mining Course?

The recent articles in your columns regarding mining schools and the great number of graduates impels me to suggest a course that would probably remedy this state of affairs automatically. Why would not some representative mining school institute, say, a seven-year course in mining engineering, in which alternate years were allotted to field work at paid employment in and about the mines? Such a course [illegible] would turn out only [illegible] and practically equipped engineers, illustrative of others.

Park City, Utah. J. F. [illegible]

Replacement Copper Deposits in the Warren District

Mineralogical and Geological Features of an Important Copper Mining Region—Deposition Intimately Associated With Faults and Fractures And Intrusive Rocks—Enrichment of Deposits Not Always Evident

By Graham John Mitchell

Written for *Engineering and Mining Journal*

COPPER DEPOSITS of the replacement type offer an interesting field for applied geology. The genesis, mode of occurrence, structural relations, and mineralogy of orebodies of this class involve questions the solution of which requires detailed study. Observations in the Warren district, Bisbee, Ariz., during the last three years are summarized in the following discussion:

The distribution of ore with respect to the Sacramento Hill stock can be seen by studying Fig. 1, which is a horizontal projection of the known orebodies, many of which have already been mined. The granite-porphyry intrusive in which the Sacramento Hill ore occurs is bordered on the south and west by the sedimentary series, including Cambrian, Devonian, Carboniferous, and Cretaceous formations; whereas the dividend fault brings the Pinal schist to the surface on the north and northeast. The ore is seen to lie in a semicircle to the south of the dividend fault and is less extensive as the distance from the central porphyry mass increases.

Another evident feature is the extension of ore out along lines comparable to the spokes of a wheel, in reality representing mineralization in radiating zones of faulting and fracturing. The primary copper minerals, represented by the sulphides, chalcopyrite, bornite, and chalcocite, accompanied by pyrite, galena, and sphalerite, have replaced the limestone, frequently retaining the bedded character of the sedimentaries, whereas in others it is irregular with no semblance of bedding. The strongest metallization, as can be seen in Fig. 1, took place nearest the Sacramento Hill porphyry, where the sediments are also more strongly metamorphosed. It is not my purpose to enter into a general discussion of the geology and ore occurrences of the district, but rather to take up typical orebodies and to point out the geological features which characterize them.

Mining of Oxide Ore Profitable

The first mines to be developed in this district were in oxidized ore, the Copper Queen and Irish Mag being good examples of altered sulphide deposits which passed into primary copper ore in depth. Both mines are closely associated with the early history of the camp, the former marking the beginning of the Copper Queen Consolidated Mining Co., and the latter the foundation for the Calumet & Arizona Mining Co. The high-grade "oxides" from these mines have returned millions of dollars to their owners.

The mode of occurrence of oxidized ore is illustrated by *A*, *E*, and *F*, Fig. 2. The first is a good example of bedded ore, whereas in *E* only partial replacement along the bedding is evident. In *F*, the limestone bedding has exerted no influence upon the mineralizing solutions which were guided to the seat of deposition by the fault. In *A*, the ore, represented in shaded black, is of malachite and azurite with a small quantity of "sooty" chalcocite in vugs in the carbonate masses. Impure brownish black manganese is intermixed with the carbonates, as is also impure limonite, kaolin, and partly oxidized limestone. The copper carbonates are strongly developed as botryoidal growths with an impure manganese mixture frequently forming the nuclei. The order of formation of the minerals, as illustrated by many of the botryoidal forms, is first a central core of earthy manganese, then successive layers of massive malachite, with a final coating of massive and crystalline azurite. The individuals making up these grape-like forms are generally the size of a pea or smaller. Single groups attain diameters of as much as ⅝ in. The copper carbonates also assume a massive, banded form, with malachite and azurite in alternating layers, these layers sometimes being separated by impure manganese.

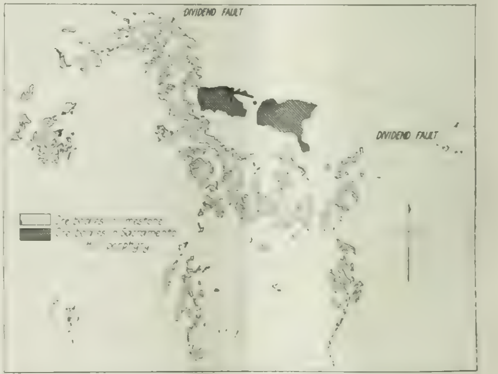


FIG. 1. HORIZONTAL PROJECTION OF OREBODIES IN WARREN DISTRICT

The relation of ore to the limestone and quartz-porphyry (*QP*) is shown in Fig. 2, *A* and *B*, the mineralization occurring on the upper side of the intrusive and replacing limestone along a steeply dipping fault. The contact of the igneous rock and ore, although somewhat altered, is rather sharp; that between the ore and limestone is gradational. On the left, in Fig. 2, *A*, the ore gradually passes into a fine textured white crystalline limestone which retains minerals of the period of primary metallization, pyrite, chalcopyrite, a little galena, and sphalerite in veinlets and small bunches in limestone.

The quartz-porphyry (*QP*) dike associated with this ore has undergone alteration to the extent of developing sericite in the feldspar and chlorite from the mica and hornblende. The rock, which is strongly fractured, contains disseminated grains of pyrite and chalcopyrite and small rounded plainly visible knots ¼ in. in diameter, made up of fine-grained parts of the rock mass. Thin sections reveal quartz and orthoclase as prominent phenocrysts, with plagioclase in a fine-grained groundmass of quartz and feldspar. The idiomorphic crystals of quartz are strongly corroded along the borders and are penetrated by fractures along which the iron and copper sulphides occur. Orthoclase and plagioclase, both as phenocrysts and in the groundmass, are strongly sericitized and contain scattered pyrite and chalcopyrite. Biotite and hornblende have been altered to chlorite and also contain pyrite and chalcopyrite. Chalcocite has formed in fractures in the chalcopyrite and along the edges of the sulphide. It also coats pyrite and is present in fractures cutting the iron sulphide. The presence of pyrite and chalcopyrite as primary minerals in the porphyry points to the source of original metallization solutions as being in this rock.

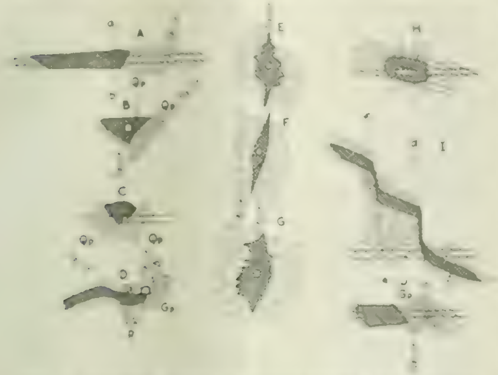


FIG. 2. [illegible] OF ORE, [illegible]

"Oxide" ore replacing limestone, both along faults and broken zones caused by such movements, is illustrated in Fig. 2, *E* and *F*. In *E* the replacement is irregular, working outward along the bedding from the fault. The ore minerals include azurite, malachite, cuprite, chalcanthite, and native copper. The first four partly and completely replace the limestone, but native copper is more commonly found in thin layers of intergrown crystals along the bedding planes. Much material of this nature is deceptive, appearing upon superficial inspection to be copper-stained altered limestone. However, when broken, it is found to be an intimate mixture of the above minerals. Replacements of this type attain dimensions of 100 ft. or more along the dip and strike of the fault, with thickness of over 50 ft.

In Fig. 2, *F*, the copper minerals noted above replace the brecciated and crushed limestone along the fault, the pronounced irregular replacement seen in Fig. 2, *E*, being absent. The line between ore and altered limestone is controlled by premineral faulting.

Orebodies of this type frequently contain the mineral delafossite, which in some instances is the chief source of copper. Superficially, it resembles graphite, in its lead-gray color, occurrence in flakes, and groups of thin flexible sheets [illegible] in. wide, which soil the fingers. It is of interest to note that the mineral was first classified as graphite until determined and named by Friedel. The following notes on the determination and naming were secured for the writer by Dr. Charles P. Berkey, of Columbia University, New York City:

> "The mineral 'delafossite' was first described by C. Friedel in the 'Comptes Rendus de l'Académie des Sciences,' Paris, Vol. 77, p. 211, of 1873. The type specimen was found at Ekaterinburg, Siberia, as a yellowish white lithomarge, by Abbe Grandidier, at St. Petersburg, in 1820. It finally reached the museum of the French National School of Mines, in Paris, as a specimen of graphite, and it was not until Friedel's article (quoted above) in 1873 that it was shown not to be graphite. Friedel gave it the name delafossite, in honor of the eminent mineralogist, G. Delafosse, who was connected with the School of Mines and Natural History Museum in Paris at the time of Friedel's work there. Friedel gives the following data on the mineral: Hardness, 2.5; specific gravity, 5.07; easily soluble in HCl; color, dark gray; lustre, metallic.
>
> "Analysis: Cu_2O, 47.45 per cent; Fe_2O_3, 47.99 per cent; Al_2O_3, 3.52 per cent."

Delafossite was first identified in the Warren district by George Miller, formerly chemist for the Calumet & Arizona Mining Co. The specimens from the Bisbee mines were found to carry impurities which are absent in the analysis of the type specimen. These impurities, as shown in analyses by William W. Brostrom, chief chemist for the Calumet & Arizona Mining Co., include lime, silica, and manganese. Mr. Brostrom's analysis gives:

	Per Cent		Per Cent
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]

Microscopic examination of crushed fragments shows the presence of fine quartz particles and grayish indeterminate dust-like material which probably represents the lime and manganese oxide.

Orebodies of the nature discussed represent oxidized primary copper minerals in place. The oxidizing solutions have attacked the primary sulphides and redeposited the copper in the form of oxides, carbonates, and native copper without a great amount of downward migration. The intimate association of ore with faults and fractures and the direct or close relation to quartz-porphyry and granite-porphyry are outstanding features.

At the February, 1921, meeting of the A. I. M. E., in New York City, Dr. James F. Kemp discussed the past and present position of chalcocite as a source of copper, and pointed out the fact that this sulphide is receiving more attention than formerly in ore development in many of the mines throughout the country. The mines at Bisbee afford a good illustration of the importance of chalcocite in making ore out of what would be classed as "low-grade" pyrite. The examples which follow serve to illustrate the importance of such enrichment.

Fig. 2, *C*, illustrates a "pocket" of ore in quartz-porphyry (*QP*), the minerals having been deposited in a V-shaped trough made by two intersecting fractures. Pyrite and chalcopyrite are the primary minerals which have altered to iron oxide and "sooty" chalcocite respectively. Assays of this ore range from 2 to 12 per cent, averaging better than 6 per cent copper. The including porphyry assays 0.12 per cent copper and megascopically is a grayish-white rock with quartz and altered feldspar surrounded by a fine-grained grayish-white groundmass. Microscopic examination shows it to be practically the same type as that [illegible] ciated with the oxide ore, the main difference being a stronger development of quartz and pyrite in the groundmass. Chalcocite is present as described in earlier illustrations.

IMPORTANT TO EXAMINE PYRITE

Bedded pyrite with disseminated chalcopyrite replacing limestone is common in the district, although the copper content of many such replacements, unless enriched by secondary alteration, falls below the present minimum grade for profitable mining. When such material is encountered in prospecting, and the copper content is too low, the question arises as to whether or not further prospect work is justified. Sometimes evidence warrants recommendation of more work; for example, when the pyrite is fractured and shows enrichment by "sooty" chalcocite along fractures it has been proved in many instances to develop into ore.

On the other hand, the lack of evidence of such enrichment in a single opening in mineral of this character does not preclude the existence of ore, as the following case illustrates: A drift cutting a 5-ft. bed of pyrite with a little disseminated chalcopyrite gave assays less than 2 per cent copper. The pyrite was fine grained, crystalline, and massive, with scattered specks of chalcopyrite. Work was discontinued, but later a raise proved the existence of small vugs in the main pyrite mass containing "sooty" chalcocite, and further prospecting encountered knots and bunches of chalcopyrite inclosed in the pyrite body, proving the necessity of prospect raises and crosscuts in deposits of this class. This ore was found within 200 ft. of dikes of quartz-porphyry and along a zone of strong fracturing and faulting.

In Fig. 2, *D*, the crosscut (*a*) cut the fault (*b*) with granite-porphyry (*GP*) on the right and a bed of pyrite and chalcopyrite enriched with "sooty" chalcocite on the left. The raise (*R*) was driven from the level below and picked up the ore as shown. Subsequent stoping has proved the bedded character of the deposit and has developed a tonnage averaging over 8 per cent copper. The inclosing limestone is dark gray, medium-bedded impure material with a bluish-white alteration product along the contact of limestone and ore. "Sooty" chalcocite has formed in numerous fractures and cavities and around the pyrite grains. The bed pinches and swells, but averages three feet in thickness.

The associated igneous rock has a light greenish-gray cast, with quartz, feldspar, and biotite easily recognizable in hand specimens. In thin sections the corroded quartz phenocrysts, with sericitized orthoclase and plagioclase, are set in a medium-grained groundmass of quartz and feldspar. Both these minerals have included grains of pyrite and chalcopyrite, which occur along fractures. The sulphides are also present in the groundmass, and chalcocite has formed on the periphery of the chalcopyrite and in fractures through it. Pyrite crystals are also surrounded by chalcocite. Biotite, partially altered to chlorite and inclosing pyrite and chalcopyrite, is a prominent constituent. Some apatite occurs in the groundmass. This rock shows less alteration than the quartz-porphyry just described.

Fig. 2, *I*, illustrates a "low-grade" sulphide transformed into ore by secondary alteration and enrichment. The primary minerals, pyrite and chalcopyrite, replace dark-gray shaly limestone, following closely the bedding of the sediments. The ore has a maximum thickness of 12 ft. but in places pinches out entirely. Stoping in this particular case extends over a horizontal area of 600 x 200 ft. The course of primary mineralizing solutions was determined by the faults (*cd*) and (*ef*), which also show post-mineral movement. These breaks have been cut 100 ft. below the ore and are marked by strong gouge and iron oxide. No igneous rock has been found directly associated with this ore, although small dikes of granite-porphyry are in the vicinity.

In addition to the two faults mentioned, minor displacements and innumerable fractures cut the sulphide bed. Along these closely spaced breaks "sooty" chalcocite has formed, bringing the grade from 2 per cent or less up to an average of over 4 per cent ore. Along the faults (*cd*) and (*ef*) native copper is strongly developed, together with some cuprite. These minerals have also formed along the top and bottom of the sulphide bed, and grade outward from the sulphide into altered limestone stained red by iron. The oxidation of the bottom, as well as at the top of the sulphide, with the formation of native copper, cuprite, and iron oxide, is the result of descending waters working outward from the faults along the contact of the limestone and primary ore.

Replacements of limestone by pyrite with a small amount of chalcopyrite and bornite, the minerals grading upward into leached siliceous material, are characteristic of some of the mines of the district. Such deposits reach a maximum of 300 ft. on the dip and strike of the lime and attain a thickness of 50 ft. When penetrated by mine workings, much of the pyrite is found to be in small crystals, which separate from each other and run like sand. Chalcocite ("sooty") coats the grains and fills vugs throughout the pyrite mass. Chalcopyrite and small specks of bornite occur in the more finely crystalline pyrite. When "sooty" chalcocite is not present in such mineral masses, the grade frequently falls below 2 per cent, but when enriched, the chutes run 4 per cent or better. Unfortunately, many of these mineral replacements are not enriched and consequently fail to make ore.

The siliceous cover, into which the sulphides penetrate as small veinlets, is a typical "jasperoid," being very fine grained silicified limestone. Descending waters have dissolved the sulphides which formerly filled the network of small fractures cutting the "jasperoid," and have left in their place iron oxide, silica, and impure lime carbonate binding together the angular siliceous fragments. Such material is locally called "siliceous breccia." An interesting feature in these orebodies is the presence of cerussite crystals occurring in vugs and along fractures associated with "sooty" chalcocite. Many of the lead carbonate crystals are coated with chalcocite, which is distinguished from the black copper oxide tenorite by testing with silver nitrate solution.[1] A drop of 10 per cent silver nitrate solution placed on this material immediately begins to form tiny needle-like crystals of native silver.

PRIMARY MINERALS OF VARYING IMPORTANCE

The primary copper sulphide minerals in the Warren district include chalcopyrite, bornite, and chalcocite, with which are associated pyrite, galena, and sphalerite. Of these, pyrite and chalcopyrite are more widely developed, whereas bornite and chalcocite, although less conspicuous, are important factors in making "high-grade" out of what would in many instances be classed as "low-grade" ore. The bedded and irregular replacements of the former in limestone reach a maximum, in individual orebodies, of 500 ft. along the dip and 600 ft. on the strike of the sediments, with a thickness of 50 ft. When pyrite and chalcopyrite are the only sulphides present, the copper content holds close to 4 per cent, but when bornite and chalcocite enter into the composition, the grade noticeably increases. The latter minerals typically occur as knots or bunches inclosed in the main pyrite-chalcopyrite masses, and are associated with fractures cutting the former. In some instances they occur as disseminated specks in the iron and copper iron sulphide. Bornite and "steely" chalcocite are generally accompanied by galena and sphalerite, especially when the former two minerals are found in fractures cutting the pyrite-chalcopyrite bodies.

---

[1] Palmer, Chase, and Bastin E. S. *Economic Geology*, Vol. 8, p. 146 (1913.)

Fig. 2, *J*, shows a fine-grained, grayish, somewhat impure limestone replaced by pyrite, chalcopyrite, bornite, "steely" chalcocite, galena, and sphalerite, the thin-bedded structure of the limestone being retained by the sulphides. Pyrite forms the bulk of the minerals present, with the others disseminated through the bed. In the entire orebody there is no evidence of secondary alteration. The sill of granite-porphyry (*GP*) is a medium-grained rock composed of quartz, feldspar, biotite, and hornblende, all of which are recognizable in hand specimens. Microscopic examination reveals these constituents as prominent phenocrysts in a medium-grained groundmass of quartz and feldspar.

Orthoclase is the most abundant feldspar both in the groundmass and as phenocrysts, and has been partially altered to sericite. Pyrite is abundant, with chalcopyrite and bornite present. The sulphides have not been affected by secondary alteration, and represent primary mineral deposition. Fig. 3, *A*, is a micro-drawing of this rock showing the phenocrysts, orthoclase (*Or*), hornblende (*Hb*) and quartz (*Qt*), set in a fine-grained groundmass of quartz and feldspar. Pyrite (*Py*) and chalcopyrite (*Cp*) are included in the hornblende and feldspar as well as in the groundmass. Bornite (*Bor*) is also present in the groundmass.

In Fig. 2, *G*, the sulphides, pyrite, chalcopyrite, bornite, "steely" chalcocite, galena, and sphalerite, form an irregular replacement in limestone along a nearly vertical fault. The inclosing sedimentary has been metamorphosed from a grayish medium-grained limestone to a fine-grained white crystalline lime. In this particular instance the ore has a vertical extent of 100 ft., with an average width of 15 ft., and extends irregularly along the strike of the fault for over 200 ft. If such an orebody were subjected to oxidation, there would result an occurrence of "oxide" ore similar to that shown in Fig. 2, *E*. This orebody is surrounded by small dikes of granite-porphyry.

DEPOSITION INTIMATELY ASSOCIATED WITH INTRUSIVES

Lenses of "steely" chalcocite are found replacing limestone and are cut by tiny fractures in which occur calcite and "steely" chalcocite. These lenses range from a few inches to 1½ ft. in diameter, and, in the case illustrated by Fig. 2, *H* (the scale of which is exaggerated to bring out the essential features), a core of unreplaced limestone remains within the sulphide. The only secondary alteration evident is the formation of "sooty" chalcocite around the periphery of the "steely" chalcocite. These lenses are in close proximity to granite-porphyry and illustrate on a small scale what has taken place in larger deposits of the same character. The slight amount of alteration enables one to study geological details such as structure and mineralogy which are of value when examining other occurrences of this nature.

One question which always arises during the study of a mineral deposit is the source of solution responsible for metallization. In the Warren district the evidence clearly shows that granite-porphyry and quartz-porphyry, the former best exposed in Sacramento Hill, are the rocks responsible for ore deposition. Those who have studied this district have pointed to the porphyry of Sacramento Hill and the exposure of similar rock in the mines as being closely related to a parent deep-seated igneous mass. The following description of the deepest igneous rock so far encountered in the region is of interest in suggesting the character of rock to be expected at greater depth:

The granite-porphyry (Fig. 3, *B*) which is from a dike encountered in the Junction shaft at 2,337 ft., proved to be practically the same as that illustrated by Fig. 3, *A*, from the 1,800 level, the only difference being in the strong development of epidote. The phenocrysts, quartz (*Qt*), orthoclase (*Or*) and hornblende (*Hb*), are set in a medium-grained groundmass of quartz and feldspar with small hornblende and biotite crystals. The most striking feature of the rock is the strong development of epidote which has been derived from the hornblende. Orthoclase has been partially sericitized and biotite and hornblende altered to chlorite. Pyrite and hematite are included in the hornblende and orthoclase, as well as occurring in the groundmass. Quartz phenocrysts with corroded borders are filled with numerous dust-like inclusions. Apatite completes the list of minerals present.

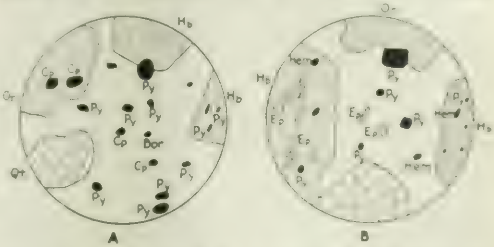


FIG. 3. A. MICRO-DRAWING OF GRANITE-PORPHYRY ASSOCIATED WITH ORE. B. MICRO-DRAWING OF GRANITE-PORPHYRY FROM DEPTH OF 2,337 FT. IN JUNCTION MINE

MOST NOTEWORTHY GEOLOGICAL FEATURES

The outstanding geological features of the Warren district which have a bearing on prospecting for and developing ore may be summarized as follows:

1. Intimate association of ore with faults and fractures, which, together with bedding planes, have served to conduct mineralizing solutions to places of deposition.

2. Close association of ore with granite-porphyry and quartz-porphyry intrusions.

3. Occurrence of "knots" or "bunches" of chalcopyrite, bornite, and chalcocite in "low grade" pyrite, the presence of which may not be evident in a single open-

ing in such material. This necessitates crosscutting and raising to prospect mineral bodies of this character.

4. The importance of "sooty" chalcocite in enriching pyritic replacements. This enrichment is not always evident, and such material should be thoroughly prospected.

5. The presence of enriched pyritic masses below leached "siliceous breccia," especially when such masses are strongly fractured and broken by faulting.

6. Displacement of ore by post-mineral faulting. Many large orebodies have been thus affected.

7. Occurrence of ore in Paleozoic formations and Sacramento Hill porphyry.

Is Moist Air Desirable for Copper Blast Furnaces?

By Julius H. Gillis
Written for *Engineering and Mining Journal*

NEARLY EVERY ONE who has engaged in the smelting of ores has considered the probable effect of moisture in the air supplied to the furnaces. It is not the intention here to enter into a discussion of the theoretical considerations in connection with the subject or even to review the conclusions reached by metallurgists who have had to deal with the problem. The general opinion is that moisture is not particularly desirable, but most of these conclusions are determined theoretically and, except in iron blast-furnace practice, little published data are available that have been derived from actual practice. The object of this article is to record some actual observations in regard to moisture in the air supplied to a copper-nickel blast furnace, in the hope that they may lead to further experiments, which will tend to prove or disprove the conclusions set forth.

In March, 1920, an exhaust pipe was so placed that the small amount of steam escaping was being drawn into the intake of a certain blast-furnace blower. Some days elapsed before this was corrected, and the incident was soon all but forgotten. Some weeks later, when I was making careful investigation as to certain operating conditions, it was noticed that there was a particularly favorable period extending over a few days, with no corresponding favorable conditions to account entirely for it. After eliminating other factors to determine the cause of these conditions, I came to the conclusion that, as it corresponded with the period in which the steam was being drawn into the intake, possibly the extra moisture was the factor sought. The data, however, were not conclusive; they were affected by other conditions and could not be taken as definitely establishing much basis for future investigation. A search of the available literature on the subject, and discussions with the local metallurgists, failed to explain the results observed, and it was October before further experiments could be made.

A test was then determined upon, and a ⅜-in. pipe was connected between the air main and a steam pipe carrying 180 pounds of steam with 100 deg. superheat. A decided change in the operation of the furnace resulted, but here again the results were confused by other factors. The experiments were continued, and larger quantities of steam were added, but the results after the first few days were rather negative. The steam would be turned on and gradually increased, with the result that at first the furnace would speed up, and crusts and accretions would be eliminated, and then the good effects would disappear. No bad effects were observed, however, until sufficient steam was used so that the water from the condensation in the blast began to give trouble around the tuyères. No accurate methods of measuring the steam used were available, but deductions could be made from the temperature of the blast and its moisture-carrying capacity. The experiments were temporarily discontinued owing to inability to get definite results.

After careful study of the various operating curves covering the period of the experiments, I came to the conclusion that we had been using too much steam, and decided to make another trial as soon as a favorable opportunity presented itself. About the last of January, 1921, after two weeks of uniform furnace operation, the steam was again connected, and a very small amount used. The temperature of the air outside ranged between zero and freezing, and the air in the blast main about 70 deg. F. above that. Sufficient steam was added so that the air was just saturated; that is, some condensation showed in the valves and bends of the pipe. Rough calculations indicated that about 300 lb. of steam was used per hour, or 7,200 lb. per day, which, at our cost of evaporation (which was high that month), amounted to $7.20 per day for steam.

The tabulated results show an increased tonnage of 14.7 per cent for the two days of the test over the average of the five days' previous, and at no time, even with the use of extra coke, had it been possible to make the same record without steam, although in the previous experiments it had been nearly equaled on several occasions. There was no change in any other operating condition during the period and no material change in the weather.

The first day's run does not coincide exactly with the period for which steam was on, as the statistical day started at 7:30 a.m. and steam was connected about 9:30 a.m. On the third day the furnace was down a few hours to change the spout, and I had no opportunity of making further tests while connected with the plant. Although the results given show increased capacity only, there are reasons to believe that corresponding savings in operation costs could be made through saving in coke and flux and in smooth operation.

FURNACE PERFORMANCE BEFORE AND DURING THE TEST

	Ore	Flux	Coke	Per Cent of Coke on Ore	Per Cent of Coke on Charge
Five days previous to test	811 20	327 60	119 00	14 7	10 4
	811 20	327 60	116 60	14 4	10.2
	764 90	293 60	107 30	14 0	10 0
	712 85	269 00	99 85	14 0	10 0
	713 60	306 70	116 70	14 3	10 4
First day of test	896 40	315 40	125 44	14 0	10 4
Second day of test	899.10	316 35	127 45	14 2	10 5

The furnace was 50 in. x 30 ft., of ordinary water-jacketed type, and was smelting raw pyrrhotite ore with converter slag as flux. The results obtained certainly indicate an advantage to be gained by the use of steam in smelting sulphide ores, and tests could be conducted at little expense in almost any plant, which would tend to increase the available information on the subject and perhaps make a material saving on operating costs.

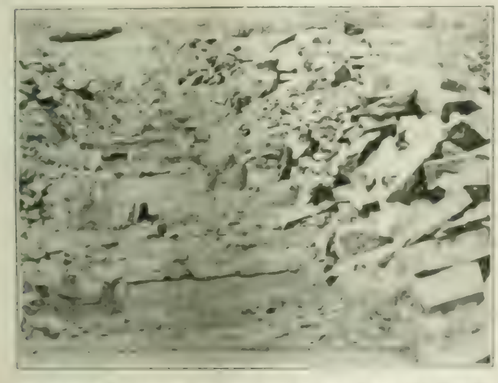
[We would be grateful for the privilege of publishing the results of any tests of this practice made at other smelters.—EDITOR.]

Iron-Ore Deposits on the Belcher Islands

Formations Similar to Those of the Lake Superior Region, Showing Folding and Extensive Glaciation and Offering Geological and Economical Possibilities, Have Been Discovered In the Hudson Bay Region—Transportation Difficulties and Inaccessibility of the District

By Dwight E. Woodbridge
Written for Engineering and Mining Journal

THE CANADIAN GEOLOGICAL SURVEY is sending a party of geologists to the Belcher Islands[1], Hudson Bay, this summer to make an examination of the iron-ore formation existing there. The Ontario government has begun the construction of a railway line, northward from Cochrane, Ont., toward Moose Factory, at the foot of James Bay, with the intention of extending the line to the bay if the iron ore is found to be of satisfactory quality to permit mining. The immediate purpose of this extension is to develop lands lying to the north of Cochrane, which is situated at the junction of the Temiskaming & Northern Ontario with the Transcontinental, both of which railroads are owned by the government.



IRON-ORE FORMATION SHOWING BLOCKY CHARACTER OF ORE

That enormous beds of iron-bearing formation exist on the Belcher Islands is well known to a few. These probably cover an area considerably greater than the beds of the Mesabi Range, and are of about the same type. In 1909, Dr. C. K. Leith headed a party that went up the east shore of James and Hudson bays, as far north as Richmond Gulf, North Latitude 56 deg. 50 min., and there found a large area of rocks that he characterized as being "of remarkable lithological similarity to the iron formation of the Upper Huronian or Animikie group of the Lake Superior region." He added: "All phases, both altered and original, of the Animikie are here represented, with one exception. The altered phases are the jaspers, ferruginous cherts, and ores. The original phases are the iron carbonates. Unaltered greenalite rock was not seen, but the lower part of the iron formation seems originally to have consisted largely of the greenalite or taconite of the Mesabi district of Minnesota. The upper part of the Nastapoka (this is the name which Dr. Leith gave to the formation around Richmond Gulf) iron formation consists principally of ferruginous cherts and jaspers of a more regularly banded type, similar to those resulting from the alteration of iron carbonate in the Gogebic and Marquette districts of Michigan. The depressions on the dip slopes of the iron formation, where the overlying ferrodolomite has been stripped off, contain concentrations to iron ore. No large deposits of good grade are exposed."

When Dr. Leith made the above mentioned examination, the existence of the Belcher Islands, except as a group of dots on the map, was unknown to white men. A subsequent investigation by some hardy prospectors, acquainted with iron ore, disclosed the fact that the islands showed numerous and well-defined iron formation outcroppings, and that, far from being mere dots, a line circumscribing the islands incloses an area of about 3,500 square miles.

During the summer of 1920 I made an examination of the iron formation of the islands, assisted by George H. Rupp, a mining engineer from Ironwood, Mich. That part of the islands examined consisted of the greater portion of the northern half of the group, roughly speaking lying north of Parallel 56, North Latitude. The formation consists of folded pre-Cambrian sediments with their main axes nearly north and south, iron rocks, and lava flows. As a consequence of this folding and of the tremendous glaciation that has taken place, the islands consist of long parallel ridges separated by deep bays, most of the latter being protected and forming admirable harbors, sheltered from the action of wind and the movement of ice. Harbors ample for the largest ships are numerous. No vegetation exists on the Belchers excepting moss, and, in a few sheltered spots, subarctic flowers and mosses. Over large areas the rocks show great glacial erosion, which seems to have been quite recent.

Such a journey as I took to the Belchers is unusual and remarkable, for at present the only way to get there is by a roundabout course afforded by rivers large enough for canoe travel, and across the bays themselves. We traveled about 500 miles by canoe and 900 miles, all told, by small motor boat. Hardships and disasters, more or less serious, are sure to be met. There are dense fogs which, in those seas, never shadowing a sail nor beaten by a wheel, with no lights nor aids to navigation, are hazardous in the extreme; there are frequent storms, for these northern latitudes are subject to sudden and severe winds; there is ice, and to run into it from windward in fog or wind is death to a thin-ribbed, river-built motor boat. There is the actual wreck of these boats, perhaps, and the usual untoward incidents always to be expected during a trip into a new and distant region where there are no accommodations nor facilities of any sort whatsoever. But all these would soon be forgotten if the region were to be opened and connected with the outside world. They would make an attractive human-interest story, but are not necessary to a discussion of the mineral possibilities of the Hudson Bay region.

---

[1] *Engineering and Mining Journal* of Aug. 28, 192[illegible], [illegible] will be found interesting in connection with this subject.

The northern slope of the great Laurentian shield, extending as it does along the St. Lawrence River and west to the Lake Superior country, consists essentially of sediments generally similar to those on its southern side. In the latter are mineral-bearing regions of tremendous importance, iron, copper, nickel, silver and gold, as well as other minerals. The northern side of this shield is practically unexplored; the interior of Ungava Land has been traversed but a few times, by A. P. Low and others; the maps show no geology except along the coasts and close to the banks of the larger rivers.

DIFFICULTIES OF TRANSPORTATION IMPEDE PROSPECTING

Wild tales are told of croppings of copper and other minerals, but transportation is so difficult that few have made the attempt to corroborate these stories. There are reports of other iron deposits than the Belchers in this vast region; I have heard of billions of tons of commercial ore in the interior of Ungava, only 200 or 300 miles north of the St. Lawrence. Copper specimens are brought to civilization; nickel and cobalt and lead ores are shown by the few prospectors who have braved the interior. But it is an unknown land, with its myths and its mystery, and no one knows the truth regarding it.

BUILDINGS AT FORT ALBANY, WITH THE SAWMILL IN THE FOREGROUND

Aside from the mineral possibilities there is an attraction in this far country, that which every explorer feels in scenes that others have not visioned. Off to the south lie the oldest posts of the Hudson's Bay Company, Ruperts House, Moose Factory, Fort Albany, Fort George, and the rest—there are seventeen stations in the James Bay district alone. There are the Eskimos and south of them the Crees. There is the wild life of the country—polar bear, moose, Arctic fox and hare, otter, seal and walrus, innumerable water fowl and plenty of fish. There are the broad deep rivers, like the black Albany that flows for hundreds of miles with a current boiling like oil, between dense forests of dark and virgin spruce; or like East Main, so large that an ocean liner might sail for fifty miles from its mouth. There are exposed the titanic results of glacial erosion, extensive lava beds, with the geologic story easy to read because it is uncovered, with neither trees, nor moss, nor soil, for hundreds of miles. Four scientific journeys have been made to the Belchers, within my knowledge; to each of these some near-disaster occurred, but none of them has met with anything more than might be expected from such a region.

SHIPPING FACILITIES MAY OFFSET ORE-PRODUCING HANDICAPS

The possibilities of the district were appealing, especially as Dr. Leith had stated that he had found, in the Nastapoka formation, concentrations of merchantable ore up to four or five feet in thickness. It seemed to me that, if such concentrations did occur anywhere in that formation, there might be localities where it would be of a greater and commercial thickness; also, it was not too far away. Although the name Hudson Bay suggests a distant and inaccessible region, it is a fact that under a rail rate which the Canadian government probably will make on ore, if shipped from there, the district is strictly and immediately competitive with Lake Superior, all things considered, for iron ore that is of equal purity with the averages from the lake. The one additional handling and the increased rail freight charge to get that ore to Lake Erie ports are counterbalanced by royalty and taxation charges current in Minnesota and elsewhere.

A brief study of the situation from what information was available from prospectors and others made it evident that the Nastapoka formation, as seen by Leith on the west shore of Ungava Land, near Richmond Gulf, was identical in many respects with that to be found on the Belcher Islands, and that if iron existed in the one locality it might be expected to exist in the other. I may say that this conclusion was the basis of the decision that the district be further examined.

BELCHER IRON FORMATION OF GOOD QUALITY

Iron-bearing formations themselves are not usually of a quality that will permit their use in the blast furnace; they are generally too low in iron and too high in silica or other inert or deleterious elements to be commercial. A process of concentration, natural or artificial, must take place. Sampling of the formation at the Belchers, this sampling extending over a length of many miles, showed it to be of a grade comparing favorably with the iron formations around Lake Superior in their entirety. The average iron content of the 125 square miles of the Mesabi district, for instance, is computed to be about 30 per cent iron; about 50,000 drill holes in the Gogebic have given an average of about 35 per cent iron. The comparable average of the Belchers is about 38 per cent iron, with all samples of 50 per cent or better excluded from the computation. In considering this newly discovered area and in comparing it with other and developed districts, one must be mindful that it is a wide extending formation, and not mines, that are the basis of comparison. A spade has never been put into the ground on the Belchers, nor has there even been sunk a drill hole. The whole study is one of geologic possibilities and similarities, with comparisons of the great mass of the iron-bearing formation.

At the Belchers the iron-bearing formation shows a thickness up to 400 or 500 ft. and can be followed along its eroded edges for many miles. My own work included fifteen miles of outcroppings, running up to about 400

CREE INDIAN VILLAGE ON LOWER JAMES BAY

ft. in thickness. The formation is underlain by quartzites and early limestones and is capped by various recent lava flows, several different flows being discernible. The foldings and the erosions have cut through all these, disclosing greenstones, similar to those of the Lake Superior region, and it is not difficult to formulate an ideal cross-section of the various rocks.

Conditions Warrant Investigation of Commercial Possibilities

Extensive areas were found in the formation where there had been sufficient concentration of ore to present faces up to 25 ft. in thickness of an average iron content of better than 52 per cent natural iron. The ore is very dense and close grained, blocky, breaking in rhombohedral blocks, reminding one of the Newfoundland ores under the sea at Bell Island, and the moisture content is extremely low, considerably less than 1 per cent. But not enough commercial ore was disclosed by my examination to permit a recommendation that the development of mines, the construction of ships, docks, and a railway, were warranted without further and considerable definite knowledge to be derived from exploration by drill or otherwise. It was reasonably safe to assume the actual presence of commercial ore in minable thicknesses up to a tonnage of not far from a million tons, but this was altogether too little on which to base the large expenditures necessary. It is enough, however, to base thereon a material exploratory campaign. If concentration of commercial ore in such a field, in minable thicknesses, is obtained, the probabilities are that there is vastly more to be found by search, and it is not impossible that on these islands exists one of the greater potential iron-ore fields of the world.

Geological Determinations Specific Respecting Formation

Geologically speaking, two questions arise as to the possibility of commercial tonnages of iron ore in this region: First, if the geological conditions were such as to allow the depositing iron-bearing solutions, did such solutions exist; that is, are there underlying comparatively impervious rocks in basin or synclinal form in which these solutions might have been arrested and deposited their iron? Second, were the iron-bearing rocks exposed to atmospheric action for a sufficient period to permit this concentration to proceed adequately to make ore?

As to the first query: There has been much folding of sedimentary series, including the underlying quartzites and the iron formation. This is definite, and there can be little doubt on this point on the part of anyone who has studied the situation. As to the second query: Such an examination as Mr. Rupp and I were able to make showed that the upper jaspers of the formation are lean and cherty and almost devoid of iron, and they seemed to show a considerable leaching action that could not have taken place if the lava and the formation sediments were synchronous or nearly so. Also, if the lava flows had been coincident with the foldings of the sediments, one would expect to find, in the upper bedding planes of the formation, sills or intrusions of the molten masses between the stratification of the iron rocks. We were unable to find such appearances, although the formation for many miles was closely studied for that phenomenon. Everywhere the contact of the base of the lava and the upper portion of the formation was clear and sharp, with no effect on the jasper but that magnetization that might have been expected and that is incident to baking in a reducing atmosphere, such as must have been prevalent here at some time. This all was to be expected, for the ages of the formation and of the overlying flows probably are far apart in geologic time.

Mining Possibilities, in Labor and Timber

The only inhabitants so far north are Eskimos, and there are thousands of them in the tributary regions, up to Baffin's Bay and Chesterfield Inlet. They are a willing, kindly, trustful, hard-working and happy race, amenable to reason and discipline. This I found not only from my own observations, but from the unanimous consensus of opinion of those who knew them well. They live daily in fear of starvation, without the slightest semblance of comforts or knowledge of the amenities of civilization. True, they probably would not exist long if too much comfort was accorded them, but if properly handled and properly fed with the only supplies they are used to—raw sea products and such other food as is natural to their habitat—and if assured of life from which the fear of starvation and drowning were removed, it is probable that the labor supply would be ample and excellent. Think of a race that has never seen a potato nor cooked food!

[illegible]

The Eskimos are physically and mentally able. They have to be, or they could not survive. Their life is and always has been a constant struggle against the sea and the climate, and that they exist at all is proof of their adaptability and the sharpness of their intellects. One will note the same condition among northern Norwegians of the older type—that same struggle for life with the sea and the rocks, and their mental alertness and characteristic aptitude are the results of conditions, not so severe though of like type, as those under which the Eskimos live. These people are so built physically as to warrant the belief that they would make excellent miners. It is fortunate that it is not necessary to consider Indians as miners, for there is as much difference in the mental and physical attitude of the two races as there is between an I. W. W. and a man working on his own.

No timber exists on the islands or on the mainland adjacent, but on James Bay, 100 to 150 miles south, the rivers are channels through magnificent forests of spruce, owned by the dominion government, and as yet of no value at all. Mining timber should cost at the islands not a third of what it now costs in the Lake Superior region.

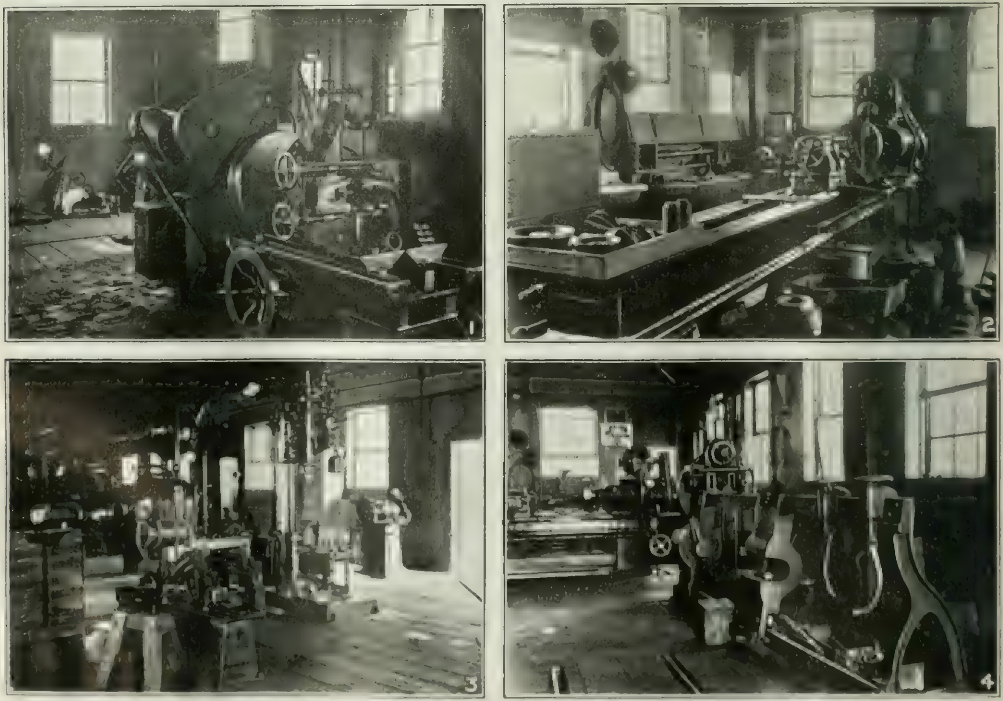
The possibilities of this newly discovered iron-formation region are truly interesting, and the more it is studied the more clearly do they stand out and the obvious objections fade away.

German Sulphur Industry Recovering

Although in former years large quantities of sulphur required by the German industries were imported from Italy, preference is now being given to the American raw sulphur. At the same time Germany is making great efforts to become independent of foreign resources. Before the outbreak of the war, considerable quantities of sulphur were produced within the country. In 1912 no fewer than 109 factories were engaged in the manufacture of sulphuric acid, with a combined production of 1,650,000 tons per year. During the same year 2,017,000 tons of sulphur-bearing minerals was worked up, of which, however, only 999,000 tons was mined in the country. On account of war, conditions underwent radical changes, as Germany was cut off from any importations of sulphur as well as raw materials. For this reason the exploitation of the domestic pyrite deposits assumed large proportions, and alone in the district of Meggen, in Westphalia, the production of cupriferous gravel, sulphuret of zinc and lead, and other sulphur-bearing minerals, rose from 200,885 tons in 1914 to 766,371 tons in 1920.

A new process by which sulphur is gained from gypsum and sulphate of magnesium is being improved at present. Germany requires 140,000 tons of sulphur per month. In 1917 the monthly production of sulphur from domestic raw materials amounted to 64,000 tons, and it has largely increased during the last four years.

A Well-Equipped Mine Machine Shop



INTERIOR VIEWS OF REPAIR SHOP AT THE STARPOINTER SHAFT, RUTH MINE OF THE NEVADA CONSOLIDATED COPPER CO., RUTH, NEVADA

1—Pipe-threading machine. 2—Long bed lathe. 3—Emery wheel, light drill press and power hacksaw. 4—Hydraulic press.

Improvements in Nodulizing at Chrome, N. J.

An Agglomerator To Press Roasted Product Into Cakes and Pulverized Coal Burned in an Exterior Combustion Chamber Effect Marked Economies—No Rings Whatever Now Form

BY C. L. COLBERT
Assistant Superintendent, U. S. Metals Refining Co., Chrome, N. J.
Written for *Engineering and Mining Journal*

THE ROTARY KILN has been used at the smelter of the U. S. Metals Refining Co. at Chrome, N. J., for nodulizing flue dust and fine ores for a number of years. This machine successfully handled large tonnages with low costs, before affected by the wartime prices of fuel oil and labor. The rapid rise in costs without the ability to obtain increased tonnages finally made nodulizing for a time prohibitive.

The principal reason for the limit in tonnage which could be treated was the difficulty in keeping the kiln in operation continuously, owing largely to the impossibility of preventing the formation of rings of semi-fused ore on the lining. The original method of operation offered a choice between two evils. In one case firing the kiln so that a good nodulized product would be discharged, resulted in a ring formation of such nature and so high up in the kiln as to make its removal very expensive. The other, so firing the kiln as to bring the rings close to the discharge end, where they could be easily handled, involved the making of an inferior nodulized product. The aim formerly was to effect a compromise between these two extremes by getting a good nodulized product with as little ring trouble as possible. This mode of operation required close and intelligent attention on the part of the operators.

With the decreased intelligence of the available labor and with the great letting down in efficiency that took place during the Great War, it was found impossible to obtain satisfactory operation except for short periods, and the kilns were always producing an unsatisfactory product or carrying bad rings. After a heavy ring had formed, it was always necessary to shut down, cool off the kiln, and send men inside with bars and hammers to cut through the ring, which process was usually detrimental to the brick lining, as a portion of the lining came off with the ring. Occasionally it was possible to change the charge and partially flux out the ring, but the operation afforded only a temporary improvement.

The Chrome installation contains two 60 x 7-ft. Vulcan kilns. Previous to 1921 these were fired with 28 deg. Bé. fuel oil, under 50 to 75 lb. air pressure, burned in a standard Hauck burner, the flame discharging directly into the discharge end of the kiln through an orifice in the brickwork of the hood.

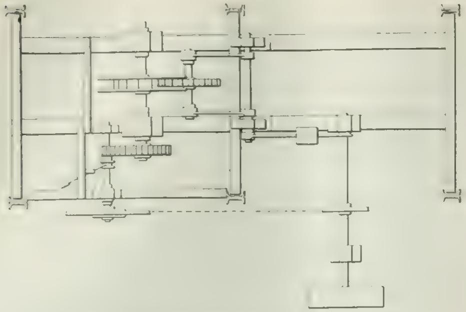
The troubles outlined made it imperative that some solution for the ring problem be devised, which, besides giving a product physically satisfactory for smelting, would permit a reduction of treatment charges. Both of these objects have been accomplished through the design (1) of a mechanical agglomerator, and (2) a combustion chamber for properly firing the kiln with either pulverized coal or fuel oil.

The mechanical agglomerator as developed consists of two co-operating rolls, as shown in the sketches, between which the semi-plastic material discharged from the kiln is passed and by which it is compressed. One of these rolls is built with side flanges between which the periphery of the other roll passes so as to confine the material while it is being subjected to pressure. One of the rolls may move toward or away from the other roll, thereby allowing the pressure on the material to be varied or to allow for varying quantities of material discharged from the kiln. As shown by the sketches, this movement is secured by supporting one roll from a shaft about which it may move angularly through the small range necessary, a movable counterweight being provided at the opposite side of the shaft to permit of adjusting the apparatus as desired. Only the other roll is power driven, the adjustable roll rotating by frictional contact. To insure rotation, its surface is provided with irregularities, alternate depressions and projections.

AGGLOMERATED CAKES OF FLUE DUST

This apparatus was made and installed in January, 1920, and has been very successful. The material as discharged from the kiln is rolled out into a ribbon 4 in. wide and usually from ¾ in. to 1½ in. thick, the thickness varying somewhat with the amount of feed and the spread of the agglomerator. The ribbon, as it rolls downward, breaks off into lengths of 3 to 6 in., which are carried away to storage.

To get best results, the product discharged from the kiln into the agglomerator rolls should be at a bright red heat, at which temperature the material is semi-plastic and can be pressed readily into a flat ribbon. After agglomeration, the hot product should be removed as quickly as possible to suitable storage. A screen test of this final product will show less than 5 per cent passing ¼-in. mesh. The photograph shows a pile of cold agglomerated product. An idea of the size of the pieces can be obtained by noting the common building brick standing on end. The capacity of the agglomerator depends principally upon the width of the wheel. The drive for the wheel had best be pro-



PLAN OF AGGLOMERATOR MECHANISM

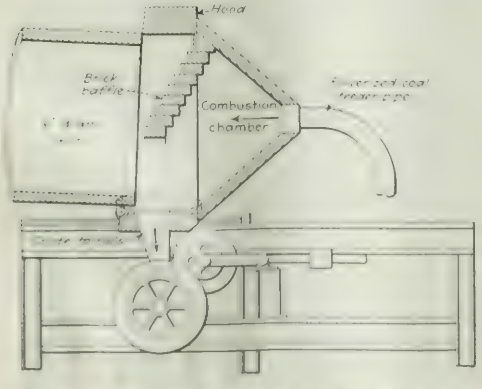
vided with a variable-speed motor to permit quick adjustment for the ordinary variation of the kiln feed.

THE PROBLEM OF PROPER FIRING NEXT SOLVED

Oil firing, as originally practiced, was not altogether satisfactory from the agglomerating standpoint, as the proper degree of heat was hard to control without constant regulation. Under skillful handling, satisfactory results were obtained, but a little carelessness on the part of the operator speedily developed ring troubles. The oil consumption under average conditions varied between 20 and 30 gal. per ton of material handled.

The rapid rise in the price of fuel oil soon made this material prohibitive, and other fuel was considered. It was finally decided to experiment with powdered bituminous coal, and the smallest size of "Aëro" pulverizer was purchased. After several weeks of experimenting, a method of firing has now been developed, which is satisfactory from the cost standpoint, as well as from that of the product obtained from the kiln.

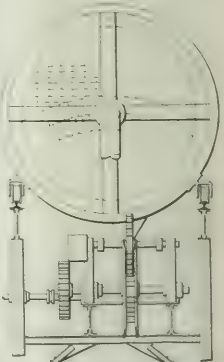
The first attempts at powdered-coal firing were made by blowing the fine coal into the discharge end of the kiln, through the opening in which the oil had previously been introduced. Ignition was finally accomplished, but only at a point far up in the kiln, close to the feed end. Excellent nodules of large size were made for a short period, but it was soon necessary to stop and dig out the ring which quickly formed. So high a temperature was developed that metallic copper was found in the rings. The screw-feed apparatus could not stand such excessive heat, and this method of firing had to be changed.



SIDE ELEVATION OF DISCHARGE END OF NODULIZING KILN AS IMPROVED

A COMBUSTION CHAMBER THE SECOND BIG IMPROVEMENT

A number of different experiments finally led to the use of a stationary brick combustion chamber at the discharge end of the kiln. The pulverized coal and air, properly mixed, were delivered into this chamber, which was maintained at a white heat. The hot gases were then discharged under a bridge wall into the mouth of the discharge end of the kiln. The proper height for the bridge wall is very important for obtaining the right position of the zone of maximum temperature inside the kiln. For the conditions existing at Chrome, 22 in. has been determined upon as the proper height. The kiln shows a visible red heat not further than 10 to 12 ft. from the discharge end, with the highest heat at the point of discharge. The result of firing under these conditions has been the complete elimination of ring formations. Since the device has been installed, over six months ago, no time has been lost on this account, and as long as the conditions mentioned are maintained, a ring cannot form. The heat control is remarkably even, and firing causes little trouble. With these improvements, the quantity of feed was pushed to the limit of the capacity of the agglomerator, and the quantity of coal burned per ton of material treated was gradually lowered, until now the cost of fuel is considerably under the cost obtained with fuel oil at pre-war prices. Continued experiments demonstrated that fuel oil can be burned in the combustion chamber in place of pulverized coal, giving the same agglomerator conditions; and using fuel oil, the combustion is much more economical in the quantity of oil burned per ton of material treated than formerly. The efficiency of oil, however, based on B.t.u.'s per ton of kiln material, did not equal that given with coal. These results cannot be considered as final, for only one type of oil burner was used.



END ELEVATION, SHOWING ARCH OF BRIDGE WALL AND AGGLOMERATOR

The more efficient burning of the fuel has increased the kiln tonnage from 30 to 40 tons per day to 80 to 90 tons; the limit has been restricted only by the size of the agglomerator and lack of better provision for taking care of the product. The kiln tonnage under proper conditions could be increased to 125 to 150 tons per kiln day.

The experimental combustion chamber now in use is only a makeshift, and one designed properly should be much more economical in operation. With the present arrangement, a ton of agglomerated material is produced by burning 70 lb. of bituminous coal. By using oil, the production is a ton of agglomerated material for 10½ gal. of oil. The oil, from the B.t.u. standpoint, as already mentioned, is not as efficient as pulverized coal. To get equal heat efficiency, one ton of material should be treated with 6½ gal. of oil. This present figure of 10½ gal. for oil is about one-third the old thermal requirement for fuel, and the second figure would be approximately one-fifth of the former requirement.

The figures given for bituminous coal are for coal containing 3 to 6 per cent moisture. Such coal is easily obtained, and the only preparation necessary ahead of the pulverizer is a crushing and screening of the run-of-mine coal in a short rotating screen. Coal containing a high percentage of moisture must be dried so that efficient grinding can be obtained at a reasonably low power cost.

Some work has been done, substituting the "buckwheat" size of anthracite for the soft coal after the combustion chamber has been heated. Short runs have been made, successfully demonstrating that if supply bins of both kinds of coal be provided, a considerable saving might be made by using a cheaper coal part of the time.

METHOD CONSERVES SULPHUR

The smelter at Chrome has been for the last few years, and still is, deficient in sulphur, and the small content of sulphur received in the material to be smelted must be conserved as much as possible. It is, therefore, aimed to retain as much sulphur in the kiln product as possible. and not put fine sulphide into the kiln unless absolutely necessary. The flue dust charged to the kiln carries about 7 to 9 per cent of sulphur and the agglomerated product about 4 to 5 per cent, the sulphur elimination not exceeding 50 per cent.

Previous work on high-sulphur-bearing concentrates, run under the former conditions, gave a sulphur elimination of 70 per cent on a 30 per cent sulphur feed. Another run, on flue dust, gave a 60 per cent sulphur elimination.

My opinion would be that the amount of sulphur eliminated could be closely regulated by varied lengths of kilns, speed of revolution and pitch, as well as varying the method of firing. All of these factors should give complete control, and a certain combination of factors could be changed, to a considerable degree, in a kiln installation to give a variable product to suit conditions.

The character of the material treated will govern the results to be obtained; a flotation concentrate containing high iron, sulphur and copper will melt easily if exposed to much heat for an extended period, and will require a short kiln for treatment, especially should conservation of the sulphur be an important item. Flue dust low in sulphur, or concentrates which require long heat treatment to attain the proper temperature for the elimination of all the sulphur possible, will require a much longer kiln and more revolutions per minute. Carefully prepared mixtures are not necessary for kiln treatment, and high sulphur contents require only a reduction in fuel requirements.

Blasting Mats of Wire Netting

Blasting mats made of mine netting have been successfully used in quarry work, according to the *Quarry Magazine Journal*. A mat is 6 ft in length, [illegible] ft wide, and the netting is about [illegible] in. x 1 in. mesh. Each piece of wire matting weighs about twenty-eight pounds.

A Wooden Smelter Stack

BY S. PAUL LINDAU

Written for Engineering and Mining Journal

When the smelter of the Compañia Metalúrgica Mexicana, at San Luis Potosí, was started in 1891 there was an adobe stack 60 ft. high for the roasters, and a self-supporting wooden stack for the lead and copper blast furnaces. The adobe stack has long ago been discarded, but the wooden stack still remains in good condition and is doing the work it was intended for. It has been overhauled possibly twice.

The stack and, in fact, the entire smelter were designed and built by Franz Cazin, consulting mechanical engineer, of Denver, Col. Before this, two wooden stacks were built at the old El Paso smelter by the late R. S. Towne, but proved rather unsatisfactory, as they had to be held up by a multitude of guy ropes.

WOODEN STACK AT SMELTER OF CIA. METALURGICA MEXICANA, SAN LUIS POTOSI, MEXICO

The reason for building the wooden stack at San Luis Potosi was primarily the difference in cost, which was about one-half; then the convenience in building and erecting it on the ground with the regular crew and material. Texas long-leaf pine was used.

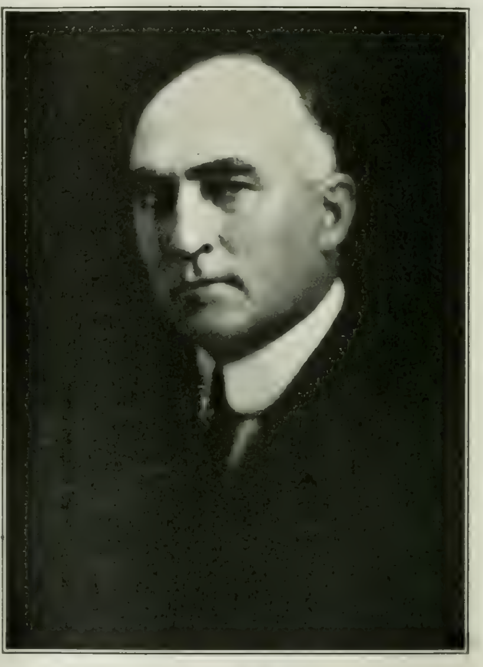
The main point of interest is the method of construction of the corner posts and braces. These are made longitudinally in two pieces, the 8 x 8-in. members being made of two 4 x 8-in. pieces well bolted together with broken joints and [illegible] at [illegible]. This makes them practically one piece and gives sufficient strength to withstand the tremendous strain caused by the high winds which occur there every spring. This also made construction much easier.

The stack is 164 ft high and 11 ft 6 in square inside. The stone foundation is 8 ft high. The amount of lumber used in construction was 41,000 ft

Mining Engineers of Note

Albert Burch

ALBERT BURCH'S career is a direct refutation to the conclusion that a university training is a prerequisite to a successful professional life. His mining experience was acquired through the hard knocks administered by practical work in his profession. He received little technical schooling, for in 1880, when he was only thirteen years old, he left school because of the removal of his family to another part of Nebraska, his native state. After receiving a short course in surveying under a tutor, and spending a year at York College, he began work for the Burlington R.R., busying himself with railroad construction and location and advancing by January, 1887, from back flagman to chief of first locating party. He then, through the solicitation of the superintendent, became underground surveyor and outside foreman at the Bullion Beck & Champion mine at Eureka, Utah. In 1890 he was commissioned a U. S. Mineral Surveyor and opened an office for patent survey work. Three years later he was offered the superintendency of the Bullion Beck & Champion mine, which he accepted, but he was fired a year later by one "Cabbage" Ryan, into whose control the mine had passed. Reopening his office as mineral surveyor, he also took over some mining leases, and with C. E. Loose promoted the Grand Central Mining Co., of Mammoth, Utah, and other properties, all of which proved to be successful and gave him valuable training in mine promotion. Continuing his patent surveys, he became, in 1897, manager of Lawler's Gold Mines, Ltd., a small gold property in western Oregon. It was there, after a few months' work, that he met F. W. Bradley, who was examining the gold mine, and who offered him the superintendency of the Bunker Hill & Sullivan mine, at Wardner, Idaho, an offer that was accepted. He was in charge during the trying labor disputes and conflicts in the Cœur d'Alenes, a period noted for the violence of the activities of the strikers and outsiders attracted by the disturbances, the blowing up of the company's mill, and for its loss of life. In June, 1901, he was appointed manager of the B. H. & S., a position he held until 1903, at which time he organized the firm of Burbridge & Burch, with headquarters at Spokane, Wash., and engaged in the development of various mining properties under option. This work was not entirely successful. Mr. Burch then moved to San Francisco to engage in consulting practice, and has remained there ever since. His work has carried him from Alaska to Mexico, but he has been chiefly confined to the United States in the examination of many mines and prospects. At various times he has been consulting engineer for the Kimberley Estate, of Sharon, Pa.; the Chicago Exploration Co., of Chicago; the Bunker Hill & Sullivan Mining Co. (litigation only), the Goldfield Consolidated Mines Co., of Goldfield, Nev.; the Mountain Copper Co., Ltd., of California; the California Exploration Co. and the Plymouth Consolidated Gold Mines Co., Ltd., both of London; the Primos Co., of Philadelphia, and other companies. During the war he "did his bit" as consulting engineer for the U. S. Bureau of Mines, reporting upon manganese and chrome deposits in Cuba and stimulating production of war minerals in California and Oregon. He was personally connected with the development, equipment, and operation of the Plymouth Consolidated Gold Mines, Ltd., which is a British corporation, obtaining the option upon the property and intending first to turn it over to American capitalists. However, due to the withdrawal of this capital, he received British financial assistance.


ALBERT BURCH

Unlike the career of some mining engineers whose work has taken them to the four corners of the earth, Mr. Burch's field has been pre-eminently the development of our own domestic resources in time of both peace and war. Throughout his long contact with mining he has been an exponent of cordial co-operation between not only his employees and himself but also between his companies and the public. He has his own ideas as to value of welfare work, and feels that much of it lacks the essential quality of sincerity. His professional record bristles with the romance and adventure of mining, and it is apparent that he has got the fullest enjoyment from all his work.

CONSULTATION

How To Test for Platinum in Ores

"Will you please give me a method of testing platinum ore, simply to identify the platinum content?"

Although most of the world's platinum is derived from placer deposits, it also occurs in veins associated with chromite and disseminated in peridotite rocks. Its specific gravity is commonly given as 14 to 19, whereas that of gold is 15.6 to 19.3. Concentration by panning will show platinum grains as readily as gold. Platinum is infusible at ordinary temperatures, but may be fused with the oxyhydrogen blowpipe. The metal is soluble in aqua regia only, and has a shining steel-gray streak. In color it resembles some common metals from steel to silver, so that this characteristic alone is an unreliable indication of platinum. However, the properties recorded, infusibility and insolubility in ordinary acids, enable a preliminary qualitative test to be satisfactorily made, which should be confirmed by an analysis, or assay for platinum, performed by an experienced assayer or chemist.

No confusion should exist between the identification of platinum and other metals. Logan, in a bulletin of the California State Mining Bureau, "Platinum and Allied Metals in California," records the mistaken identity of fine grains of silvery white metal, highly magnetic, (platinum may also be magnetic), but lower in specific gravity than platinum, for the metal. The grains were mostly iron, although a mineral called awarite, Ni_2Fe, had also been identified in the sands of the river from which the metal had been taken. A blowpipe would have disclosed the error and assisted in the determination of the mineral.

Chemical means may be used for the detection of platinum. The so-called "Glow Reaction" is one method, and was first used by L. J. Curtman and P. Rothberg, who disclosed the test in a report of the American Chemical Society. The substance to be tested for platinum is brought into solution by dissolving it in hot aqua regia, and about 0.2 c.c. of this solution is absorbed in a piece of thin asbestos paper by alternately dipping the paper into the solution and heating until the required volume is absorbed. The moist paper, held by one end in a pair of tongs, is heated to redness in a bunsen flame and then removed. After redness has ceased, but while the paper is still hot, it is brought into a stream of mixed illuminating gas and air from a bunsen burner. If platinum is present, the asbestos paper will begin to glow. The glow must last for some time, and can be brought back after it has once died out, by again heating the paper and holding it in the stream of gas. The burner must be arranged to supply a fairly good mixture of gas and air, and the pressure must not be too great. For the greatest sensitiveness, the solution should not be too acid, the asbestos paper must be thin, and the glow is intensified by having the gas warm.

The glow reaction depends on the catalyzing action of the finely divided platinum compound, which hastens and intensifies the oxidation of the hydrogen in the illuminating gas. The test shows the presence of as little as 0.002 mg. of platinum, 0.005 mg. of iridium, 0.0005 mg. of palladium or 0.0009 mg. rhodium, but it does not reveal the presence of osmium or ruthenium. It may be applied successfully to black-sand concentrate or to solutions, without preliminary separation of other substances. This is not a test suitable for use in the field, but one that can be rapidly employed in the laboratory or where the materials necessary for the reaction are available.

A method that may be used in the field requires nitric and hydrochloric acid to form aqua regia, and some potassium iodide. A few grams of the material to be tested is dissolved in a casserole by means of aqua regia, gently evaporated to dryness, and the residue heated until every trace of nitric acid is expelled, which is indicated by the disappearance of the acid fumes. The residue, containing platinic chloride, is dissolved in water and filtered. A few drops of potassium iodide solution added to the clear liquid gives platinum iodide, which dissolves, producing a deep rose-colored liquid resembling cobalt nitrate. A variation of this method may be had by dissolving the material in aqua regia as before, evaporating to dryness, and redissolving in hydrochloric acid, and evaporating again to a thick paste. Dilute with water and then add a few drops of H_2SO_4 and a crystal of potassium iodide. The solution will assume a wine-red color if platinum is present, but does not work satisfactorily if large quantities of iron are contained in the sample. There are other wet tests for platinum, but the ones given here will suffice.

Discussing qualitative tests for the platinum metals, Hall[1] states that to differentiate and determine the metals of this group requires considerable equipment and a skilled analyst. Many published methods will not give accurate results, and others are accurate only under certain conditions. According to the authority quoted, "Aqua regia converts silver to chloride and dissolves palladium, gold, and platinum, but not iridium except with vigorous treatment or when alloyed with platinum. All these elements, except silver, give colored solutions, which range from yellow through orange to dark red, depending on the combination and concentration of the metals. Oxalic acid precipitates gold from slightly acid solutions, but not the others. Potassium or ammonium chloride in concentrated solution will precipitate platinum and iridium, but not gold or palladium in its usual condition. Potassium iodide, even in dilute solution, with gold gives free iodine; with platinum, brownish red color of platinic iodide; with palladium a black precipitate soluble in excess. This last reaction is extremely delicate. Silver chloride precipitated in the presence of palladium and platinum is contaminated by these metals." Platinum assays are difficult and troublesome to make. In case of doubt it is well to have results checked.

---

[1] [illegible] Handbook.

HANDY KNOWLEDGE

Shaft-Testing Apparatus

By ALFRED GRADENWITZ

Written for Engineering and Mining Journal

Apparatus recently perfected by E. Jahnke, professor at the Berlin Technical High School, in conjunction with G. Keinath, chief engineer of the Siemens & Halske firm, permits shafts and cables to be checked in operation by automatically making record of any defective places in the shaft or places where the cable is put to excessive strain. The apparatus is lowered into the shaft and readily ascertains its condition. It is described as a vertical acceleration gage, and is attached to the wall of the cage, without interfering with the operation of the latter. After it is run up and down with the cage for about ten minutes, the diagrams recorded by the apparatus are removed.

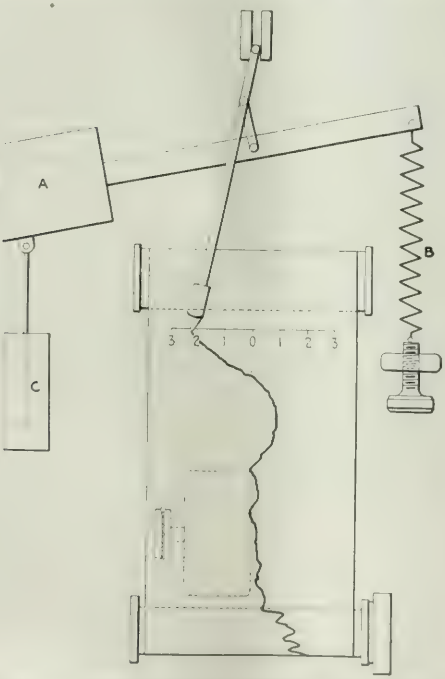


FIG. 1. SKETCH OF SHAFT-TESTING APPARATUS

The apparatus is a sort of seismograph and records all vibrations made by the cage. As may be inferred from Fig. 1, it consists of a weight *A* carried by a one-arm lever and kept in equilibrium by the spring *B*. This weight is lifted or lowered, as the case may be, by any acceleration shock acting on the cage, its motion being transmitted by a pair of toothed wheels to a recording lever moving in a straight line. Its maximum deflection is 60 mm., its sensitiveness being adjusted by exchanging the spring *B*. To insure accurate records the working of the recording lever should be aperiodic; this is obtained by connecting the weight with an oil-damping device consisting of a piston moving up and down in a pot. The influence of temperature on this device can be checked from outside. Another condition that must be observed to insure accurate records is that the vibration of the device itself should be of short duration, so that the recorder may follow any rapid vibrations. This has likewise been met in a most satisfactory way, the recorder having a frequency of seven half-vibrations per second. The recorder writes with a non-spluttering pen on a paper tape, 120 mm. in useful width, advancing 5 mm. per second under the action of clockwork. The whole outfit is contained in an oak case fixed to the cage.

The apparatus described is mainly intended to serve as a safeguard in preventing accidents due to the breaking of cables. Being an elastic body, the cable under the action of the drive, the operating devices, and any irregularities in the structure of the shaft will undergo acceleration shocks tending to lengthen it. The energy of these shocks will be converted partly into tension energy of the cable and partly into energy of motion (kinetic energy). The following types of vibration are thus produced:

1. Starting vibrations, namely, harmonic vibrations, especially marked when the cage is suspended from a long cable. These vibrations, in employing electric or steam operation, will be rather light, unless their amplitude be increased by periodically changing variations of acceleration. When, in steam operation, the unavoidable jerks at starting come into resonance with the frequency of the cable, the amplitudes of vibration are likely to assume very considerable figures.
2. Braking vibrations, produced during the final stage of the run, when the operating device does not insure a uniform retardation as well as under the action of loads and when the engineer is unable to insure by hand a uniform run-out of the cage.
3. Guide vibrations occurring when the cage is running in bent guides or, when the load is not uniform, is moving to and fro between its guides. This type of vibration is characterized by sharp peaks in the acceleration curves.
4. Spring vibrations, noted when a spring is fitted between the cable and cage.
5. Tension vibrations, produced in the cable under the influence of the cable weight and reflected repeatedly at the upper end of the cable as well as at the cage.

Comprehensive tests made with this apparatus have shown any defects in the shaft and at the hoist to be readily detected by its means. In fact, the curves obtained in a ten-minute test (during which the cage is moving up and down) enable any change in the condition of the shaft and cage to be ascertained. They also show whether the operating devices are working well, how the engineer is operating the lever, and so on. Finally, by comparing the diagrams obtained at different periods, any decrease in the elasticity of the cable can be ascertained. In fact, the acceleration gage could properly be termed "shaft tester."

The fact that the apparatus also permits the winding engine to be checked is strikingly shown by Fig. 2. The irregular course of that diagram was due to two concurrent circumstances. On the one hand, there was an accidental defect in the adjustment of the operating mechanism, and on the other, the engineer, being tired, failed to operate the hoist in a normal manner.

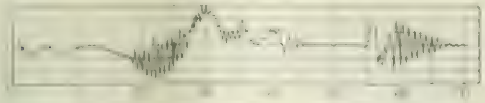


FIG. 2. RECORD INDICATING DEFECTIVE OPERATION OF HOIST.

Inasmuch as in interpreting diagrams obtained by means of the acceleration gage there can be a doubt as to the cause of a given trouble, it is a good plan also to provide a rotary acceleration gage which will record the acceleration of the cable on the drum or Koepe disk. The type of apparatus used by Jahnke and Keinath is based on the following fundamental idea:

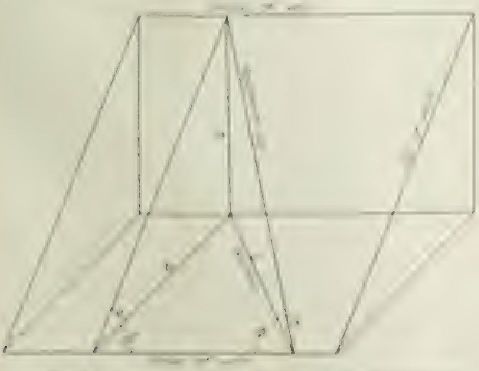
To the drum or Koepe disk there is coupled a small continuous-current dynamo supplying a continuous-current pressure corresponding to the number of revolutions. To this is connected across a condenser a recording milli-ammeter. Inasmuch as the current is proportional to the rate of variation of electric pressure—that is to say, to the rotary acceleration—this apparatus enables the operation of the engine to be checked at any time and at any distance from the engine house, in a much more perfect manner than would have been possible by observing the speed.

Determining Dip of Vein at Depth

By D. M. STRANAHAN

Written for Engineering and Mining Journal

During the course of work at Edwards, N. Y., it became necessary to determine if possible, whether the ore found at a low level in one of the diamond-drill holes was the same vein that was being worked above. The diamond-drill hole, however, was not in the same section as the mine workings, but further southwest along the strike. Consequently, it was not possible to use the true dip of the vein in making the section through the workings and the drill hole. Therefore it was necessary to calculate the apparent dip. This was worked out in the formula given below, so that it could be used in connection with any dip and any angle for the section.



SKETCH ILLUSTRATING METHOD OF DETERMINING VEIN DIP

The true dip and strike are known; also the position of the diamond-drill hole in reference to workings. Therefore, using the diagram

Let ρ = true dip;
ϕ = angle of section with strike;
α = apparent dip

Then $b = c \sin \phi$

$$c = \frac{b}{\sin \phi}.$$

$$\text{Tan } \alpha = \frac{a}{c}$$

but $\frac{a}{b} = \tan \rho$, $a = b \tan \rho$

Therefore $$\tan \alpha = \frac{b \tan \rho}{\frac{b}{\sin \phi}} = \tan \rho \sin \phi.$$

Then α = angle whose tangent is $\tan \rho \sin \phi$

Filling Matte Ladles

Written for Engineering and Mining Journal

At the smelter of the Calaveras Copper Co., Copperopolis, Cal., the matte from the forehearth of the blast furnace is discharged through a cast-iron launder into small matte pots and hauled to the matte beds. To reduce the spillage to a minimum, a short section of cast-iron launder is mounted upon wheels supported by tracks over the discharge end of the launder. When a ladle car is almost full, the short section is rolled into place and the stream of matte runs into the next car. The section is of sufficient length to more than span the space between the cars.

MOVABLE LAUNDER [illegible] WHEN FILLING MATTE LADLES

THE PETROLEUM INDUSTRY

The Comodoro Rivadavia Petroleum Fields*

Development of Argentine Oil Field Has Been Steady —Use of American Drilling Outfits Has Resulted in Reduced Costs

THE settlement of Comodoro Rivadavia, in the National Territory of Chubut, Argentina, was founded in 1901 as a trading post on one of the most desolate parts of the desert coast of Patagonia. In December, 1907, while the government engineers were drilling for water, they encountered oil at a depth of 535 meters.

Though oil had been discovered previously in other parts of the Republic no attempt was made toward government exploitation until the discovery of the Rivadavia fields in 1907. Since then government development in Comodoro Rivadavia has steadily increased up to the beginning of the present year, when the monthly production reached over 200,000 bbl. During the last year reservations have been decreed also in the National Territory of Neuquen, and exploration wells have been sunk there by the Federal Bureau of Mines.

LITTLE DEVELOPMENT DONE IN OTHER FIELDS

Besides the Comodoro Rivadavia oil fields there are three distinct oil regions in Argentina as determined by seepages and drillings. These are at Neuquen, Mendoza (Cachueta), and Salta-Jujuy on the Bolivian border. In addition to these fields, surface indications are said to point to oil in the region of Bahia Blanca, and along the coast north of Mar del Plata, both in the Province of Buenos Aires. Several geologists also believe that the general trend of the Patagonian formations would indicate that oil may be found in other parts of Patagonia than Comodoro Rivadavia and Neuquen. In comparison with the evident potential possibilities of the Argentine oil fields little development work has been done.

The accompanying figures give the output, in barrels, of the official workings at Comodoro Rivadavia since the first well was drilled in 1907. Production on private workings began in 1916 with an output of about 55,000 bbl., and in 1920 still amounted to less than 10 per cent of the total production.

PRODUCTION OF COMODORO RIVADAVIA OIL WELLS

Year	Barrels	Year	Barrels
1907	101	1915	514,837
1908	11,454	1916	816,316
1909	18,801	1917	1,142,918
1910	24,676	1918	1,242,740
1911	13,096	1919	1,183,105
1912	46,930	1920	1,465,570
1913	130,411	1921 (first three months)	538,855
1914	275,471		

CHARACTERISTICS OF COMODORO RIVADAVIA PETROLEUM

In its natural state the oil of Comodoro Rivadavia is black and viscous, with a smell of benzine. It has a specific gravity of 0.912 at 15 deg. C. and of 0.8041 at 150 deg. C. An analysis made by Dr. Fritz Reichert for the Argentine Bureau of Mines showed the following contents: Carbon, 78.136 per cent; hydrogen, 12.010 per cent; oxygen, 4.637 per cent; sulphur, 0.340 per cent; nitrogen, 1.130 per cent; water, 3.500 per cent; and ash, 0.247.

GOVERNMENT EXPLOITATION OF OIL

Official production of petroleum in Comodoro Rivadavia began immediately upon its discovery in December, 1907, about 100 bbl. being produced that month. Up to 1910, 5 wells had been drilled, all yielding oil or gas, and the production that year reached 24,000 bbl. By the end of 1917, 63 wells had been drilled, and 11 more were being drilled, while the yearly production passed the 1,000,000-bbl. mark. From then on the production has been limited by transportation facilities, and the actual production of 1,465,570 bbl. in 1920 does not at all represent the potential capacity of the 90 producing wells.

No dry wells have been struck on the government reservation, although several drillings were abandoned before completion on account of their undesirable location. Most of the wells are approximately 150 ft. above sea level and are grouped in two small valleys, 2 and 3 miles north of the town, and directly above the seashore.

AMERICAN EQUIPMENT USED IN WELL DRILLING

A general characteristic of the wells is that the production is greatest during the first month, and after that the output decreases decidedly. The temperature of the oil is about 32 deg. C., as it stands in the wells at a level of 300 to 400 meters below the surface. All of the first wells were drilled with the Austria Fauck machines, capable of reaching a depth of 1,000 meters, but the deepest drilling so far has been but 634 meters. All of the government engineers at first were Germans, but later an American engineer in the service of the Argentine government was permitted to use American outfits in drilling two wells, and a considerable saving of time and money was demonstrated by the use of this equipment. Although the original cost of labor at the field has been cheap, the time consumed in drilling has often been great, and the total cost relatively large. Some wells drilled in 1915 cost $45,000. The water in the wells is salty. During the first years sea water was used in drilling, but in 1912 the government wells began piping water a distance of 15 miles through a 4-in. pipe line which gives 200,000 gal. per day, and a larger pipe line is now being installed.

Three methods of extraction are being employed in the fiscal wells—namely, piston, hollow plunger, and pump. Many of the early wells are still giving good results, although some difficulty has been met with from time to time, due to several of the wells becoming choked with sand, which either reduced the output considerably or caused it to come to a standstill for some time. Since 1917 several wells have produced large supplies of gas at high pressure, but as the nearest city of any size is 600 miles distant, no attempt has been made to utilize this gas except to meet the small local requirements.

---

* Abstracted from *Commerce Reports*

As previously mentioned, the actual production of oil from the Comodoro Rivadavia fields seems to be limited to the quantity which can be transported in the three tank steamers owned by the Argentine government, which have capacities of 4,300 tons, 3,000 tons, and 2,400 tons. Two others are expected from England this year, which will have a capacity of 5,000 tons each. Storage tanks are provided at Buenos Aires and at the military port near Bahia Blanca, and it is proposed to erect tanks at Rosario and other points, as well as to increase the present storage capacity at the ports in anticipation of increased production from the fields. Six more tanks of 6,000 tons' capacity have been ordered.

Each well is now provided with one or more tanks of 6,000 tons, and one of 8,000 tons' capacity, located at the loading wharf. The wharf at Comodoro Rivadavia, which is of steel, is 2,800 ft. long, 27 ft. above high-water mark, and carries a 10-in. pipe. The water depth at the end of the wharf is 23½ ft. at low water, and the rise of the tide is 18 ft. Because of the strong winds the tank steamers are moored to buoys away from the wharf and receive the oil through a flexible pipe 250 ft. long. The loading capacity of the pumps is 600 tons per hour, or the oil can be loaded by gravity at the rate of 200 tons per hour.

Analyses of the Argentine mining laws by legal authorities seem to establish definitely that there is no great obstacle to the exploitation by foreigners of the petroleum of Comodoro Rivadavia. However, all Argentine political parties and the Argentine people in general seem to view with suspicion any company that has the appearance of being a "foreign trust," and American companies interested, therefore, should consider the example already set by British and German capital of forming national companies incorporated under the Argentine law.

A market for the oil exists in the country and in the neighboring republics. In the year 1919 in addition to the domestic production of approximately 1,500,000 bbl., Argentina imported over 2,000,000 bbl. of crude and fuel oil, besides quantities of gasoline, benzine, and other petroleum products. The petroleum needs of Argentina have been estimated by an Argentine engineer at 35,000,000 bbl., including the requirements for the operation of the railways and industrial establishments, but excluding the needs of steamers taking on fuel in the River Plate ports and at Bahia Blanca. Allowing for increases in operation and in transportation, the Argentine Petroleum Department estimates that the fiscal workings will yield something less than 5,000,000 bbl. by the year 1924, and the deficiency in the national needs must be made up, therefore, by the workings of private companies. British, German, Dutch, and Norwegian capitalists have already shown active interest in the development of the Comodoro Rivadavia oil region, and it would seem well worth the attention of American interests.

Permits Under Leasing Act Increase

During June, the U. S. Geological Survey reported upon the structural relations of 1,066 applications for prospecting permits under the oil sections of the leasing act of Feb 25, 1920, thus bringing the number of such reports rendered since July 1, 1920, to 6,994

Mackenzie River Oil Field

SPECIAL CORRESPONDENCE

T. A. Link, geologist, and W. H. Waddell, surveyor, of the Imperial Oil Co., have arrived at the company's location in the Fort Norman oil area, and have staked for the company an additional sixty square miles of territory, which the company will prospect in the immediate future. Preparations are being made to drill for additional wells in close proximity to the well sunk last year. Across the river on Bear Island a crew of the Imperial Oil Co. is building a derrick for the rig of No. 2 well, which will be put down on the most northerly point of the island. A gasoline distilling plant is being installed near No. 1 well. Six miles up the river a well-drilling equipment has been landed for the Mackenzie River Oil Co., which will drill a well there this summer. Other companies which are bringing in machinery are the Fort Norman Oil Co., which will drill one well, and the North Northwestern Oil Co., which will sink two wells. Mr. Link confirms reports which have obtained currency, as to the recklessness with which staking has been done all along the river.

Of the 700 square miles more or less staked on both sides of the river between Fort Norman Post and the site of the original well, 53 miles down the river, Mr. Link estimates that not more than 200 square miles have been properly staked out and will be recorded. Many of the boundary lines of the stakers are crossed and recrossed and tangled in the most inextricable manner.

New Arizona Oil Field To Be Drilled

A deep test well is to be sunk by a Nogales syndicate in the new field, near Elgin, Ariz., where oil of paraffin base was found lately in a water well. There also is to be exploration by an Oklahoma company of the northern part of the same district, near the Empire ranch.

The State Corporation Commission is investigating the books of the International Oil & Refining Co., a local corporation, in connection with ownership of certain Texas leases claimed by the company and also by the Border States Petroleum Products Co., another Tucson organization.

Wildcat Wells in Arkansas

SPECIAL CORRESPONDENCE

Notwithstanding the recent drop in crude oil prices, a strong interest is centered on the wildcat wells now being drilled in Independence County, Ark. Grigsby No 1, the third well in the local field, was recently spudded in on the Grigsby farm, five miles south of this place, by the Walker Oil Co. Adams No. 1, drilled by the Independent Development Co., and Earnhart No. 1, drilled by the White River Oil & Gas Co., have both experienced slight gas pressure and show a small amount of oil. The former is being sunk two miles west, and the latter five miles west, of Batesville. The gas and oil showing came from the Moorefield shale at a depth of approximately 500 ft. The Big Six Drilling Co., which has the contract for sinking Cave City No. 1, twelve miles north of this place, is having trouble getting tools shipped. The derrick is up, and everything is ready to start work as soon as the rest of the equipment arrives.

Technical Papers

Sphalerite—Fluorspar Separation—The Rolla, Mo., station of the U. S. Bureau of Mines has been experimenting with the separation of the sphalerite, silica, and calcite from fluorspar in ores from southern Illinois and Kentucky. The conclusions are embodied in the Bureau's *Reports of Investigations* No. 2,264, three pages, obtainable from the U. S. Bureau of Mines, Washington, D. C., free of charge. The ordinary practice is to sort out a small percentage of high-grade acid spar by hand and remove the impurities from the remainder by jigs and tables, thus obtaining a product of about 85 per cent CaF_2. Everything but the fluorspar is wasted. The ore on which the tests were made contained 7.3 per cent lead, 27.9 zinc, 35.7 calcium fluoride, 9.5 silica, and 4.7 per cent calcite. Electrostatic processes were tried, and also flotation in connection with tabling. The former seemed particularly promising, a marketable zinc product being made. Before passing through the electrostatic separator the ore is wet-ground to 10 mesh, and classified for table feeds and to remove slime. Tabling is employed to recover lead. Copper sulphate to the amount of about 1½ lb. per ton of ore, used in weak solution, seems to give the sphalerite a thin coating of copper, which makes the electrostatic separation better. The ore is then dried, screened to minus-10 plus-20 mesh, minus-20 plus-48 mesh, and minus-48 mesh, followed by electrostatic treatment of these three sizes, yielding zinc concentrate, fluorspar, and tailing. The process may be troublesome to conduct in wet weather, and further work on a commercial scale is required to prove its practical advantages over present methods.

Chile Copper—A. W. Allen has published three articles entitled "The Chuquicamata Enterprise" in the *Mining and Scientific Press* for June 4, June 18, and July 23 (San Francisco, Cal., price 15c. each). The papers cover the history of the Chile Exploration Company's work, and the present mining and metallurgical methods and results.

Mineral Concessions in India—The *Journal of Indian Industries and Labour* for May, 1921 (Superintendent of Government Printing, Calcutta, India, price Rs. 1-8) contains a sixteen-page article entitled "Principles Governing the Grant of Mineral Concessions in India." The present rules have been in force since 1913.

Alberta Mineral Resources—The second annual report on the mineral resources of Alberta, for 1920, is now available from the Provincial Secretary, Edmonton, Alberta. The principal mining industry of that province is, of course, coal, though the deposits of clay, iron, mica, petroleum, salt, sodium sulphate and talc are also discussed.

Manganese — The manganese deposits near Bromide, Okla., are described in an eighteen-page bulletin, No. 725-E, issued for free distribution by the United States Geological Survey, Washington, D. C. The deposits are small and cannot yield large quantities of high-grade ore, but their relations and the minerals they contain are unusual.

Mineral Resources — Recent publications of the United States Geological Survey, Washington, D. C., in the "Mineral Resources" series, issued for free distribution, include "Asphalt and Related Bitumens in 1919" (eighteen pages); "Graphite in 1919" (with a history of graphite mining in Pennsylvania) (fifteen pages); "Fluorspar and Cryolite in 1919" (twenty pages); "Magnesite in 1920" (sixteen pages); "Barytes and Barium Products in 1919" (twelve pages); and "Slate in 1919" (six pages).

Recent Patents

Flotation — No. 1,383,321 F. E. Marcy, Salt Lake City, Utah. A new design of bottom for a pneumatic flotation machine.

Flotation—No. 1,383,881. J. I. Thomas, Garfield, Utah. In this patent the impeller of the ordinary mechanically agitated machine is replaced by a device in which the blades are hollow and permeable to air. Compressed air is forced down the hollow shaft, and, emerging from the blades, rotates the device.

Dust Filter—No. 1,383,715. L. Geschwind, Paris, France, assignor to Manufacture de Produits Chimiques du Nord, Eyablissements Kuhlmann, Paris, France. A dust chamber similar to the ordinary wire-hung dust chambers commonly used, with the exception that chains are used instead of wires.

Petroleum Drilling—No. 1,382,602. A. H. Neilson, Tulsa, Okla. Design for a multiple sucker-rod socket.

Concentrating-Table Support — No. 1,382,276. E. Deister and W. F. Deister, Fort Wayne, Ind., assignors to Deister Machine Co., Fort Wayne, Ind. An improved design for the supporting mechanism of concentrating tables.

Shoveling Machine—No. 1,382,001. S. J. Kruly, Miami, Ariz. A mechanically operated dipper and track up which the dipper is drawn for discharge into a receiving car.

Method of Cleaning Oil Wells—No. 1,382,337. G. C. Bellis, Butler, Pa., assignor of one-half to T. H. Brown, Butler, Pa. A method of cleaning oil wells consisting in pouring a caustic alkali solution into the well, and after allowing it to remain for a time, pumping up the solution together with the material in the well which it has loosened.

Book Reviews

The Mining Catalog (Metal and Quarry Edition). Cloth; 9 x 12½; pp. 674. Compiled and published by Keystone Consolidated Publishing Co., Inc., Pittsburgh, Pa., 1921. Free to mine-operating officials.

This is the first edition of this book and the publishers have done well. It will be found an excellent condensed catalog of a large number of manufacturers of mining and metallurgical equipment, and a handy reference work for purchasing agents and operating men who must tell the purchasing agent what they want. Much valuable information not of an advertising nature is also included, partly tabular matter, and charts, such as may be found in handbooks, and partly complete articles taken from the bulletins of the A. I. M. E. and from the technical press, descriptive of the principles on which the classes of machinery listed operate. Those sections devoted to ore dressing and milling are particularly rich in technical information of this kind. It is unfortunate that none of this material is indexed, for its availability is thereby lessened. References to products and to advertisers are, however, well indexed.

Only those manufacturers who have paid for space are included and the list of manufacturers of any given product is therefore not complete. Most of the better known companies are represented, though some, such as the Allis Chalmers Company for instance, are conspicuous by their absence. However, the name of at least one company manufacturing a given product may usually be found.

Petroleum Register—Cloth; 9x12; pp. 640, illustrated; 1921 edition. *Oil Trade Journal*, New York. Price. $10.

An annual directory and statistical record of the petroleum industry in the United States, Canada, and Mexico. The text includes lists of producers, refiners, compounders, marketers and jobbers of petroleum and its products, natural-gas, gasoline manufacturers, pipe lines, geologists, manufacturers of and dealers in equipment, and officers of oil associations. In the statistical section will be found comprehensive figures on production, consumption and export of crude and refined products; statistics of Mexico's oil industry; price records; registry of tankers, barges, and fleets of the principal companies, and other important data. Maps of Arkansas, California, Indiana, Kansas, Louisiana, New York, Ohio, Oklahoma, Pennsylvania, Texas, West Virginia, Wyoming, and Mexico are also included. The issue will prove a most valuable work to those interested in the production, refining, and marketing of petroleum. The book has now passed through several editions, which has given the opportunity for any inconsistencies in earlier issues to come to light.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

New York University To Conduct Petroleum Lectures During Fall and Spring Terms

Conferences Will Cover Development of Industry and International Trade Competition and Related Subjects

New York University announces a series of lectures on petroleum to be given at the Wall Street Division of the School of Commerce by Ernest R. Lilley, Sc. D., consulting petroleum geologist and lecturer in [illegible], during the Fall term of 1921.

Making a survey of the industry as a whole, the lecturer will cover its development to date, its future both in this country and abroad, and its relation to other industries, emphasizing particularly its relation to those with which it is in active competition. Special attention will be given to the growth of corporations, the scope of their operations and their function in international trade competition. The subject outline follows:

Price Control—Determining Factors.

The Mechanism of the Oil Industry

The Development of America's Oil Resources.

Corporation Control in the American Petroleum Industry.

Oil in South America, Europe and the Far East.

Petroleum in World Trade.

Supremacy in Oil Resources—International Rivalry.

Gasoline from Gas—The Casinghead Gasoline Industry.

Oil from Shale—The Scotch Industry.

Oil from Shale—American Shale Oil [illegible]

Oil and Gas from Coal—The Coal Tar and Producer Gas Industries.

Power from Water—The Hydro-electric Power Plant as a Substitute for Fuel Oil.

The Future of the American Petroleum Industry.

Power from Natural Fuels—Oil, a Competitor of Coal.

During the Spring term of 1922 another series of lectures will be given on the development and valuation of oil properties. In this series stress will be laid particularly upon the mechanism of the producing branches of the oil industry. The methods used by the geologist in preliminary work, the basis of his reports to the operator, the cost and methods of drilling, the handling of production, and the methods used in the valuation of properties will receive full attention. The subjects of the lectures are:

Market Values of Oil Properties.

Oil Pools—Their Origin and Value.

Foreign Concessions — How Developed.

"Structures"—The Work of the Geologist.

Drilling Methods and Costs.

Field Equipment and Pipe Line Installation.

Forced Production—Shooting—Flooding, etc.

Marketing — The Function of Pipe Line and Refinery.

Marketing — Competitive Values in Oils.

Valuation of Leases — Developed Properties.

Valuation Methods — Partly Developed Leases.

Valuation—"Close in" Leases.

Valuation—"Wildcat" and Concessionary Tracts.

The Prospectus—How Analyzed.

Lectures will be given at the Wall Street Center, New York University, 90 Trinity Place, New York City, on Wednesdays from 5:15 to 7:00 p.m. Either series may be taken separately.

Mexican Department of Mines Issues Production Figures

Gold, Silver, and Lead Outputs Now Below Pre-War Levels

The Department of Mines of the Ministry of Industry, Commerce and Labor of Mexico announced in July the figures covering the production of the principal minerals during 1919. The figures given are as follows: Gold, 23,586 kg.; silver, 2,049,898 kg.; copper, 56,172,235 kg.; lead, 71,375,968 kg.; zinc, 11,559,685 kg.; quicksilver, 118,940 kg.; antimony, 470.738 kg.; graphite, 4,023,015 kg.; tungsten, 21,970 kg.; tin, 1,588 kg.; arsenic, 2,246,378 kg.; manganese, 2,294,227 kg., and molybdenum, 1,767 kg. The statement from the department also gave the production of gold for May, 1921, as 1,703 kg. The silver production given for May, 1921, was 121,419 kg

Figures also are given by the department covering production during the years prior to 1919 as far back as 1910. Owing to the internal disturbance throughout that entire period, figures as to Mexican production have been fragmentary. For that reason the following [illegible] production being given in kilograms:

Year	Gold	Silver	Copper	Lead	Zinc
1910	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1911	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1912	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1913	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1914	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1915	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1916	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1917	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1918	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Mining Congress Exposition To Be International in Scope

Mexican Exhibit Will Be Large for Meeting To Be Held on Oct. 17

The National Exposition of Mines and Mining Equipment which is to be held in Chicago under the auspices of the American Mining Congress will be international in character.

Approximately 250 exhibits representative of the latest forms of mining equipment machinery made in the United States will be shown at that time. Latin-American countries will be represented in Chicago with official delegations, who will come to the exposition for the purpose of studying American methods and equipment.

Mexico will also be officially represented with a large exhibit, illustrative of its natural wealth. No question is of more interest to American mining men at the present time than the future of Mexico. Millions of dollars of American capital was invested in Mexico in the days of Diaz and there are unlimited opportunities for future mineral development as soon as a policy has been adopted which will enable close co-operation between Mexican and American interests.

It is hoped that as a result of the conferences and discussions at the convention of the American Mining Congress, the mining interests of the United States will indorse and agree upon definite resolutions in regard to a policy toward Mexico. It is the feeling of many of the Western mining states that President Obregon has shown constructive ability in handling the domestic problems in Mexico and that his government should be recognized by the United States as a first step toward bringing about the possibility of American [illegible] working effectively in Mexico.

There will also be representative delegations from European countries.

The National Exposition of Mines and Mining Equipment [illegible], appealing both a national and an international interest, and it is believed that this event coming to Chicago will create [illegible] of plans which will have a far-reaching effect upon the future development of American mining interests both at home and abroad.

MEN YOU SHOULD KNOW ABOUT

E. E. Free is in San Francisco.

R. T. McKinney, of Gold Hill, S. C., is in Toronto.

M. G. Gulley is doing geologic work in the oil fields of the Big Horn basin.

Augustus Locke has left San Francisco for Calumet, Mich., on professional work.

O. R. Whitaker, mining engineer of Denver, has been in Mexico on professional business.

John M. Fox has been appointed superintendent of the Kelly mine at Randsburg, Cal.

James M. Platt, mining engineer, is filling a professional engagement at Las Truchas, Mexico.

Howard K. Welch, manager of the Hardshell Mining Co., of Patagonia, Ariz., is in New York.

Charles Janin, who has been in Washington for several weeks, has returned to San Francisco.

L. G. Mosburg, of the U. S. Geological Survey, has been assigned to work in the Eldorado, Ark., oil field.

John C. Anderson, of Tucson, Ariz., is engaged in mine examination work in the Pioche district, Nevada.

Norman Carmichael, general manager of the Arizona Copper Co., Clifton, Ariz., is in British Columbia.

Lewis Sanders, who has been investigating mining property in Colorado recently, has returned to New York.

A. J. Eveland, mining engineer, has returned to Mexico City, following an extended visit in the United States.

J. B. Eby, of the U. S. Geological Survey, has been assigned to work in the vicinity of Lewiston, Mont.

Morton Webber, accompanied by his assistant, **W. T. Benson**, has been engaged in examination work in Sonora, Mexico.

E. B. Knopf has completed the geological field work which he has been doing in the Quarryville - McCalls Ferry area.

L. S. Ropes has returned to Helena, Mont., from the Yellowstone Valley, where he has been engaged in examination work.

F. G. Stevens has returned to Toronto from the Rex mine, northern Manitoba, which he has been examining for New York interests.

Fred Pope, of New York, has been looking over the Cobalt, Kirkland Lake, and Porcupine camps, in Ontario, during his vacation.

R. A. Bryce, of Toronto, has returned from examining properties in the Fort William and Goudreau districts, in western Ontario.

T. W. Vaughan, of the U. S. Geological Survey, will be engaged in field work in New York State during August and a part of September.

A. R. Globe, formerly assistant manager of the Hollinger Consolidated Gold Mines, has returned to the Porcupine district after two or three years' absence.

F. W. Denton, Painesdale, Mich., has been appointed a member of the board of control of the Michigan College of Mines, succeeding **James McNaughton**, of Calumet, Mich.

A. J. M. Sharpe has resigned as managing director of H. S. Willcocks & Co., Ltd., of London and Manchester, to become manager of the International Metal Service, London.

J. B. Tyrrell has recently been elected one of the vice-presidents of the American Association for the Advancement of Science, and chairman of the Engineering Section of that body.

James G. Ross, consulting mining engineer for the Milton Hersey Co., Ltd., of Montreal, has returned from an extended examination trip to the northern interior of Quebec.

Edwin Higgins, of Oakland, Cal., recently visited the Lake Superior district, where he was formerly in charge of mine rescue work for the U. S. Bureau of Mines.

E. S. Bastin, of the University of Chicago, is spending a part of the summer in the service of the U. S. Geological Survey, investigating the enrichment of silver ores.

S. N. Graham, professor of mining at Queens University, is making Haileybury, Ont., his headquarters for the present and from there will investigate various properties in northern Ontario.

Edwin L. Derby, Jr., chief geologist for the Cleveland-Cliffs Iron Co., and **John M. Bush**, superintendent of the company's North Lake mines, both of Ishpeming, Mich., are in Washington, D. C.

C. L. Adams, who has been assistant superintendent of the Copper Range stamp mills at Freda, Mich., has succeeded **A. F. Cavanaugh** as superintendent of the Mohawk-Wolverine mills at Gay.

Donald B. Gillies, of Cleveland, was elected president of the Alumni Association of the Michigan College of Mines at the third reunion at Houghton, Aug. 5-6. **William Kelly**, of Vulcan, Mich., was elected an honorary member.

George A. Laird has resigned as general manager of the Guiana Development Co., and, after completing some examinations for the same company, will return to the United States, expecting to be in New York by Christmas time.

J. P. Bonardi has resigned his position in the U. S. Bureau of Mines to become manager of the assay and chemical department of the Mine & Smelter Supply Co., at Denver, Col. Mr. Bonardi has been with the Bureau for five years.

McKinley W. Kraigh has been appointed acting chief of the tax division of the American Mining Congress. He will assist mining companies in making their tax returns and also will attempt to secure adjustments where inequities have arisen.

Sherwin F. Kelly, representing C. & M. Schlumberger, Prospection Electrique, of Paris, has arrived in New York preparatory to making an extensive study of American and Canadian ore deposits to determine their adaptability to investigation by means of the system of electrical prospecting developed by Professor Schlumberger, and described in the issues of the *Engineering and Mining Journal* of May 7 and May 14. Mr. Kelly is staying temporarily at 9 West 83d St., New York.

Mining engineers and metallurgists recently in New York City included: R. T. Wilder, Matehuala, S. L. P., Mexico; **A. W. Stickney**, London, England; **M. Gardner Talcott**, Cleveland; **Nelson Dickerman**, San Francisco, and **W. H. Seamon, Jr.**, Sherwood, Md.

SOCIETY MEETINGS ANNOUNCED

American Association for the Advancement of Science, Engineering Section, will hold its next meeting at Toronto, Canada, Dec. 27 to 31.

The Executive Board of the American Engineering Council of the Federated Engineering Societies will be held at the Cosmos Club, Washington, D. C., on Sept. 30. The most important business coming before this meeting will be the election of a president to succeed Herbert Hoover, who resigned after he became Secretary of Commerce. Nominations to fill this vacancy were ordered at the last meeting of the Executive Board, so that they could be reported at the September meeting. Some of the other items which have been before the Executive Board will come up for further consideration. Special attention will be given the plans for the Engineering Assembly, extension of employment service, and the question of licensing and registration of engineers.

OBITUARY

John L. Cochrane, for many years statistician of the U. S. Bureau of Mines, died in Cleveland Aug. 3. His death came suddenly following an apparent recuperation from a paralytic stroke which occurred in January. He had been in the Federal service in Washington for about fourteen years, first with the technologic branch of the U. S. Geological Survey, and later with the Bureau of Mines. Since the creation of the Bureau in 1910 he had been in charge of the publications work of the organization, and, through the dissemination of safety information and literature, had played an important rôle in the work of the Bureau in reducing the death and accident rate in the mining industry. Mr. Cochrane contributed to the technical press a large number of articles on mine-safety and mineral conservation topics.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

Walter Fitch, Jr., Co. Claims Shaft Sinking Record

A telegram dated Aug. 6 has been received by the *Engineering and Mining Journal* from the Walter Fitch, Jr., Co., stating that the company had already broken the world's shaft sinking record by 15 ft. with 9 days yet to go. The company began its effort to break the record at 8 a.m., July 15 last, when it started the work of deepening the Water Lily shaft of the Chief Consolidated Mining Co. at Eureka, Utah. The present world's shaft sinking record is 310 ft., made by the Crown Mines, Ltd., Johannesburg, South Africa, in July, 1919.

Imperial Iron Mine in Michigan Being Opened by Ford

The Ford interests have started work preparatory to opening the Imperial mine at Michigamme, Mich., on the Marquette Range, which was acquired last year. The old buildings are being torn down and will be replaced by new structures. New machinery, all of which will be electrically driven, will replace the old machinery now at the mine. There is a first-class steel headframe in position, which will be used. Double tracks will be laid in place of the single tracks in one of the incline shafts. It is expected that actual mining will be started by fall.

The Michigan Tax Commission credits the Imperial with 1,000,000 tons of limonite iron ore, the average of which is about 52 per cent iron. The ore will be shipped to the River Rouge plant of the Ford company, near Detroit. This is Henry Ford's first venture in the metal mining business. Albert Richards, son of the late Captain W. J. Richards, who was in charge of mining operations for the McKinney Steel Co., is the superintendent of the Imperial mine.

Afterthought Copper Co. Sued For Patent Infringement

Suit for infringement of patent has been brought against the Afterthought Copper Co. by George C. Carson. The patents involved are No. 1,302,307, of April 20, 1919, and No. 1,149,495, of Aug. 10, 1915, and apparently cover side feeding in reverberatory furnaces. The trial will take place on Aug. 17.

WEEKLY RÉSUMÉ

At Washington, the House Committee on Mines and Mining at the suggestion of Secretary Fall, has recommended that the War Minerals Relief Act be amended to permit consideration of claims mailed before noon June 2, 1919, and to allow the correction of errors made through miscalculations. Director Bain of the U. S. Bureau of Mines is quoted as stating that the mining industries should concentrate on means to improve underground methods which, he says, have not kept pace with improvements above ground.

The Walter Fitch, Jr., Co. claims to have broken the world's record for shaft sinking, an object it set out to accomplish on July 15. In California, the Shasta Zinc & Copper Co. is said to have found it necessary to install further refining equipment. Suit has been brought against the Afterthought Copper Co. for infringement of patents apparently covering side feeding in reverberatory furnaces. A zinc smelter near Los Angeles has been acquired by the Simon Silver-Lead Mines Co. of Mina, Nev., which has announced its intention to engage in the manufacture of zinc oxide. In Utah, the Utah Steel Corporation is said to be planning to install a blast furnace with a view to smelting local iron ores. In Michigan, the Ford interests have started to open the Imperial iron mine. Independent iron ore operators in the Lake Superior district have again cut wages. In Mexico, the Dolores Esperanza Corporation has placed a new modern power plant in operation at its Dolores mines.

Shasta Zinc & Copper Co. Completes Initial Run

Work Stopped To Add Further Refining Equipment

The zinc oxide plant of the Shasta Zinc & Copper Co. at Winthrop, Cal., has completed its initial run, demonstrating the metallurgical success of the new installation. The smelting operations will be suspended for the time, pending the increase in facilities for the further refining of the zinc oxide produced. An experimental furnace has been erected and operated for some time in refining the zinc oxide, and has demonstrated that the output of the baghouse, with additional refining, will make an acceptable product. It was at first hoped that the baghouse product would be sufficiently pure to be directly marketed

Crafts Declare Strike Lost at Tonopah and Divide

Miners Expected To Take Similar Action Soon—Assured They Will Not Be Discriminated Against

The crafts unions in the Tonopah and Divide districts of Nevada have declared the strike which began in April 16 lost. Members have been reinstated except where their positions have already been filled. The miners have not yet officially declared the strike lost, but many of them are applying for work. The miners' committee met the operators Aug. 8 and were assured that they would not be discriminated against. It is believed that the strike will be declared lost and off without delay.

Simon Silver-Lead Company Acquires Zinc Smelter

Announces Intention To Engage in Manufacture of Zinc Oxide

The Simon Silver-Lead Mines Co., operating at Mina, Nev., has issued a letter to stockholders announcing that it has acquired control of the Kirk-Simon Smelting Co., at Harbor City, Cal. This plant has been acquired for the purpose of manufacturing zinc oxide, which the company claims will enable it to dispose of its zinc concentrates at a substantial profit. It is located about eighteen miles from the center of Los Angeles and about three miles from Los Angeles harbor. This plant is now being remodeled.

Utah Steel Co. May Smelt Local Iron Ores

The Utah Steel Corporation is planning to add a blast furnace and sheet mill to its plant at Midvale, Utah, in the near future. As is well known, there are large deposits of iron in Utah, as well as large coal fields. Last year 600,000 tons of sheet iron and tin plate were shipped to the West from Eastern points, and these products, manufactured in Utah, could be delivered at greatly reduced freight rates, it is said. Eastern capital is stated to be available, and the company is making a campaign for Western support. The officers of the Utah Steel Corporation are: C. W. Whitley, vice-president of the American Smelting & Refining Co., president; M. S. [illegible], general manager; N. [illegible], vice-president; S. [illegible], secretary; M. H. [illegible], treasurer.

NEWS FROM WASHINGTON

By **PAUL WOOTON**
Special Correspondent

Ending Assessment Work Year At Noon Advantageous

Will Prevent Disputes Arising Where Two Locate Same Ground at Night, Not Seeing Each Other

The text of the bill prescribing a change in the period for doing annual assessment work of unpatented mineral claims, which passed the House of Representatives recently, reads as follows:

"That Section 2 of 'An act to amend sections 2,324 and 2,325 of the Revised Statutes of the United States concerning mineral lands,' approved Jan. 22, 1880, be, and the same is hereby, amended to read as follows:

"Sec. 2. That Section 2.324 of the Revised Statutes of the United States be amended by adding the following words: 'Provided, That the period within which the work required to be done annually on all unpatented mineral claims located since May 10, 1872, including such claims in the Territory of Alaska, shall commence at 12 o'clock meridian on the first day of July succeeding the date of location of such claim: Provided further, That on all such valid existing claims the annual period ending Dec. 31, 1921, shall continue to 12 o'clock meridian July 1, 1922.' "

In the course of the discussion of the bill in the House, Representative Hayden, of Arizona, said:

"The wisdom of beginning the year in which assessment work must be done, at noon instead of at midnight, will not be disputed by any one familiar with the location of mining claims. There have been frequent disputes caused by two or more men going upon the same piece of ground in the middle of the night, often without seeing each other. Rights to mineral claims henceforth will be initiated when the sun is at meridian height, instead of at that time of night 'when churchyards yawn and hell itself breathes out contagion to this world.'

"The desirability of changing from the calendar to the fiscal year long has been recognized. It meets with the approval of practically all those engaged in prospecting and mining."

Representative Summers, of Washington, made the following statement to the House:

"One important reason for this legislation is that temporary roads are necessary to get to these mining properties. These roads generally are washed out during the winter. If the year can be made a fiscal year, the prospector, instead of building the road every year, can build the road once in two years, and do one year's work before July 1 and another year's work after July 1."

It is believed that the Senate's concurrence in this matter is insured and that the bill will become a law in the near future.

Underground Mechanical Development Lagging, Says Bain

Industry Generally Slow To Adopt Devices Already Proved Successful—Should Concentrate To Improve Methods

Now that there is the most urgent need for the adoption of the most efficient methods in mining, H. Foster Bain, the Director of the U. S. Bureau of Mines, thinks the mining industries should concentrate on means to improve underground methods. Improvements underground, Mr. Bain says, are not keeping pace with improvements above ground. He has in mind mechanical developments and the general layout of underground workings. In metal mines, particularly, he points out, there are many operations in which there would be ultimate economy if the present workings were abandoned and an entirely new mine was opened. The mine then could be designed in advance so as to permit of economical transportation and other savings.

Before mills, smelters, or other surface improvements are installed in connection with mining operations, Mr. Bain points out, the whole subject is given careful preliminary study. If a mine is to be opened, there is a small expenditure for surveys and a little outlay on blueprints, and that is about all the preliminary work done on the matter of layout or the method of working. Once a mine is opened, the operator practically has committed himself, because changes of layout afterward made involve almost prohibitive expense.

Despite the notable improvements that have been made above ground in mechanical devices, mechanical development below ground, Mr. Bain points out, has lagged far behind. Shoveling, one of the largest underground costs, is still done largely by hand labor in face of practical perfection of mechanical shoveling devices. It has been a matter of common knowledge for many years that there must be an increasing shortage of common labor. There has been no secret about the trend of the nation's immigration policy. Despite the knowledge that mechanical means must be resorted to to supplant the shortage of common labor, there has been little advancement in the installation of many mechanical devices in metal mines. Even where such improvements have been installed, with great reduction in costs, the example set has not been followed generally. In the opinion of Mr. Bain, the time is particularly opportune for thought on this subject by the operators of metal mines.

Amendments to War Minerals Act Recommended by Committee

Ask Consideration for Claims Mailed Before Noon on June 2, 1919—Would Permit Correction of Errors in Calculation

Following a suggestion from the Secretary of the Interior, the Committee on Mines and Mining of the House of Representatives has recommended amendments to the War Minerals Relief Act which will permit the consideration of claims deposited in the mail prior to 12 o'clock noon on June 2, 1919, and permit the correction of errors made through miscalculation. No effort was made on the part of the House committee to broaden the language of the Senate bill, which refers to extending the scope of stimulation. It has been contended that the Senate bill will apply only to those claims on which the Secretary of the Interior has not acted. The Secretary of the Interior does not share that view, as is indicated in his letter to Representative Rhodes, the chairman of the House committee. The text of Secretary Fall's letter follows:

"Senate bill 843 merely amends the act of March 2, 1919, relative to war minerals relief in relation to the character of request or demand; that is to say, stimulation. It broadens the scope of stimulation along the line which, I may say, I should have followed had I passed upon the cases already decided as an original proposition.

"In reviewing these cases, I have power, in my judgment, to reach the end provided in this bill without additional legislative authority.

"However, much more serious questions are presented in the consideration which is now being given by way of review of some of these cases and original examination of others.

"It appears that the commission passing upon these cases submitted to the comptroller and had a ruling from him upon the question of time limit in the matter of presentation of cases. The rule was adopted that although a case might have been mailed prior to the expiration of the time limit, unless it had reached the hands of the commission itself prior to 12 o'clock it should not be considered and no such cases were in fact considered.

"I am unofficially informed that a messenger was watching for mail, and at exactly 12 o'clock the mail which had arrived was taken out, and that no cases arriving through the mails or otherwise at any time thereafter were considered.

"Second. Cases which were considered and upon which a decision was reached allotting or allowing a certain amount to be paid were later reopened or reconsidered and an additional amount allowed, it being shown that an error had been made by the commission itself, and not through any fault of the claimant, in arriving at the original sum. The comptroller declined to pay the additional sum.

"Should the pending measure (S. 843) be adopted, or even without the authority contained therein being granted, should the secretary find upon review that additional amounts were due to some of those who have already had their claims passed upon by the commission, such conclusion being reached either under authority of legislation or under the present incumbent's interpretation of the law as it exists, the comptroller, under his prior rulings, would decline to pay such amounts so found to be due.

"It will thus be seen that should the comptroller adhere to his rulings, while the Secretary of the Interior might, in so far as his authority extends, grant relief or additional relief in reviewing cases, or in original consideration of those yet pending, and such action of the secretary be (as it would be) contrary to the rulings of the comptroller, no recourse would be left except an appeal to Congress for leave to file claims before a court of claims or some other tribunal.

"I had hoped that no legislation whatsoever would be necessary, and in my conception of the law none would be necessary; but it is impossible, of course, for the Secretary of the Interior to control the judgment or action of the comptroller. Congress can do so, and it also can afford relief.

"I therefore consider it my duty to suggest to you that S. 843 be passed with an amendment to the effect that claims filed or mailed at any time prior to the expiration of the time limit fixed in the congressional act may be considered as if same had reached the particular office of the claims commission in the city of Washington at the time when the claims which were considered by the commission did so reach their office. Of course, I am not suggesting to you the words of this amendment.

"That the bill should also be amended to provide that should a review of the cases already decided develop the fact that by mistake in calculation, or by a strict ruling of the commission contrary to the proposed provisions of S. 843, as to the matter of stimulation, that amounts or additional amounts so found due should be approved for payment by the comptroller."

Employment Situation Worst in Metal Industries

In analyzing the employment situation during July, the United States Employment Service reports improvement in the vehicle industry, in railroad repair shops, in the leather industry, in textiles, in lumber manufacture, tobacco manufacture, and in the paper and printing industries, with the broad conclusion that indications everywhere point to the certainty of an approaching business revival. In the course of its summary, the Employment Service says:

"The darker side of the picture has to do with metals and metal products. From mining to manufacturing, the entire process in all its ramifications has felt the full force of the present industrial depression. As a result there continues to be serious unemployment in a multitude of interrelated industries and in widely separated sections of the country, affecting the mountain districts of the West, as well as the thickly populated industrial areas of the East. The outstanding causes are a falling off in the foreign demand and continued listlessness of the domestic market; in other words, an almost unprecedented lack of orders."

Copper Going East Via Panama

An analysis of Panama Canal traffic for June shows that 9,525 tons of copper passed through the canal during that month. Of that amount, all but 1,000 tons was en route to eastern ports of the United States. The 1,000 tons went to Europe. Tin shipments totaled 1,350 tons, of which practically all came to the United States. In addition, 1,030 tons of copper ore was shipped through the canal, all of which went to the east coast of the United States. The same is true of 5,040 tons of iron ore. Zinc ore to the extent of 1,400 tons moved through the canal during June.

Government Sells Copper

The Bridgeport Iron & Metal Co. has purchased from the Government 127,075 lb. of copper rotating bands assembled on cast-iron projectiles. The purchase included 2,527 gross tons of cast iron. The price for the copper was 8¾c. per lb. The price paid for the cast iron was $9.37 per gross ton.

Purchases of silver under the Pittman Act to Aug. 10, totaled 344,614 fine ounces. This brings the total purchases under this act to [illegible] fine ounces.

NEWS BY MINING DISTRICTS

London Letter

Modderfontein B Company's Last Report Shows Increase in Reef Width and Gold Content—Randfontein Central's Development Position—Mount Morgan's Report

By W. A. Doman

London, July 25—When dealing with a narrow reef such as that worked on the New Modderfontein and Modderfontein B properties on the Far Eastern Rand, a variation in thickness of 5 in. is of some moment. The June quarterly development report of the Modderfontein B company shows this difference. Here are the figures for the first half of the current year on the Main Reef Leader:

Quarter	Feet Sampled on Reef	Feet Pay	Width In.	Assay Value Dwt.
March	1,730	[illegible]	12	34
June	[illegible]	[illegible]	17	43

Coincidently with the increased width, the gold content has improved, and taking the number of in.-dwt., as is usual on the Rand, as an indication of profitability, the result is: March, 408; June, 731. The first is quite good, the second excellent, and about compensates for the lower payability, the percentages being respectively 72.7 and 36.5. If reference be made back further still to the December quarter of last year it is found that 60.4 per cent of the footage sampled was payable, the reef width being 18 in. and the gold content 34.8 dwt., or 626 in.-dwt. During the nine months, [illegible] ft. were sampled and [illegible] ft., or 55.6 per cent, came within the payable category.

Generally speaking the average of payable ore for the whole of the Far Eastern Rand is estimated to be in the neighborhood of [illegible] per cent, so that the Modderfontein B does not fall far short of the average. In any case the value may be regarded as exceptionally good.

Comparing the above with the results of the New Modderfontein for the first six months of the year, the figures for the latter company are:

Quarter	Feet Sampled on Reef	Feet Pay	Width In.	Assay Value Dwt.
March	[illegible]	[illegible]	[illegible]	[illegible]
June	5,970	[illegible]	6	30.9

In in.-dwt. the results are: March [illegible]; June [illegible]. Of the [illegible] ft. sampled, [illegible] ft., or [illegible] per cent, were payable. This showing is in keeping with what is expected of so great a mine.

At the western end of the Rand the development position of the Randfontein Central has greatly improved of late. Here are the results of nine months' operations:

Quarter	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
March, 1921	[illegible]	[illegible]	[illegible]	[illegible]
June	[illegible]	[illegible]	[illegible]	[illegible]

Relatively little development work was done in the March quarter owing to labor troubles, but work has since got into [illegible]. Possibly under the present management shareholders will be given more information as to the technical position than under the Robinson regime, for I believe they were never actually told the number of reef-bearing claims comprised in the property. The debenture and share capital [illegible] exceeds £7,000,000, and it is [illegible] to work on a large scale and [illegible] to give [illegible] return upon it. The company has only paid [illegible] per cent since it came into existence.

For the twelve months ended May 29 last, the Mount Morgan Gold Mining Co. earned a revenue of £1,038,683 at a cost of £918,524, the surplus being £120,159. The surplus was earned owing to the realization of copper and gold produced previous to the present financial period at prices greater than those at which the same were taken into account for the previous financial period. Owing to the decline in the price of copper, the miners were asked to accept a lower scale of wages, as production of blister would cause the company a loss of £2,300 weekly. The government offered to meet the company by reducing rail wages £1,000 weekly, but no arrangement with the men has yet been made. During the year 148,574 tons of material was treated in the smelting section for a production of 5,149 tons of copper and 76,463 oz. of gold. These figures compare with 178,055 tons of material and 5,880 tons of copper and 80,578 oz. of gold in the preceding twelve months.

CANADA

British Columbia

Gold Production of Province Expected To Increase This Year

Victoria — George H. Kilbourne, of the Consolidated Mining & Smelting Co., is reported to be making satisfactory progress in the mineral survey of the Esquimalt & Nanaimo land belt, Vancouver Island, of which work he has charge. He has two parties in the field, and the ground is being thoroughly covered. When his reports are submitted the Canadian Pacific Railway Co. will be in a position to resume negotiations with the provincial government with a view to placing the administration of the minerals of the belt under the sole jurisdiction of the province.

Vancouver—That the gold production of British Columbia for 1921 will be considerably greater than that of 1920 is indicated by the receipts to date at the Dominion Assay Office, Vancouver. The total receipts of bullion this year so far aggregate in value $1,275,000, as against $1,073,000 for the same period last year. The improvement, generally speaking, is ascribed, first, to the reopening of the Rossland mines by the Consolidated Mining & Smelting Co. and, second, to the fact that the placer-mining areas are working under more satisfactory conditions, there being plenty of water, which was scarce last year.

Trail—Ore shipments received at the Consolidated smelter the week ended July 31 were as follows:

Mine	Locality	Tons
Sally.	Beaverdell.	34
Surprise	Republic.	231
Company mines		12,496

Kaslo — Negotiations are under way between Thompson & McKinney, who have been operating the North Star mine at Kimberley, and the Utica Mines, Ltd., for a five-year lease of the latter's property at 12-Mile. The negotiations, if concluded, will obligate the lessees to expend at least $3,000 per year in development, and pay the company 15 per cent royalty on output.

Ainsworth — Two carloads of high-grade silver-lead ore have been stoped at the Blue Bird mine, on Woodberry Creek, following a strike made on the property by Eric Johnson, the owner.

Cranbrook — The East Kootenay Prospectors' Development Co., an offshoot of the local Prospectors' Association, is being financed by issuance of $9,000 worth of stock, which is being sold throughout this section.

Ontario

Silver Islet Exploration Co. Opening Old Property

Porcupine—The Dome Mines during the three months ended June 30 realized profits of $235,697, or at the rate of a little over 20 per cent, on the issued capital. Operations at the lower levels have been so favorable as to make it possible to treat a grade of ore much higher than in former years. It is officially intimated that dividend disbursements of only 10 per cent will be continued, and that additional distribution will come in the form of capital return. A disbursement in the latter form of 20 per cent is expected before the end of the present fiscal year.

Fort William—Good progress is being made at the Silver Islet mine, which has been reopened after having been closed down for forty years. The Silver Islet Exploration Co. has completed 200 ft. of the drift which is being run beneath Lake Superior, by which the operators expect, after driving 1,200 ft., to tap three rich veins.

MEXICO

Chihuahua

New Modern Power Plant of Dolores Mines Placed in Operation at Madera

Madera — One of the most up-to-date and modern power plants in Mexico has recently been completed and put into operation at Madera, Chihuahua. This plant has been built to supply power for the mill and mine at the Dolores mines, one of the units of the Dolores Esperanza Corporation. The power is transmitted over a distance of thirty miles through one of the roughest mountain regions in northern Mexico. The all-steel tower transmission line was installed about nine years ago, at which time an oil-engine plant was to have been built. However, because of the troublesome times during this period, nothing was done until the summer of 1920, when work was started on a steam-turbine installation, a short description of which follows:

The building is of all-steel construction, having a floor area of 5,250 sq. ft. The windows are of Fenestra steel sash, glazed with factory ribbed glass. All doors are of steel, which makes the structure absolutely fireproof throughout.

The main generating units consist of two Allis - Chalmers three - stage turbo-generators, 2,300 volts, 60 cycle. The condensers are of the Allis-Chalmers jet type, driven by Keer steam turbines, evactors being used for extracting air. All of the auxiliaries are steam driven, the class of labor for operation having been considered.

One of the most unique features of this plant is the abundant water supply, which is drawn from a mill pond belonging to the Madera Lumber Co., Ltd. The cold water is carried to the cold well by an underground concrete conduit the dimensions of which are 2½ by 3 ft. by 720 ft. long. From the cold well all condensing and plant supply water is drawn, the latter being pumped into a 10,000-gal. supply stand tank. All of the discharge and drains are returned to the mill pond through a similar concrete conduit for a distance of 350 ft. and then in a 2½ by 2-ft. wooden flume. With this ample cold-water supply there is a very small temperature drop in the condensing water, and a high vacuum is easily maintained.

The steam-generating units consist of two 500-hp. B. & W. boilers, with a working pressure of 220 lb. per sq.in. The boilers were shipped from Glasgow, Scotland. They are equipped for both coal and oil firing. The stoker installation is of the hand-shaking type manufactured by the Files Engineering Co. Three Best oil burners are installed in each boiler. The gases are carried in an underground concrete flue to a 7 by 150-ft. self-supporting steel stack.

The fuel-oil system consists of two storage tanks and a 14,000-gal. underground measuring tank. The oil is supplied to the burners by pumps and maintained at a constant pressure by means of pump governors and relief valves in the circulating line.

The outside substation consists of a bank of three 50-kva. Allis-Chalmers transformers, with one spare. The current is here stepped up from 2,300 to 33,000 volts.

This plant was designed by Woodell & Resler, architects and consulting engineers of New York, under the supervision of G. A. Schroter, consulting engineer for the Dolores Esperanza Corporation. The plant was erected and put into operation by the firm of Kniffin & Thornhill, engineers and contractors, of Chihuahua, Mexico.

Chihuahua—In Chihuahua unsettled political conditions and strikes of railroad and mining company employees have affected the production of minerals during recent years to a considerable extent. Most of the mines in the more distant districts have been closed down for years. The low prices of metals and insufficient means of transportation have handicapped the normal production even in the near-by camps. The fall of the price of silver during the last year has forced the majority of mines producing low-grade ore also to shut down.

The same troubles accounted for the

closing of most of the smelters in the republic, and have also affected the Avalos smelter of the American Smelting & Refining Co., near Chihuahua.

The beginning of the current year brought some betterment of labor and transportation conditions, and the slow rise of silver prices has encouraged the reopening of many mines which were doing construction or development work on a small scale during the critical period.

The smelter at Avalos is again working to the full capacity, treating ores not only from the properties owned by this corporation, but also a considerable amount of custom ore coming from the south, and producing silver-gold bullion and lead bullion, which is being shipped to the United States, either for refining or for reshipment.

The Tecolotes unit of the American Smelting & Refining Co., at Santa Barbara, resumed its operations in June after a shutdown of several months.

The large San Diego mill, at Santa Barbara, property of the American Smelters Securities Co., has been completed and is now operating.

Reports from Parral are to the effect that the mining district has regained its former activity. Most of the mining companies there are working full time. The A. S. & R. also resumed the work of unwatering and examining the important Tajo group of mines in the city of Parral. This company has an option on these mines, and it is thought will purchase them.

The American Metals Co., which had an option on the Inglaterra mine at Santa Eulalia, ran into large quantities of good ore early in the year, and purchased the mine outright in May from Dale Brothers, British bankers and former principal owners.

La Reina Mines, Ltd., a London concern, Lindsay Brown, general manager, is doing development work on a small scale. The 900-ft. shaft has been retimbered and a new headframe installed. This mine, situated in the heart of the rich Santa Eulalia mining district, has already produced over 10,000 tons of silver ore. At present a chimney of rich ore, running as high as 400 oz., has been struck, though on account of the high cost of labor and material, combined with the low silver prices, a very reduced number of workmen is being employed. Extensive development work is being left until conditions improve.

The Buena Tierra Mining Co., British owned, closed down in June on account of the high cost of production and low grade of ore, according to current reports.

The Cigarrero mine, rich in lead-silver, expects to reopen shortly.

The Julieta mine, a well-known gold-producing property, Paul Ginther manager, has started operations.

Guadalupe Galvan, an individual operator, has shipped from the Talemantes mines, situated in the Parral district, three carloads of a high-grade manganese ore to the Monterrey smelter.

The Santa Elena or Santa Marina silver mine of the Cusi Mexicana group in Cusihuiriachic has been unwatered and examined by engineers of the Peñoles company, which is the Mexican corporation of the American Metals Co.

The Pinos Altos mining company has had engineers examining its silver-gold properties near Concheño and states that it is possible that operations will be resumed, giving work to about fifty men at first and to a greater number later on. Like so many other properties in the western part of Chihuahua, the Pinos Altos mines have been closed for a number of years.

The Cia. Minera Lepanto has closed down. Low prices of silver are given as the reason. It has at the station of Conchos of the National Railways over 50,000 tons of ore dumped, which on account of inadequate service of this road could not be shipped to the Monterrey smelter.

Parral—The Minas Nuevas mine near Parral, a unit of the American Smelting Securities Co., is working a full force of between 400 and 500 men.

The San Patricio mine of the Cia. Minera de San Patricio, S. A., is working a full force of about 250 men and running its 300-ton mill. This is a subsidiary company of the Cia. Agricola y de Fuerza Electrica del Rio Conchos, S. A., the large Canadian power company. T. G. Mackenzie is general manager of the concern, and A. W. Morris is mine superintendent. The company has been shipping bullion from its new mill for some months.

Guanajuato

Aurora Mine Near Xichu in New Hands —Former Operations Described

Xichu—In northeastern Guanajuato the Aurora mine has passed to new ownership; also the new management has built an automobile road from San Luis de La Paz, the railroad terminus, to Higueras beyond Victoria, near the base of the Sierra Gorda, and machinery is arriving for the construction of a new treatment plant. The Aurora lies 65 miles northeast of San Luis de La Paz. Eleven years ago there was a tolerably fair road to the Sierra Gorda, about 30 miles away, and across the mountains a trail only fit for pack and saddle animals. The valley of Xichu is narrow, with steep slopes, and drained by a little river of the same name. The town of Xichu, six miles up the river from the mine, is headquarters for the valley and is surrounded by little farms, orchards, and gardens. The climate is mild, and orange, lemon, banana, cane and other subtropical plants abound.

As a mining center this is apparently an old one, antedating Spanish occupation. At all events many old holes give evidence of having been made by use of fire and water instead of explosives. [illegible] of the type employed between two and three hundred years ago are scattered through the region, an indication of the age of the industry.

The Aurora is the only large operation that has been under way in the district in recent times. It is said that two other mines, the Olympo and Soledad de Reyes, had been developed and abandoned, whether from lack of ore, or lack of ore salable at that time, was not made evident.

Studies of the Aurora indicated an abundance of zinc blende and pyrite, with a lesser amount of galena, the real commercial ore (at that time), all silver bearing. The country at the Aurora is clay slate and limestone, or slate, with much lime carbonate. The center of the mountain mass is apparently andesite, highly mineralized, which has undoubtedly played quite an important part in the genesis of the ore.

The mine is reputed to have produced, during the many years of its operation, from four to five million pesos in silver and lead. In 1910 all of the exploited orebodies were above drainage level, and access to the mine was gained by adits or crosscuts. The lowest one, the Socavón de Cristo, enters from the main valley, or Arroyo de Xichu, 16 meters above the river, and at least five others enter from a lateral arroyo, Barreño. The Tenacidad level, 42 meters above the Cristo, was long the principal working level and a track was laid from its portal along the mountain side to the terminus of a cableway crossing the Arroyo de Xichu, to a smelting and milling plant on the opposite side.

Near the loading station was a dump of 20,000 tons of mixed zinc-lead-silver ore. The smelting works were built in 1895 and included two 36-in. Frazer & Chalmers water-jacketed blast furnaces, a reverberatory furnace, a 10-stamp battery, a crusher, six concentration tables, and other equipment, all out of use then. The reason given was that the presence of so much zinc interfered with the profitable treatment of the ore.

In 1910, about 200 men were employed, nearly all of them in the upper working. The ore mined was galena, running 1 to 3 kg. of silver per ton. The mining was on the buscon system, half the ore's value going to the owners and half to the workers, after the deduction of a fixed sum to cover freight and smelting charges. The ore of value was usually concentrated by picking and breaking, then screening and washing the fines on a wooden planilla. The product was shipped by burros over the Sierra Gorda to San Luis de la Paz, and then by rail to the smelting plant at San Luis Potosí.

ALASKA

Anchorage—A stampede has been caused by the report of a discovery of gold quartz in a district thirty-nine miles north of Anchorage.

The Collector of Customs for Alaska reports that the value of products shipped from the territory during May amounted to $[illegible]. The largest item was more than [illegible] lb. of copper ore.

ARIZONA

Tom Reed Sends Weighty Exhibit to Phoenix—Two Killed in Shaft at Bisbee

Oatman—The United Eastern is reported to be preparing to sink the Big Jim shaft 400 ft. deeper and also to deepen the Eastern shaft.

Phoenix—As an exhibit in the appeal of the Tom Reed Gold Mines Co. from a Superior Court decision in favor of the United Eastern Mining Co., 3,400 lb. of ore and rock, in thirteen crates, have been forwarded from Kingman to the clerk of the Supreme Court at the Capitol in Phoenix. For lack of "filing" space, the exhibits were returned by the clerk to the express office, to be held till the high court should have made order concerning their disposition.

Protest has been made to the State Board of Equalization by H. J. Duffy, chief clerk of the United Verde Mining Co., against a ruling of the board fixing at 15.7c. the taxable valuation of copper bullion on hand in Arizona. It was alleged that the bullion is worth no more than 13c. It was explained that the commission's figure were based upon the average price of copper for the previous year.

Miami—An El Paso firm has secured a contract for erecting a two-story, reinforced-concrete department store, 100 x 75 ft. in dimensions, for the Miami Consolidated Copper Co. The foundation will be on piling.

Bisbee—An unusual accident, in the Wolverine & Arizona shaft, has resulted in the death of two men. They were buried under a fall of earth from the shaft collar, brought down by a flood of water from a torrential rainstorm. At the time the men were in a bucket that was being hoisted and were only 50 ft. from the surface when the avalanche struck them. They were thrown to the bottom, 350 ft. below, and the bucket crosshead was wedged in the shaft.

Construction work has been completed on the big plant of the Apache Powder Co., near Benson. Operation will wait on the reopening of the larger copper mines of Arizona, nearly all of which have a financial interest in the enterprise.

Globe—C. E. Hart, superintendent for the Louis d'Or Mining Co., reports that at 80 ft. in the new main working shaft ore has been struck carrying about 1 per cent copper, in bornite form. Exploration by drilling, he states, has shown the presence of an orebody 8,000 ft. long and almost 2,000 ft. wide, averaging 300 ft. thick.

A 100-ton mill is being erected on the El Capitan property, the enterprise financed in Texas and managed by L. F. Williams. In addition to concentration, the mill is to have an acid-leaching unit for surface ores. Mr. Williams states there has been development on the property of 2,000 tons of ore that will average 24 oz. silver, with some gold.

Mayer—Partridge & Leonard have purchased the old Rigby reduction plant, overlooking the Mayer townsite, and will junk the machinery. The plant was operated in 1906, with rated capacity for 125 tons of ore a day, using the patented Poehle & Croasland volatilization process, understood to have been unsuccessful under local conditions.

Patagonia — Richard Kingdon, recently mine superintendent for the United Verde Extension at Jerome, has been engaged to take charge of the development of the Arizona-Patagonia property, better known as the Blue Nose.

Duncan—The property of the Duncan M. & M. Co., recently sold by the receiver, is in the hands of A. M. Frasier, trustee for the company bondholders at Hillsboro, Tex. An effort is being made to consolidate with other interests in the same district. All the free-milling ores are to be handled in the new mill recently completed on the Duncan property.

The Norman King mine and the Great Ballalli group which adjoins it have been taken under lease and option from the Utter brothers by H. W. Evans and L. C. Butlar, of New York. The property is situated near the old Clear Lake mill, in the Steeple Rock district. Several carloads of ore already mined will be shipped at once. Mr. Evans will be in charge.

NEW MEXICO

White Syndicate To Work Last Chance Mine—Octo Company Sued for $32,000 Due on Notes

Lordsburg—An association known as the White Syndicate has been organized to work the Last Chance mine, which is under the direction of John White, who took the property over under a lease and option last spring. The syndicate is composed of J. G. Nicholas, William (Missou) Hines, E. T. Williams, Joe Crites, all of Denver, Col., and John H. White, who will continue as manager.

Suit was filed July 19 by the Anita Copper Co., represented by G. W. Forman, of Los Angeles, against the Octo Mining Co. for $32,000 in promisory notes alleged to have been given by the Octo company to certain of its stockholders for funds advanced and used for work on the property. These notes had been turned over by them to the Anita company, a new company that was organized under the laws of California for the purpose of taking over the Octo assets. Some of the stockholders of the Octo, however, refused to turn in their stock: hence the filing of the suit.

This situation has led to a suit asking for the appointment of a receiver for the Octo by Lawrence R. Boyd, of Lordsburg, claiming an unpaid balance of $3,800 due on property now held by them.

Frank G. Kaerwer is pushing developments of the Ruth property. A new hoist house and gallows frame has been erected, and a 12-hp. Novo hoist installed. The shaft has been timbered for 40 ft. and a complete camp equipment built. The shaft shows a 6-ft. vein of siliceous lead-silver sulphides. This carries an average of $40 in lead-silver and some gold. The force will be increased soon.

Steins Pass—The McGee Brothers have given a contract for sinking their main shaft another 100 ft. to Akers and Tabor, of Lordsburg. Work will begin at once.

Fierro—Sam L. Houghton, formerly geologist for the Hanover-Bessemer I. & C. Co. and the Chino Copper Co., has made a contract for 1,000 tons a month of fluxing ores to be shipped to the El Paso smelter. The ore will be taken from the H-B property at Fierro under lease.

Silver City—The properties owned by the C. Amory Stevens estate on Chloride Flat have been opened to lessees. This is silver ground that has produced silver extensively in the old days and has many miles of old drifts. Colonel Porterfield is in charge.

The Hecla-Devide Mining Co. is figuring upon a mill on the Langston property, at Pinos Altos. F. H. Davis is superintendent.

COLORADO

Vindicator Opens Promising Ore at 2,000 ft.; To Deepen Main Shaft

Victor — A promising orebody has been opened on the 2,000 level of the Vindicator mine. The company plans to sink the main shaft another 150 ft. The pumping problem at the Vindicator is serious, as the water must be raised about 2,000 ft., and the company, probably in co-operation with other mining interests in the neighborhood, has tentative plans which involve the extension of the Roosevelt tunnel a distance of about 3,300 ft. The work would require about two years and would be expensive, but it is believed that the cost would be justified by the fact that extensive orebodies would become workable at a profit, and much promising territory would be made available for development. The new orebody is in the downward extension of the Lillie vein, which was opened in the 1,900 level last year. The ore has been opened for a horizontal distance of about 300 ft., and is payable throughout this distance. George Stahl is general manager.

Cripple Creek—The Heck Gold Mining & Leasing Co. has been organized to operate mining properties in the Cripple Creek district. The company is capitalized for $300,000. Alfred Steele is president and C. B. Heckler general manager. The directors are, in addition to the above, S. A. Gaston, Francis P. Haynes, and Walter C. Cockran.

The Damon property of the United Gold Mines Co. is being developed and operated under lease by Stuart Cox and associates. Electrical hoisting equipment has been installed, and the company is mining about fifty tons per day. The ore averages about $[illegible] a ton.

The Engineer's Luck property is being developed by lessees and a 4-[illegible] vein of 1 oz. gold ore has been opened. The first shipment has been made to the Golden Cycle mill at Colorado Springs.

Idaho Springs—The Columbian Mountain Mining & Leasing Co. has installed a new seven-drill air compressor. Development work is in progress, and a promising vein has been opened.

SOUTH DAKOTA

Discovery of Gold in Black Hills Commemorated

A monument to commemorate the discovery of gold in the Black Hills of South Dakota was dedicated at Custer, S. D., on July 27. The site on which it is erected is on French Creek, where H. M. Ross, a practical miner who accompanied Custer's expedition, first discovered gold in 1875.

WASHINGTON

New Era Iron & Steel Corporation To Try Making Iron on Commercial Scale

Spokane—Objection has been raised by the mining committee of the Spokane Chamber of Commerce and other organizations to the provisions of the Fordney Tariff bill which call for a duty on coal coming into the United States equal to that imposed on coal by the country of origin.

Sultan—A good wagon road is being built to the section northeast of Sultan, which has some very promising mineral showings. This should stimulate mining development greatly, but owners so far are contenting themselves with doing development only.

Sedro-Woolley—After months spent in experimenting in the making of pig iron from black sand, the New Era Iron & Steel Corporation is ready to start a smelter on commercial production of iron from local iron ores mixed with certain varieties of black sand. Some of the best pig iron produced in the United States has been turned out, it is claimed, in recent trials.

MONTANA

Boston & Montana Mill To Be Ready Sept. 15—Butte-Jardine Mill Running Steadily

Elkhorn — Installation of milling equipment at the Elkhorn mill of the Boston & Montana Development Co. is speeding up, and an effort will be made to have the plant ready for operation by Sept. 15. More than fifty more men were added to the mill force the last week, and the total mill and mine force now approximates 200 men. The ore showing continues favorable, and further tonnage is looked for on the 300 level.

Race Track—From 100 to 130 tons of ore is now being treated daily by the Butte-Jardine mill at the Champion mine. The heads are reported to be running from $13 to $20.

IDAHO

Foundations for Armstead Mill Almost Completed—Interest Revived in Warren District

Sandpoint—A winze being sunk on the property of the Falls Creek Mining Co., on Pend Oreville Lake, 20 miles south of here, is now down 25 ft., and the orebody has widened to 3 ft., about 8 in. of which is a high-grade galena. The values are chiefly in silver and lead, with some copper and zinc. Drifting will be started at 50 ft.

Talache—With preparations for mill construction under way and accommodations for a large crew of men being built, much activity is manifested around the property of Armstead Mines, Inc., which for the past three or four years has been systematically developing the old Keystone group. The improvements in the wagon road to Sagle, the shipping point on the Northern Pacific Ry., have been completed, and the foundations for the 150-ton flotation plant are almost completed.

The Blue Bird property, adjoining the Armstead mine, and which is under lease to Messrs. Coleman and Ward, has been developed to a stage where production of some high-grade silver ore may be looked for, beginning this month.

Warren — More interest in the Warren district has been manifest this season than for years past, and the same may be said of the Marshall Lake section. The gold-bearing veins of the district are once more proving attractive to people seeking investments in metal mining.

MONUMENT COMMEMORATING DISCOVERY OF GOLD IN BLACK HILLS, DEDICATED RECENTLY AT CUSTER, S. D.

UTAH

Power Contract Case Appealed to U. S. Supreme Court

Salt Lake City—Lead furnaces in blast at the Salt Lake Valley smelters Aug. 1 were: United States Smelting Co., at Midvale, four lead furnaces, including one furnace on matte concentration; A. S. & R., at Murray, four lead furnaces. No lead furnaces were in blast at the International.

The right of the Utah Public Utilities Commission to abrogate "special" power contracts between the Utah Power & Light Co. and large users of power, entered into a number of years ago before the creation of the commission as a body, is again being called into question. As has already been reported in these columns, the Utah Copper Co. and other large users of power, [illegible], in all, brought the matter before the Supreme Court of Utah, which held that the Utilities Commission had the right to fix power rates, and therefore the right to abrogate the contracts. Now the Union Portland Cement Co. and the Ogden Portland Cement Co., and the Utah-Idaho Central Railroad Co. have filed preliminary appeals against the ruling of the Utah court with the United States Supreme Court, the cement companies fixing increase in power costs at 70 and the railroad at 80 per cent.

Eureka—Ore shipments from the Tintic district for the week ended July 30 amounted to 153 cars. Shippers were: Tintic Standard, 56 cars; Chief Consolidated, 31; Iron King, 14; Dragon, 11; Eagle & Blue Bell, 10; Victoria, 10; Iron Blossom, 6; Centennial-Eureka, 3; Little May, 2; Swansea, 2; Colorado, 2; Gemini, 1; Bullion Beck, 1; Eureka Hill, 1; Mammoth, 1; Gold Chain, 1; and Sunbeam, 1.

A survey is being made at the Tintic Standard on the 1,400 level with a view to drifting 1,000 ft. to the site of the proposed new or No. 2 shaft.

Alta—The Little Cottonwood Transportation Co. has been operating its [illegible] line from Alta to Wasatch steadily throughout the present shipping season.

Park City—Shipments for the week ended July 30 amounted to [illegible] tons, as compared with [illegible] tons the week preceding. Shippers were: Silver King Coalition, [illegible]; [illegible]; Ontario, [illegible].

NEVADA

Hamilton District Now More Active—Activity in Gold Hill District on Comstock Lode

Virginia City—Gold Hill is a busy place. Since the completion of the railroad spur across American Flat, trainloads of building material and machinery have been coming in regularly, almost daily. Visitors are surprised at the scale of operations, as much is being done and little said. A lodging house, with a club and recreation rooms in connection, with accommodation for 150 men, is about half completed. Construction work on the cook and mess houses has been started. Excavation for the coarse-crushing plant, a steel frame building about 250 ft. in length, is well under way, and railroad spurs are being laid through the mill site.

Underground all energy is being devoted to the completion of the main haulage tunnel, and remarkable progress is being made. Some development work on various levels is being accomplished from the Imperial.

At the North End the Con. Virginia and Ophir continue development work and regular ore shipments.

Ely—The Hamilton district is becoming more active and a large number of operations are under way. Old properties that were producers in the early days of the White Pine excitement are being worked on a small scale. The Jennie A mine in the northern part of the district is under lease to Ely men and a small but steady production is being made.

The Lake Valley mine, 60 miles from Ely, is attracting some attention. A 50-ton mill is being built. The ore contains silver and a little gold, the values being contained in a white sugary quartz ledge which can be traced for several miles. A 450-ft. tunnel has opened up much milling ore.

MICHIGAN

The Copper Country

Quincy's New Furnace in Operation—Copper Range Experimenting With Underground Shovel and Picker

Houghton — A total of 6,526,000 lb. of copper was shipped out of the Lake Superior district in July. Rail shipments were confined to a few carloads. July metal sales exceeded those of June, when 5,858,000 lb. was shipped by boat. In comparison with shipments in July of last year, however, the total was considerably less, 10,034,000 lb. going out by water in July, 1920.

Calumet & Hecla is in receipt of orders for 200,000 lb. of copper for domestic consumers and 100,000 lb. for export. This metal will be shipped soon, these orders being all that are on the C. & H. books. Calumet & Hecla continues to operate two furnaces at the smelting plant.

Work on Quincy's new furnace, No. 5, of 130,000 lb capacity, has been finished, and the furnace went into blast as a completed unit on July 28, when 80,000 lb. of copper was refined in a test charge. It worked with the smoothness of perfection in every operation, and with its automatic casting machines, trolley dipping system, and other automatic devices will help keep smelting costs down to a minimum.

Quincy has only one furnace in operation. Copper Range is using two out of five furnaces, smelting its own mineral and that of Mohawk and Wolverine as well. Although the Copper Range plant—that of the Michigan Smelting Co.—has five furnaces, it seldom has used more than three, even in normal times. Calumet & Hecla is down to two furnaces out of a total of twenty-four.

The development of mechanical devices underground in the Copper Range mines is having some success. A combination shovel and picker has been devised for work in the stopes and is now in use in the Champion. A power shovel takes up the rock and throws it back on a belt conveyor, where men are stationed to pick out the poor rock. This method of handling and selecting rock is proving satisfactory. In rock selection one man will now do the work that formerly required three men. The device was built in the Copper Range shops.

Menominee Range

Florence Mine Running Three Days Per Week—Wages Cut 10 Per Cent

Florence — The Florence mine has been placed on an operating basis of three days per week, and wages have been cut 10 per cent. This mine is on the Wisconsin side.

Crystal Falls—The M. A. Hanna Co. has issued orders to ship 145,000 tons of ore from the Carpenter mine and 65 tons from the Monongahela. This will about clean up the stockpiles at both mines, which are not hoisting at present. With the ore on hand disposed of it is likely that both mines will resume in the fall if general conditions are improved. It is understood that the Hanna company disposed of the ore to Henry Ford, who has been using Crystal Falls ore in his River Rouge furnaces for several years. The Hanna company is the only mining company with docks near the Ford furnaces.

Marquette Range

Mary Charlotte Mine Closes Down Again

Negaunee—Soon after starting operations with a full crew of men, the Mary Charlotte was closed down last week. The company has suspended shipments which were going to East St. Louis, Ill. The pumps are being continued in operation.

The independent iron mining companies of the Lake Superior district reduced wages 12½ per cent on Aug. 1. This order followed the one of the Oliver Iron Mining Co. which called for a cut of 10 per cent on the same date. The independents have cut a total of 37½ per cent this year, and the Oliver has cut 30 per cent. Few underground mines in the entire Lake Superior region are being worked full time, most of them being operated on a basis of three shifts per week. The Oliver company's mines on the Gogebic Range are giving each man eight days' employment every four weeks.

MINNESOTA

Mesabi Range

Operations at Hill-Trumbull Pit Temporarily Increased

Chisholm—At the Dunwoody mine, the Tod Stambaugh Co. is preparing to sink a shaft preparatory to mining ore that is not available for direct loading in the pit. The shaft is to have four compartments and is to be sunk a depth of 225 ft. The sinking will begin at once. The work on the headframe, which is to be of wood, is to be started soon.

Nashwauk—The Hawkins mine and concentrator of the Wisconsin Steel Co. have been reduced to a one-shift basis. About fifty men have been laid off.

Marble—The Mesabi Cliffs Iron Mining Co. has increased the number of shifts at the Hill-Trumbull pit and concentrator to two shifts of twelve hours each. The operations had previously been confined to one shift of fourteen hours. The twelve-hour shifts are temporary only, the operators desiring to increase shipments.

Chronology of Mining

July, 1921

July 1—Empire, North Star, and Idaho-Maryland mining companies in Grass Valley district, California, shut down, following refusal of men to accept wage cut of 75c. to $1 effective on this date. International smelter at Tooele closed.—Quincy Mining Co., Michigan, cut wages 6 per cent.

July 15—Minerals Separation North American Corporation made party plaintiff in Miami Copper Co. suit.—Walter Fitch, Jr., Co. set out to break world's shaft sinking record in Water Lily shaft at Eureka, Utah.—International Nickel Co., Ontario, cut wages.

July 17—Central Eureka Mining Co., Sutter Creek, California, cut wages 50c. per shift.

July 18—Petroleum placed on free list by House.—Bill providing for compulsory use of metric system introduced in Senate.

July 21—Fordney Tariff bill passed House.

July 23—Meeting held at Charleston, W. Va., preliminary to organizing a Charleston Section of the A. I. M. E.

July 25—Utah State Industrial Commission fixed attorneys' fees in workingmen's compensation cases.—Federal Trade Commission began hearing on iron ore freight rates in effect in Lake Superior district.

July 26—Over 250 power consumers in Utah petitioned Public Utilities Commission protesting against the rates charged by the Utah Power & Light Co.

THE MARKET REPORT

Daily Prices of Metals

Aug	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
4	11.625	25.25	26.00	4.35	4.15@4.20	4.20
5	11.625	25.50	[illegible]	4.35	4.15@4.20	4.20
6	11.625-11.75	25.75	26.50	4.35@4.40	4.20	4.20
8	11.625-11.75	26.75	27.50	4.35@4.40	4.20@4.25	4.20
9	11.75	26.75	27.625	4.35@4.45	4.20@4.25	4.20@4.25
10	11.75	26.125	27.00	4.35@4.45	4.25	4.25

*These prices correspond to the following quotations for copper "delivered": Aug. 4th and 5th, 11.875c.; 6th and 8th, 11.875@12c.; 9th and 10th, 12c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Aug	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
4	70[illegible]	70[illegible]	74[illegible]	158	160	23[illegible]	23[illegible]	25	25[illegible]
5	70[illegible]	70[illegible]	74	[illegible]	161[illegible]	24	23[illegible]	25[illegible]	[illegible]
6									
8	70	70[illegible]	74	[illegible]	[illegible]	23[illegible]	[illegible]	25[illegible]	[illegible]
9	70	70[illegible]	74	[illegible]	[illegible]	23[illegible]	23[illegible]	25[illegible]	26[illegible]
10	70[illegible]	70[illegible]	[illegible]	[illegible]	[illegible]	23[illegible]	[illegible]	25[illegible]	[illegible]

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Aug.	Sterling Exchange "Checks"	Silver			Aug.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
4	35[illegible]	99[illegible]	61[illegible]	[illegible]	8	[illegible]	[illegible]	61[illegible]	[illegible]
5	[illegible]	99[illegible]	61[illegible]	[illegible]	9	[illegible]	[illegible]	60	[illegible]
6	[illegible]	99[illegible]	61[illegible]	[illegible]	10	[illegible]	[illegible]	[illegible]	37

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, Aug. 10, 1921

Although trading has shown only a slight improvement during the week, a much more favorable sentiment is noticeable, both among producers and consumers. All the metals share in the better tone. Copper sagged a little but made a strong recovery. Lead is still the strongest of all the group. Zinc is showing a firmer tendency. The hope is expressed by producers in close touch with statistical conditions that the corner in the metal markets is now being turned, but the behavior of the metals has been so erratic and variable that it is idle to make any definite declaration.

The freight rate on copper to Continental ports has been lowered and is now [illegible] to Hamburg and $6 to Rotterdam, Antwerp and Havre, compared with $8 and $7 respectively. Transpacific rates to Hongkong and Kobe are now $8.

Copper

Copper staged a strong comeback during the week. Last Thursday and for two days thereafter copper was sold below 12c. delivered, in fair-sized tonnages, the aggregate being over 1,500 tons of copper which we can trace. [illegible] 11⅞c., that had been paid, attempted to obtain still more [illegible] but met with a stern refusal from producers; in fact, the market stiffened to such a degree that no more metal was available at the 11⅞c. level, and today it would be difficult to procure any below the 12c. level of last week. Most of the copper purchased is intended for immediate consumption, but at least one lot was sold because the purchaser felt that copper at 12c. and below was exceedingly cheap and was worth purchasing and holding. A few weeks ago it was reported that the Government was intending to dispose of about 10,000,000 lb. of copper, and was to open bids for this amount last week. It is now understood that this copper has been temporarily, at least, withdrawn from the market. Possible use for this metal may be found among the various copper-consuming departments of the Government. Besides unduly depressing the market, the sale of this copper at the present time would have been to the detriment of the price that might ultimately be received. Export business has not been particularly good, but shipments are being regularly made to European countries at prices equivalent to those here. The market appears much stronger today and is ripe for an upward movement.

Lead

The American Smelting & Refining Co. is continuing its official contract price of 4.40c. Lead is still the most favored non-ferrous metal, and is in a good statistical position. Inquiries and sales have been made in good volume, particularly when compared with other metals, and several thousand tons have been sold. Another order of 1,000 tons was marketed during the week. The demand for lead is again becoming more diversified and is not confined to one or two groups of consumers, as during last week. As a result of the satisfactory movement of lead into consumers' hands, some of the largest producers are well sold up on production and can afford to keep out of the market for a time or refrain from pushing sales. There has been a little more activity in the Chicago market than usual, lead being sold at prices about 10 points above the St. Louis level

Zinc

The market is practically the same as last week. A slightly greater volume of inquiry is apparent [illegible] and brass people.

[illegible]

reported to have been shaded on at least one sale.

Tin

The tin market has been inactive, prices fluctuating as usual in conformity with sterling exchange and the London market. No support has been given the trade in this country. Tin for forward delivery is quoted the same as spot.

Arrivals of tin, in long tons: Aug. 1st, Straits, 25; 8th, London, 125; Rotterdam, 25; 9th, Hongkong, 25; Liverpool, 50.

Gold

Gold in London: Aug. 4th, 115s. 1d.; 5th, 114s. 2d.; 8th, 113s. 3d.; 9th, 111s. 4d.; 10th, 112s. 7d.

Foreign Exchange

Sterling took a sudden advance on Monday, demand selling at one time as high as 372¼. The rise was attributed to covering by shorts and was followed by a relapse on Tuesday, as expected. Cable transfers are now quoted 1c. higher than the demand figures given on page 275. On Tuesday, Aug. 9th, francs were 7.76c.; lire, 4.365c.; and marks, 1.235c. New York funds in Montreal, 11$\frac{7}{16}$ per cent premium.

Silver

Since our last report the London market has been weak, on account of selling by the Indian bazaars and China, and on the 9th fell to 36¼d. The sharp advance in sterling exchange partly offset the London decline, and with sellers in New York and Frisco withholding silver, the New York market ruled higher than the London parity. Today both London and New York are quoted higher, and the market closes steady.

Mexican Dollars—Aug. 4th, 46⅞; 5th, 47⅜; 6th, 47⅜; 8th, 47½; 9th, 46⅛; 10th, 46⅞.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 21@23c. per lb.; 22½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 4.60@4.65c.; market dull. W.C.C. brand, 5⅜@5⅝c. per lb. Cookson's "C" grade, spot 9@9¼c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese. guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500-lb. lots.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb.; black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $165@$185 per oz.

[1]**Molybdenum Metal**—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz. Nominal $70, Los Angeles, Cal.

Palladium—Nominally, $50@$53 per oz.

Platinum—Nominally, $69@$72 per oz.

Market has become much stronger, due to the withdrawal of offerings and an increasing interest among consumers.

Quicksilver—Nominally, $43.50@$45 per 75-lb. flask. San Francisco wires $46.25.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—22c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]**Zircon**—Washed, iron free, 8c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 6—Zinc blende, per ton, high, $23.70; basis 60 per cent zinc, premium, $21; Prime Western, $21@$20; fines and slimes, $19@$18; average settling price, all grades of blende, $21.73.

Lead, high, $52.10; basis 80 per cent lead, $50; average settling price, all grades of lead, $47.95 per ton.

Shipments for the week: Blende, 5,428; lead, 868 tons. Value, all ores the week, $159,580.

Market conditions are in no way satisfying, and the present rate of ore production is largely a matter of sentiment, producers maintaining a force of miners solely to provide employment, and many others have been given work on road improvement to prevent want among men of families that can find no other work. Producers realize they are producing beyond the demand and that their margin of profit often disappears in wages.

Platteville, Wis., Aug. 6—No market for zinc or lead ore. Shipments for the week, none. Shipments for the year: Blende, 11,461; lead, 978 tons. Shipped during the week to separating plants, 160 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,500@$2,000; No. 2, $850@$1,250; spinning fibers, $350@$850; magnesia and compressed sheet fibers, $225@$350; shingle stock, $95@$150; paper stock, $55@$70; cement stock, $16@$27.50; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada.

One producer reports the demand for asbestos starting in again, with inquiries about 50 per cent greater than last month. He feels that there will be no material decrease in the prices of crudes and fibers for some time. The mines are either shut down entirely or working on short shift, and until the stocks on hand are consumed production will be small, with no overproduction and no surplus. The 5 per cent export sales tax has been removed.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, car load lots; (off-color) $22@$26 in bags carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

---

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

China Clay (Kaolin)—Crude, $6.50@$8.50; washed, $9@$10; powdered, $13@$20, bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

Feldspar—No. 1 soap grade, $7@$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, $6@$6.50; No. 2, $5@$5.50. Market dull. Large stocks are available and quotations are nominal. Producers report cancellations of orders. No. 1, Canadian, ground, $26 f.o.b. cars.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $13.50, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, 1@2c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined—Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $45@$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead Burned—$33 per net ton Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, [illegible]@$70, all f.o.b. New York.

*Monazite—Minimum of 6 per cent thorium oxide, $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $11.65; 75 per cent, $10.65; 75@74 per cent, $10.15; 70 per cent, $6.25; 68 per cent, $5.75; 68@66 per cent, $5.50.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 12c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica—Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $7.50@$11 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—6c. per lb.

Sodium Nitrate—$2.10@$2.30 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $15@$17 per ton, f.o.b. in bulk, Western mines, spot and six months' contract; $22@$25 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.35 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 14c. per lb. of chromium contained; 4 to 6 per cent carbon, 15c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $65@$70, f.o.b. furnace; resale, $90, delivered; English, $65@$70, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, [illegible], f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works. Imported material, $1.75@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $40; 50 per cent, $65; 75 per cent, [illegible].

Ferrotungsten—Domestic, 70 to 80 per cent W., [illegible] per lb. of contained tungsten, f.o.b. works. Foreign, 80c. duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$4.25@$4.50 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 20½c. per lb.; wire, 14@14½c.

Lead Sheets—Full lead sheets, 8.25c.; cut lead sheets, 8¾c. in quantity, mill lots.

Nickel Silver — 31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets 16¾c.; sheathing, 16¼c.; rods, ⅜ to 3 in., 13¾c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $50 per ton; 70 per cent, [illegible] f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—[illegible] per net ton.

Fire Brick—First quality, 9-in. shapes $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $70@$75 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Aug. 9, 1921

Volume of demand on steel mills continues upward, but improvement is slow. That most clearly marked is in sheets, tubular goods, and merchant steel bars. There is heavy buying of sheets for box-car roof replacement and a little railroad buying for other purposes. The automobile trade is a fair buyer. Steel-ingot production has been at almost 30 per cent of capacity, but may average 35 per cent for August and a 40 per cent rate may be reached by late fall.

Steel prices are beginning to show steadiness. [illegible] fractional prices are being quoted. Thus, when black sheets were openly quoted at [illegible], [illegible] quotations were made at [illegible]. Now, when the regular market is 3c., quotations are of 2.97½c., 2.95c., and 2.92½c., according to keenness of competition. Open prices continue at [illegible] for bars and [illegible] for shapes and plates, concessions of $1 to $3 a ton being common on attractive orders.

Pig Iron—Bessemer, [illegible]; basic, $20; foundry, $17.50, Valley furnaces.

Semi-finished Steel—Small lots of sheet bars have sold at [illegible], Pittsburgh [illegible]. Billets show no movement.

Coke

Connellsville—Furnace, [illegible]@$3; foundry, [illegible]@$4.50.

---

*Foote Mineral Co., Philadelphia, Pa.

Pittman Act Makes Silver Exports Light

Foreign Silver Only Being Sent Abroad—Market Fairly Steady at Sixty-Cent Level—Germany Is Using Silver as Collateral for an American Loan—India Has Large Silver Reserves—About One-Third Pittman Purchases Have Been Made

EDITORIAL MARKET STUDY

ALTHOUGH the American silver producer is temporarily free from worry over silver prices, to say he is disinterested would be a gross misstatement, as the time is gradually but surely coming when American silver must be sold in an open market again. Foreign silver prices have remained fairly steady around 60c. per oz., at which level the market is quiet but not high enough, under present labor and supply costs, to induce a heavier production from foreign mines, particularly those in Canada and Mexico. In fact, production from foreign mines is declining. Decreased production, however, cannot help being ultimately beneficial to the silver-mining industry of the world, for, one of these days, treatment of silver as a "speculative football" will cease, a genuine consuming demand for the metal will appear, and mining can be resumed on a pre-war scale.

Unfortunately, silver, like gold, is inextricably linked with monetary systems and finance. Its industrial uses are secondary. Consequently, much depends upon the whims of governments as to how silver shall be handled. Of late, numerous examples leave no doubt as to how Europe, at least, is discarding silver. Much can be said for and against the European attitude of sending silver to the melting pot. For some countries desperation is the root of the trouble; for others it is the result of a disorganized paper and metal currency system.

On July 26, a shipment of silver from Germany valued at $800,000 and consigned to a local bank was received in New York. This silver is part of a lot expected to total $10,000,000 which the German government is shipping to the United States to obtain much-needed American credit. The silver shipments had caused the trade much perturbation, as it was thought that the German attitude might include a quick disposal of the metal, with the probable result of disorganizing the market. It will be recalled that Germany last year was a heavy seller of silver, with disastrous results to the market. However, it appears that the $10,000,000 in silver to be shipped to the United States is to be used as collateral to secure a loan, and hence will not be pressed upon the market, except upon default of the loan. Had a procedure such as this been carried out last year, it is likely that the heavy and unprecedented decline in the silver market of 1920 would have been cushioned and much milder. The silver shipment is intimately associated with reparations, and it was originally planned to keep the silver in Germany as the basis for credit. This plan gave way to the one ultimately carried out—shipping the metal to the United States.

Although silver coinage has temporarily been abandoned by Europe, all European states prior to the war were regularly engaged in purchasing silver for purposes of coinage. According to the Director of the Mint, the silver coinage of the world for the five years prior to the war averaged about 120,200,000 oz. annually. World production of silver for the same period (1909-1913) was about 221,600,000 oz., which gives some idea of the importance of coinage demands to the silver market. Although coinage of silver has fallen, production has also shown a large decrease, partially offsetting the decrease in coinage.

A British bullion broker calls attention to an important difference in the present position of silver coinage in India. Whereas, on July 31, 1914, India's silver reserves were about 116,500,000 oz. in coined rupees, the total is now about 227,000,000 oz., due to the great activity of the Indian mints in 1917, 1918, and 1919, and the extraordinary demand for silver during that period. This should have an important bearing on the demand in India for silver coinage. India obtains its greatest proportion of silver from London. North America, Shanghai, and other Asiatic ports, Australia, and Burma also send their treasure to the Indian market. Despite the large accumulations of silver in India, the imports of silver into that country during the first four months of the year were about 31,500,000 oz., compared with some 100,000,000 oz. annually before the war, indicating a rate of importation slightly less than that before the war. This situation is ascribed to the still pronounced prosperity of the country.

Exports of silver from the United States are confined to foreign silver, as domestic silver is being sold to the Government at $1 per oz. under the provisions of the Pittman Act. The outward-going volume of silver has reached small proportions, and imports are also light. Great Britain, China, and Hongkong are the chief destinations of the exported silver. Mexico is by far the heaviest contributor of silver imported into the United States. From June 1, 1920, to July 1, 1921, about 66,000,000 oz. of silver was imported into the United States, compared with 57,000,000 oz. exported, confirming the impression that domestic industrial consumers of silver are obtaining supplies from cheaper foreign deposits rather than high-priced domestic silver.

Purchases of silver under the Pittman Act now total over 66,000,000 oz., not quite one-third of the 207,000,000 oz. which will make up the total purchases. The price of foreign silver is far from that of domestic, and there is nothing visible which would make it appear that silver will rise above one dollar again before the purchases have been completed. Criticism of the Pittman Act, which was particularly violent last winter, has momentarily abated, but as another wave of criticism may roll in at any moment, it behooves all silver producers interested in the welfare of their industry to be ready promptly to combat any uncalled-for claim for repeal of the act. Eternal vigilance is the price of safety. The silver miners have nothing to be ashamed of in the Pittman Act. On the contrary, the fullest publicity cannot fail to inform the unprejudiced observer of the eminent fairness of the legislation, and the just reward silver is receiving for the signal service it rendered during the war.

MOVEMENTS OF SILVER TO AND FROM THE UNITED STATES

In Ounces

To	Average Monthly (1913)	Average Monthly (1920)	January, 1921	February, 1921	March, 1921	April, 1921	May, 1921	June, 1921
EXPORTS								
China and Hongkong	829,400	7,185,000	3,164,320	1,833,460	738,030	487,630	1,108,100	
India	152,740	53,500	667,800	295,090	553,090	100,000		
Great Britain	3,943,700	410,300	1,370,150	1,606,470	765,400	1,008,800	1,039,490	
Canada	68,000	588,400	259,990	234,090	224,770	266,200	145,800	
Mexico		270,000	449,800	184,930	112,680	361,200	53,600	
All countries	5,097,000	9,468,000	6,690,750	5,336,880	2,918,530	2,318,800	2,352,600	1,424,010
IMPORTS								
Mexico	2,130,200	4,433,100	3,390,600	3,237,400	2,375,300	2,023,700	4,523,400	
Peru	180,400	999,200	529,800	268,000	539,100	451,400	648,100	
Canada	806,800	315,700	242,300	611,200	451,000	261,562	171,900	
Central America	122,000	599,900	136,300	161,500	89,500	270,800	274,800	
All countries	3,440,000	7,338,300	4,838,900	4,862,100	3,872,000	3,299,750	6,956,000	3,627,300

COMPANY REPORTS

New York & Honduras Rosario Mining Co.

A report of the operations of the New York & Honduras Rosario Mining Co. for 1920 gives production as follows:

PRODUCTION

	1920	1919
Dry tons treated	140,100	[illegible]
Ounces silver produced	1,711,349	1,484,67[illegible]
Ounces gold produced	8,091	[illegible]
Ratio of silver to gold	214	[illegible]
Bars doré [illegible]	1,097	[illegible]
Bullion fineness	968.44 Ag 4.33 Au	979.14 Ag [illegible] Au

A net profit of $211,667.54 was realized by the year's operations, and dividends totaling $320,000 were paid in 1920, surplus being reduced from $2,657,455 to $1,403,204 as the following statement shows:

Production of gold and silver	$1,568,612.32	
Less: Freight and expenses on bullion	56,877.31	
Operating income		$1,511,735.01
Operating expenses		1,125,196.19
Operating profit		$386,538.82
New York administrative expenses		67,498.26
Net income from operating		$319,040.56
Other income		34,895.52
Total income		$353,936.08
Deductions from income		107,232.82
Net profit for period		$246,703.26
Appropriated for reserves		
Fire insurance	$4,123.52	
Reducing Liberty bonds to market value	30,912.20	35,035.72
Profit and loss balance carried to surplus		$211,667.54

SURPLUS

Surplus Jan. 1, 1920		$2,657,455.42	
Deduct: Reserve for depletion of mine, 1920	$350,250.00		
Dividends paid in 1920	320,000.00		
Amortization paid 1920	80,000.00		
Amortization distributions previously charged to reserve for depletion	500,000.00		
Reserve for advances to Sabana Grande Honduras Mining Co., previously charged to reserve for depletion	200,063.86		
Increasing reserve for contingencies	15,604.71	1,465,918.57	1,191,536.85
Surplus Dec. 31, 1920			$1,403,204.39

Reserves of ore are estimated to amount to 211,780 tons containing 3,455,530 oz. of silver and 14,194 oz. of gold. The realizable value of the company's product was $1,568,612.32, compared with $2,115,158.25 for 1919. The per ton operating expense was $8.51, compared with $9.50 for 1919. The net cost of producing silver was 63.46c. per oz.

Operations were affected by the fall in price of silver, rate of exchange and cost of supplies, besides injuries to the property through storms.

The company's concession from the Honduras government was renewed by special act of the National Congress of Honduras for twenty years. The company agrees to perform certain public work at its own expense in return for the concession.

Capitalization, 200,000 shares of a par value of $10 each.

The New Jersey Zinc Co.

A report of The New Jersey Zinc Co. for the quarter ended June 30, 1921, follows:

Income, including dividends from subsidiary companies, after deducting [illegible] expenses, taxes [illegible], repairs and maintenance, [illegible], depreciation and contingencies	$647,440.16
Deduct: Interest on first mortgage bonds	40,000.00
Net income	$607,440.16
Deduct:	
[illegible] interest on stock subscriptions	$11,512.63
Surplus for the quarter	$595,927.53

A dividend of 2 per cent was declared from surplus, payable Aug. 10, 1921.

Poderosa Mining Co.

Copper; Chile

The twelfth annual report of the Poderosa Mining Co., Ltd., for the year 1920 states that the net receipts from sales of ore, interest, and transfer fees amounted to £112,303 8s. 9d., and after providing for mining, management, and general expenses in Chile, London office expenses, depreciation of investments, and income tax, amounting to £76,799 8s. 6d., there remains a balance of £35,504 0s. 3d., out of which the sum of £17,154 8s. 7d. has been allocated as follows:

	£	s.	d.
Depreciation of buildings, machinery and plant, etc.	[illegible]	[illegible]	4
Mine development	11,[illegible]21	4	11
Bolivian property	2,546	[illegible]	4
	17,154	8	7

This leaves a net surplus of £18,349 11s. 8d. to be carried to the balance sheet. Adding the balance of £7,289 9s. 2d. brought forward from 1919, the net balance is £25,639 0s. 10d., which the directors recommend should be dealt with as follows:

	£	s.	d.
To pay a dividend of 2s. 6d. per share, less income tax	8,750	0	0
And to carry forward (subject to corporation profits tax) the sum of	16,889	0	10
	£25,639	0	10

During the period under review, 5.011 tons of copper ore, of an average assay of 30.13 per cent copper and 15.16 oz. silver per ton, has been shipped to the smelters, as compared with 1,498 tons, assaying 31 per cent copper and 12.97 oz. silver, respectively, for 1919.

Production from the various units of the property was as follows:

	Tons	Per Cent	Fine Copper Tons
Poderosa mine	4,434.8	[illegible]	[illegible]
Rosario mine	124.1	24.48	[illegible]
San Carlos mine Concentration	715.0	[illegible]	178.75
Totals	5,273.9	[illegible]	[illegible]

Costs per ton are given as follows in pounds sterling:

	Working Expenses	Prospecting and Development	Capital Expenses	Total
Per ton of ore at mine	9.43	2.18	0.74	[illegible]
Per ton copper at mine	33.58	7.76	[illegible]	[illegible]

Mining Dividends for July, 1921

The following dividends were paid by American mining and metallurgical companies during July, 1921:

Companies in the United States	[illegible]	[illegible]	Total
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Companies in Canada, Mexico and [illegible] America			
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

MINING STOCKS

Week Ended August 6, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Ahmeek	Boston	48	48	48	Sept. '20, Q	$0 50
Alaska-Br. Col.	N. Y. Curb	*37	*35	*36	......	
Allouez	Boston	*18	*18	*18	Mar '19	1 00
Anaconda	New York	37¼	35¼	35¾	Nov. '20, Q	1.00
Arcadian Consol	Boston	2	1¾	2	.....	
Ariz Com'l	Boston	8	7¼	7¾	Oct '18, Q	.50
Big Ledge	N. Y. Curb	*27	*22	*24	.....	
Bingham Mines	Boston	9¼	9¼	9¼	Sept. '19, Q	.25
Calumet & Arizona	Boston	48½	46	46½	June '21, Q	.50
Calumet & Hecla	Boston	224	219	219½	June '20, Q	5 00
Canada Copper	N. Y. Curb	*35	*30	30	.....	
Centennial	Boston	8½	7	7½	Dec. '18, SA	1.00
Cerro de Pasco	New York	27	24	24½	Mar. '21, Q	.50
Chile Copper	New York	10½	10	10	.....	
Chino	New York	23½	22½	22½	Sept '20, Q	.37½
Columbus Rexall	Salt Lake	*28	*27	27	.....	
Con. Arizona	N. Y. Curb	....	....	*3	Dec '18, Q	.05
Con. Copper Mines	N. Y. Curb	1¼	1	1¼	.....	
Copper Range	Boston	32	31¼	31½	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*38	33	38	......	
Davis-Daly	Boston	6½	6¼	6½	Mar '20, Q	.25
East Butte	Boston	8	7¾	8	Dec '19, A	.50
First National	Boston Curb	*54	*52	*52	Feb. '19, SA	.15
Franklin	Boston	2¼	1¾	1¾	....	
Gadsden Copper	N. Y. Curb	.		*25	....	
Granby Consol	New York	17¾	16¼	17	May '19, Q	1.25
Greene-Cananea	New York	21¼	20	21¼	Nov. '20, Q	.50
Hancock	Boston	2½	2¼	2½	....	
Howe Sound	N. Y. Curb	2¾	2¼	2¼	Jan '21, Q	05
Inspiration Consol	New York	33¾	32½	32½	Oct. '20, Q	1.00
Iron Cap	Boston Curb	5½	5½	5½	Sept '20, K	25
Isle Royale	Boston	19¼	19	19¼	Sept '19, SA	50
Kennecott	New York	19¼	18	18	Dec '20, Q	.50
Keweenaw	Boston	†2	†1	1¼	....	
Lake Copper	Boston	†3	†2¼	2½	....	
La Salle	Boston	1½	1¼	1⅜	....	
Magma Chief	N. Y. Curb	....	..	*8	....	
Magma Copper	N. Y. Curb	17¾	17¼	17¾	Jan. '19, Q	50
Majestic	Boston Curb	*7	*6	*7	..	
Mason Valley	Boston	1½	1¼	1¼		
Mass Consolidated	Boston	1½	1½	1½	Nov '17, Q	1 00
Miami Copper	New York	21¼	20¼	20¾	May '21, Q	.50
Michigan	Boston	1¾	1¼	1¼		
Mohawk	Boston	49	47½	47¾	Nov. '20, Q	1 00
Mother Lode Coa.	N. Y. Curb	4	3½	3½	.	
Nevada Consol	New York	10¼	9¾	10	Sept '20, Q	.25
New Baltic	Boston Curb	.		3	.....	
New Cornelia	Boston	14	13½	13½	Aug. '20, K	.25
North Butte	Boston	9¼	9¼	9½	Oct. '18, Q	.25
North Lake	Boston	†*50	†*25	*25	.....	
Ohio Copper	N. Y. Curb	.		*12		
Old Dominion	Boston	23	22	22	Dec. '18, Q	1 00
Osceola	Boston	26¼	23	23	June '20, Q	50
Phelps Dodge	Open Mar.	†155	†145		July '21, Q	1 00
Quincy	Boston	37	36	36	Mar '20, Q	1 00
Ray Consolidated	New York	12¾	12½	12½	Dec. '20, Q	25
Ray Hercules	N. Y. Curb	*30	*26	*28	.	
St. Mary's Min. Ld.	Boston	31	31	31	June '20, K	2 00
Seneca Copper	Boston	17¼	16	16¼	....	
Shannon	Boston	*85	*85	*85	Nov '17, Q	25
Shattuck Arizona	New York	7	6¾	6¾	Jan '20, Q	25
South Lake	Boston	1	1	1	....	
Superior Copper	Boston	3	3	3	Apr '17,	1 00
Superior & Boston	Boston	1½	1¼	1¾		
Tenn. C. & C. cfs.	New York	7¾	7½	7¾	May '18, I	1 00
Tuolumne	Boston	*48	*38	38	May '13,	10
United Verde Ex.	Boston Curb	23½	22	22	May '21, Q	25
Utah Consol	Boston	4	3½	3½	Sept. '18,	25
Utah Copper	New York	48¾	46½	46½	June '21, Q	50
Utah Metal & T.	Boston	1³⁄₁₆	1⅛	1³⁄₁₆	Dec. '17,	30
Victoria	Boston	†1½	†1¼	1¼	....	
Winona	Boston	†*50	†*45	*40	......	
Wolverine	Boston	11	10	10	....	
		NICKEL-COPPER				
Internat. Nickel	New York	14¼	13½	13½	Mar '19,	50
Internat. Nickel pf	New York			84	Aug '21, Q	1 50
		LEAD				
National Lead	New York	75¼	74¼	74½	June '21, Q	1 50
National Lead, pfd.	New York	103	103	103	June '21, Q	1 75
St. Joseph Lead	New York	11	11	11	June '21, Q	25
		QUICKSILVER				
New Idria	Boston	†*50	...	*50	....	
		ZINC				
Am. Z. L. & S.	New York	8	8	8	May '20	1 00
Am. Z. L. & S., pfd	New York			25	Nov. '20, Q	1 50
Butte C. & Z.	New York	4¼	4¼	4¼	June '18,	50
Butte & Superior	New York	13	12	12½	Sept. '20,	1 25
Callahan Z. L.	New York	4¼	4	4	Dec. '20, Q	50
New Jersey Zn.	N. Y. Curb	117	115½	116	May '21, Q	2 00
Success	N. Y. Curb	*2	*2	*2	Feb. '16	03
Yellow Pine	Los Angeles	‡....	....	*55	Sept. '20, Q	.03

*Cents per share. †Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	½	½	½	....	
Alaska Juneau	New York	1¾	1½	1¾	....	
Carson Hill	N. Y. Curb	...		13½	....	
Cresson Consol. G.	N. Y. Curb	1½	1⁷⁄₁₆	1⁹⁄₁₆	June '20, Q	$0 10
Dome Extension	Toronto	*65	*65	*65	....	
Dome Mines	New York	17½	17	17½	July '21, Q	.25
Florence Goldfield	N.Y. Curb	*43	*40	*42	.....	
Golden Cycle	Colo. Springs	‡.		*55	June '21, Q	.02
Goldfield Consol	N. Y. Curb	*6	*6	*6	Dec. '19,	.05
Hollinger Consol	Toronto	7.20	7 06	7 15	July '21, M	.05
Homestake Mining	New York	56	56	56	July '21, M	25
Kirkland Lake	Toronto	*40	*35	37	....	
Lake Shore	Toronto	1.20	1 15	1 19	Jan. '21, K	02
McIntyre-Porcupine	Toronto	1.96	1 90	1.95	May '21, K	.05
Porcupine Crown	Toronto	*15	13½	*14	July '17,	03
Portland	Colo. Springs	‡*44	*43	....	Oct. '20, Q	01
Reorgan. Booth	N. Y. Curb	..	...	*4	May '19,	.05
Silver Pick	N. Y. Curb	*13	*11	*13	....	
Teck Hughes	Toronto	*15	*13	*15	....	
Tom Reed	Los Angeles	‡.	..	*71	Dec. '19,	.02
United Eastern	N. Y. Curb	2¾	2⅝	2¾	July '21, Q	.15
Vindicator Consol	Colo. Springs	‡..	...	*30	Jan. '20, Q	.01
West Dome Consol	Toronto	*8	*7	*7¼	....	
White Caps Mining	N. Y. Curb	*5	*4	*5	....	
Yukon Gold	N. Y. Curb	1⅛	*90	*95	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*21	*18	*18	Apr. '20, M	.03
Batopilas Mining	New York	....		½	Dec '07, I	.12½
Beaver Consol	Toronto	*29	*26	*27	May '20, K	03
Comagas	Toronto	1 65	1 65	1 65	May '21, Q	.12½
Crown Reserve	Toronto	*10	*8½	*9	Jan '17,	.05
Kerr Lake	N. Y. Curb	3¾	3¾	3¾	July '21, Q	.12½
La Rose	Toronto	*21	*15	*18	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	†20	†10		Oct '20, Q	.03
Mining Corp. Can.	Toronto	1.25	1 15		Sept '20, Q	.12½
Nipissing	N. Y. Curb	4¾	4¼	4¾	July '21, Q	.15
Ontario Silver	New York	3¾	3¼	3½	Jan. '19, Q	.50
Ophir Silver	San Francisco	..		*9	Jan. '12,	.10
Peterson Lake	Toronto	*5	4¼		Jan. '17,	.01½
Temiskaming	Toronto	*23	*22	*22	Jan. '20, K	.04
Trethewey	Toronto	*15¼	*12	.	Jan. '19,	.05
		GOLD AND SILVER				
Barnes-King	Butte	‡		60	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*75	*65	*68	....	
Cash Boy	N. Y. Curb	*6	*5	5	....	
Consol. Virginia	San Francisco			*16	....	
Dolores Esperanza	N. Y. Curb	2¼	2¼	2¼	......	
El Salvador	N. Y. Curb	*27	20	*21	....	
Jim Butler	N. Y. Curb	8	7	8	Aug. '18, SA	07
Jumbo Extension	N. Y. Curb	*4	*4	4	June '16,	05
Louisiana Con.	N. Y. Curb			¼	.....	
MacNamara M.& M.	N. Y. Curb	*17	15	17	May '10,	02½
N. Y. Hond. Rosar.	Open Mar.			4	Jan. '21, Q	30
Tonopah-Belmont	N. Y. Curb	1¼	1¼	1¼	Apr '21, Q	05
Tonopah-Divide	N. Y. Curb	*81	*75	*78	....	
Tonopah-Extension	N. Y. Curb	1¾	1¾	1¾	July '21, Q	05
Tonopah Mining	N. Y. Curb	1⅜	1⅜	1³⁄₁₆	Apr. '21, SA	.05
West End Consol	N. Y. Curb	*75	*70	*70	Dec. '19, SA	05
		SILVER-LEAD				
Caledonia	N. Y. Curb	*9	*8	*9	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	.		1 20	Dec. '21,	.15
Chief Consol	Boston Curb	2¼	2⅛	2³⁄₁₆	Aug '21, Q	.05
Consol. M. & S.	Montreal	15¼	15¼	15¼	Oct '20, Q	.62½
Daly Mining	Salt Lake	‡†2 50		....	July '20, Q	.10
Daly-West	Boston	2¼	†2¼	2¼	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†2½	2	2	Apr. '21, K	.05
Electric Point	Spokane	‡		5	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*50	*39	*45	.	
Federal M. & S.	New York	†9	6	7	Jan '09,	1 50
Federal M. & S., pfd	New York	22	21¼	21¼	June '21, Q	1.00
Florence Silver	Spokane	‡		11	Apr. '19,	.01½
Grand Central	Salt Lake	†*29			June '20, K	.03
Hecla Mining	N. Y. Curb	4¼	4	4	June '21, Q	.08
Iron Blossom Con.	N. Y. Curb			*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	‡3	2		Sept. '20, Q	12½
Marsh Mines	N. Y. Curb			3	June '21, I	.02
Prince Consol	Salt Lake	‡..		*26	Nov. '17,	02½
Rambler-Cariboo	Spokane	‡..		3½	Feb '19,	.01
Rex Consol	N. Y. Curb	*9	*8	8	......	
South Hecla	Salt Lake	*40	*35	*35	Sept '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*12	*12	*12	Oct '17	05
Stewart Mining	N. Y. Curb	*4	3	*3	Dec. '15	.05
Tamarack-Custer	Spokane	‡		80	Jan. '21 K	.04
Tintic Standard	Salt Lake	‡		2 40	July '21, Q	.05
Utah Apex	Boston	1¼		1¼	Nov '20, K	.25
Wilbert Mining	N. Y. Curb	*3		*3	Nov. '17,	.01
		VANADIUM				
Vanadium Corp.	New York	31	[illegible]	29	Jan '21, Q	1 00
		ASBESTOS				
Asbestos Corp	Montreal			48	July '21, Q	1 50
Asbestos Corp., pfd	Montreal	77	[illegible]	[illegible]	July '21, Q	1 75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref	New York	37	[illegible]	[illegible]	Mar '21, Q	1.00
Amer. Sm. & Ref. pf	New York	72	[illegible]	72	June '21, Q	1 75
Am. Sm. pf. A	New York	70	[illegible]	67½	July '21, Q	1 50
U. S. Sm. R. & M.	New York	30	[illegible]	30	Jan. '21, Q	.50
U. S. Sm. R. & M. pf	Boston	37¼	37	37	July '21, Q	87½

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, August 20, 1921 *Number* 8

Will the Gold Standard Survive?

EUROPEAN COUNTRIES are shipping gold to the United States with reckless abandon. Already we have more gold than any one nation ever accumulated in the history of the world, the ratio of United States to world stocks of gold being about three and one-third to eight. And the end is not in sight. The attitude of all European countries with the exception of Great Britain seems to ignore entirely the metallic basis upon which modern currency systems have been slowly and carefully built. Gold reserves, in their hands, are merely a means to an end. In an effort to save financially sinking ships they are casting overboard valuable ballast, no doubt feeling that the most important object is to reach some port that will allow them to repair the heavy damage to their vessels. As a consequence, gold reserves have been reduced to extraordinary extremes, and exported gold used to reduce enormous foreign indebtednesses or to purchase sorely needed raw materials, food, and clothing.

Financial writers have dwelt upon the tendency to get away from a metallic currency basis and have been perturbed over the prospect of a permanent abandonment of the gold standard by some countries. They point to the sorry progress all Europe has made in departing from a metallic currency, and to the substitution of paper for gold as being merely one of degree. At one end of the scale is Russia and at the other Great Britain. One of the strongest arguments advanced is that those countries which have inflated their currencies the greatest amount, Russia, Poland, Austria, Germany, and others, show little tendency or willingness to return to a gold standard. Not only are they seemingly content with the present situation but they also take pleasure in exploiting the advantages which a depreciated currency gives them in foreign trade. Indeed, the solution of the intricate problems of sound currency restoration is exceedingly difficult.

The gold standard will not be abandoned—to do so is unthinkable. The mere fact that the two most powerful nations financially, the United States and Great Britain, are still firmly wedded to it will insure its retention. The gold standard is so logical and possesses so many merits that it will win out on any count. What other basis can be used than a metallic one? Paper? What will the paper be based upon? Currency of whatever nature must have something to back it. A gold coin is valuable because of its metallic content. A gold note because it is quickly convertible into gold, and so on. Gold in ultimate analysis represents over twenty dollars of good hard work to produce an ounce, and not a few mines are unable to produce it at that level. The paper rouble or mark is [illegible] the cost of printing, which is negligible. To think that a mere governmental wave of the hand and a stamp upon a piece of paper can take the place of hard work is preposterous.

Some adjustment will finally have to be made with the great amount of gold now in the possession of the United States. As several people have put it, we are only custodians of these heavy reserves. That is a matter which, however, does not involve the abandonment of the gold standard. Heretofore, as economists point out, the surplus accumulation of gold in a country automatically brings its own correction in its effect on price levels and international trade. There is no reason to suppose that the laws of economics will not work to help adjust the distribution of our present huge stocks of the yellow metal.

The gold standard was not adopted in a day, and in the period of its existence it has received many trials, both light and severe. From all of these it recovered, and although it is now undergoing its most trying experience, it will survive. The war shook everything, morally and physically, and there is no reason why the gold standard should have been an exception, but as the world is gradually returning to normal so will the gold standard again occupy its useful position among the nations which have seemingly abandoned it.

The Triumphs of Journalism

WE WONDER SOMETIMES why it is that the large newspapers do not find it advisable to have some one on their staffs who has an engineering training and who keeps informed concerning developments in the various engineering fields; or they might at least refer news stories on technical subjects to someone qualified to pass on them before publication. Three or four weeks ago the *New York Times*, which probably publishes more news than any other American paper, and which has a high reputation for accuracy, also, carried on the front page a long article by Cornelius Vanderbilt on the discovery of oil in the region around Fort Norman, in the Mackenzie River district of northwestern Canada. This was evidently supposed to be highly important news, and was featured accordingly. Yet it contained practically nothing which has not been known since last fall, or at least since March, when the whole matter was thoroughly discussed at the Montreal meeting of the Canadian Institute of Mining and Metallurgy. In fact, the article contained several misstatements, such as that the Imperial Oil Co. was trying to keep the Fort Norman discovery and the conditions attending the finding of the oil deposit a secret. Actually, the Imperial Oil Co. has been [illegible] given the fullest publicity to the geology of the whole region as far as it has been developed.

Of a somewhat different nature was the "puzzle" of a process for tempering copper, which appeared in the New York papers of Tuesday, Aug. 9. In this case the [illegible] *Tribune* [illegible] fell for the story to the extent of over half a column, even stating that the news had been confirmed. The denial, published in the press next day, was, of course, hard to find, being in fine print over in the back pages.

It was a good story, though. The inventor was "an oversea veteran with a wound stripe," a "war hero," according to the headline. "Bunton's discovery is one for tempering copper, an art lost since the days of the ancient Romans." (See *Engineering and Mining Journal*, May 14, 1921, pp. 813 and 826.) "He chanced one day to find a few pages torn from an old encyclopedia lying on an ash pile ready for a match. A picture caught his attention, and he picked up a few sheets. One of them contained an account of an old Roman metallurgist, incidentally a murderer of renown, who knew how to temper copper. The secret died with him. . . ."

"He will receive his money as soon as the discovery has gone the rounds of foreign patent offices. Not until then, by order of the Steel Corporation, is he at liberty to divulge the process. It is known, however, that there are three stages to the process. The first treatment of copper made it harder than copper has been made before when not alloyed, but keeps it still ductile and pliable. The second treatment makes it as hard as steel and the third so hard that it cannot be cut by the best steel saws, files, or chisels."

Then follow the names and official positions of those to whom Bunton confided his discovery, truly an impressive list, and the statement that one million dollars was to be paid by the U. S. Steel Corporation, together with 2c. royalty per pound of hardened copper to be produced. The added fact is given that Mr. Bunton is to be married in October.

Judge Gary said in denial that there was no foundation in fact for the story. At that, the Judge may have been "spoofing," if he was not ready to have the deal made public at the present time; and far be it from us to say absolutely that the story is not true.

Every so often, and it is usually in the "silly season," when the weather is hot, business is poor, and ordinary amusements pall, we are regaled with a story of the wonders of pseudo-science. These may usually be estimated by the technical man at their true worth, but for those newspapers which insist on publishing the whole truth, if there be such, we suggest that reporters be instructed to give all the details. We offer, as an example, a brief working model for release next July:

"Special Dispatch to the Press"

> "Buncombe, Ill., July 1.—What is without doubt the greatest discovery of the century was revealed here last night by Henry Alva, a distant relative of Thomas A. Edison, who made known his process of manufacturing malleable or non-breakable glass, of a clarity and purity not excelled by the finest fragile fabrications of the Tiffany shops. The secret is as old as the ancients, and as little known. A company has been formed to manufacture the new product, and present glass works are already being dismantled. Some of the large milk dealers in the East have advanced two million dollars to Mr. Alva, in return for which he will confine his product to fabrication in the form of milk bottles until the demand for non-breakable bottles is satisfied."

And now comes what the papers are wont to leave out:

> "The discovery was revealed before five friends of the inventor at his home at 2 o'clock this morning, after four old-fashioned glasses and a decanter had been broken. It was suggested at the time that the new product would also be useful for making poker chips. One could see by the strange look in the inventor's eyes before the discovery was announced that something unusual was about to happen.
>
> "Prosperity comes at the critical time for Mr. Alva, who, ever since the war, has been suffering from a piece of shrapnel embedded at the base of the brain, and who will now be able to have it removed. Mr. Alva has invented numerous other things of great importance, which unfortunately are so radical that they have not yet been generally accepted."

Of course, that subject is now killed as news, but there are plenty more. We suggest for the next newspaper outburst the following: a process for artificially petrifying wood so that railroad ties, telegraph poles, and frame houses will last forever.

Strike and You're Out

THE FUTILITY of the strike as an industrial weapon has again been demonstrated at Tonopah and Divide. At a time when men elsewhere were holding on to their jobs, the employees of the mining companies there walked out on April 16, refusing to accept a wage cut of 75c. per shift that had been announced a few days before. Silver was at a dollar, and silver producers were in a better position than others, so why the cut, they reasoned. The operators contended that wages were higher in the district than elsewhere in the West, except in isolated camps; that a decline in the grade of ores being worked offset the increased price of silver; and that the cost of living had lowered appreciably. But the argument was without avail, and the spectacle of hard times in many other camps had no effect: the men walked out and, except for the stragglers that have walked back from time to time, having better sense or less money than their fellows, they have been out ever since. But now the crafts have declared the strike lost, and the miners have made haste to follow suit. Little by little before this the companies had been resuming, securing men from other districts, and it was only a question of time before operations would have again been normal.

Both sides, of course, have suffered—both the stockholders and the men. The paid union officials never lose: strikes may come and strikes may go, but their pay goes on forever. All danger of its stopping is averted at the critical point by calling off the strike. The men are out four months' wages, and it will be long before they recover their former financial position. Those who are always broke are, of course, no worse off than they were before, but the better sort are undoubtedly kicking themselves mentally around the camp for their folly of last April.

As a weapon, the strike has never gained for labor a lasting benefit that could not have been obtained by arbitration and without pecuniary loss to both sides. Strike, and both sides are out of pocket.

The Cinema and the Earth Secrets

THE MOVING PICTURE is beyond question the most powerful means of enlightening and influencing opinion, especially among the rank and file, as who should say, the masses.

Who of us who has frequented these movies—and this should include every one—but has been amused and instructed at the same time by some beautiful depiction of plant or animal life, of far-away scenes that need no lecturer to explain, of manufacturing processes which in five minutes make plain what a magazine article would not—and leaves all indelibly stamped on the brain, as part and parcel of one's experience, not as a lesson conned with mastered attention and memorized with difficulty.

The Bureau of Mines has prepared and is exhibiting a series of excellent moving picture films showing various phases of the mining industry. This is a worthy activity, as it will instruct the public as to the real stern business of mining—a public which is otherwise instructed in mining by the movies only when the hero, having donned high boots and a flannel shirt, exposing muscular bare arms and a noble mien, sticks his pick once—or at most four or five times—into the rock, and then picks out the nugget which is worth a million.

We were not aware that the marvels of geological science had been depicted in action in the cinema. The bizarre possibility comes to us after reading an illustrated article on "How Rocks Grow," by William M. Butterfield, in *Science and Invention*. This is a brief and scientifically correct popular statement of some of the wonders of geology, which, with eight drawings, occupies altogether only a single page! Here indeed is much compressed into little. The illustrations show: (1) glacial action grinding rocks to powder; (2) an active volcano, showing the agency which has a part in forming volcanic rocks; (3) a mountain cascade playing its part in rock disintegration; (4) level strata of rock undisturbed by any changes; (5) the bending and deformation of originally parallel strata; (6) the erosion and upheaval of rocks, forming mountains and making the strata totally irregular; (7) man's mining operation, where he performs the functions of the mole; and (8) mining animal rock (coral rock) in Bermuda.

Many of the geological processes could be shown on the moving-picture screen so effectively that no student would fail to grasp the idea, nor would he fail to pass an examination upon it. It would be interesting to see if the cunning devices of the machine could not also be utilized to make geological changes more vivid for the advanced student and for the man of general culture. We are all familiar with the device whereby a bud blossoms into a flower on the screen before one's eyes, the pictures having been taken at slowly spaced intervals by an automatic timing device. Could not this be applied to geology, and thus forever do away with the popular belief in the everlasting hills?

Where an island of sand and gravel is being attacked by a marine or river current, for example, and within a day or a week or a month is totally destroyed, the cinema could show it to us, dissolved in a minute. Where, after heavy rains, a deep gorge is worn within a few days in some gravel deposit, the machine would show it cut out as by a knife cutting into cheese. It is difficult to foresee the lengths to which this demonstration could go. Doubtless it would be too much to expect that photographs could be taken of glaciers at regular intervals over a number of years, and then speeded up, showing us the ice actually in the motion of flow.

But what we look upon as impossible today is the conversational commonplace of tomorrow. Recently we were looking over a volume of Poe's prose. Now, we recall Poe as the man with the bulging forehead and the wild poetic imagination. One of his stories was staged in the year 2000 and something, and was of the type designed to forecast fantastic advances which the creator imagines may take place in a few hundred years. Poe's imagination took the line of future air travel, and, according to him, in 2000 A. D. they did travel by air. By aeroplane or dirigible? Not at all—by the plain balloon, with a basket, which he had already seen—without direction, and only voyaging in one direction or another by a knowledge of definite air currents in different air layers (which do not exist). When his balloon voyagers wished to communicate with the earth, or with one another, what did his riotous imagination suggest they would do? Wireless telegraphy, wireless telephoning, as they do nowadays—even light-flash telegraph, now antiquated? Oh, no—in the year 2000, according to Poe, they put their messages into a bottle and dropped it into the sea; and maybe somebody picked it up! It is a pity to expose the workings of a giant intellect by the cold light of subsequent checking up; like the financial agency that circularized us, boasting "we advised the purchase last week of Sox preferred at 28, and it is now 35." But the letter arrived a month late, and a glance at the newspaper showed that Sox preferred was selling at 15.

To be a prophet you have to act quickly and then turn the subject. So we shall not prophesy whether or not the next generation may watch upon the screen the formation of mineral veins, speeded up from some X or ultra-violet or alpha and omega ray photography machine which may penetrate the darkness of the rocks and allow focusing at a certain depth. Maybe some succeeding reviewer may find this leap of the imagination tame and falling short of the fact, but we doubt it.

Quantitative Microscopic Determination Of Minerals in Ore Pulp

THE MICROSCOPIC EXAMINATION of ore pulps is useful in understanding difficulties encountered in ore dressing. As ordinarily carried out, the pulp is screen analyzed and the individual sizes are examined. The results in conjunction with assays and analyses enable consistent conclusions to be drawn. The principal difficulty, however, is in making quantitative estimates. At best these are inaccurate, as the individual grains are rough and the lighting is irregular.

R. E. Head, of the Bureau of Mines, describes a novel use of a petrographic method in the June *Reports of Investigations* of the Bureau, which promises to be helpful to everyone interested in ore-dressing problems. It has the advantage of increasing the accuracy of quantitative estimates made by use of the microscope. It consists in taking samples of the screen sizes of the pulp and incorporating them uniformly in molten wax held in a conveniently sized mold. The greater part of the sample settles to the bottom of the mold during cooling. The briquet thus made is polished on its lower surface. The polishing cut can be made as deep as desired and additional surfaces exposed by further grinding. The resulting surface is ready to be examined by reflected light, using the usual equipment. A net-ruled micrometer disk is required for quantitative estimates, and etching with chemicals is possible to bring out differences in the minerals where their surface appearance is not such as to permit of ready identification.

In my opinion this is a practical method of considerable importance in defining limits of ore-dressing methods, and well worth the attention of metallurgists. The Bureau of Mines, in encouraging individual research of this kind in developing adequate methods, is working in the right direction.

WHAT OTHERS THINK

The Zinc Tariff Indorsed

Anent your recent references to the "Metals and Manufactures of" Schedule of the pending Tariff Bill:

There is not a large zinc producer in the United States who is not represented in the American Zinc Institute, and who does not approve of the action of the Institute in regard to a tariff, including those who also produce copper.

The zinc industry of the United States is confidently resting its claims for an adequate tariff on its ore and products upon the conviction that, notwithstanding the fact that Europe's financial and industrial rehabilitation must depend in part upon the sale of her products to the rest of the world, a majority in the House and in the Senate and the President of the United States do not believe that this rehabilitating should be done at the cost of crippling a domestic "key industry," patiently built up through the years to supply the home market at a reasonable price, or at the cost of reducing to the European level the living standard of American workmen especially trained in the industry.

New York, N. Y. S. S. TUTHILL,
Secretary American Zinc Institute, Inc.

Mexico From Without In

Living close to the Mexican border and making periodical trips into Mexico enables me to obtain a general viewpoint of that country from both "the inside looking out and the outside looking in." It has occurred to me that a word of warning at this time would be opportune.

Mexico, the Land of Contrast; the Land of Extremes; the Land of Mañana. And when "tomorrow" comes Mexico will be one of the most productive countries of the South. Her mineral resources have been developed only to a small extent, even though mining operations have been conducted there since the sixteenth century. Her wonderful acres upon acres of grazing lands are largely untouched; her large areas of agricultural and horticultural lands are still mostly virgin soil, and her many mountain streams still remain to be harnessed for both power and irrigation. Truly a wonderful country—a country of remarkable promise.

From Mexico this year will come hundreds of attractive propositions for capital. Mexico needs American assistance. Where there are such opportunities there will be those who will endeavor to interest capital in propositions which are either premature or are not commercial risks.

It must be remembered that Mexico is an old country and yet sadly lacking in most of those things which make America "home" to Americans. Mexico lacks sanitation; Mexico lacks transportation. It matters little that a certain locality can raise an abundance of foodstuffs if its produce cannot be marketed at a profit. Neither does it mean that a mine is worth one hundred thousand dollars if it has developed one hundred thousand dollars' worth of ores. The mine may be so isolated that the net worth of that ore is nil.

Many of the old Spanish mines, the *antiguas* will be placed upon the market, and it is often stated that "if those old-timers could make money from a mine with their crude methods and obsolete ideas, modern methods and equipment can reap fortunes." In this connection it is well to remember that the *antiguas'* labor cost was very small, as their laborers were practically slaves—the element of time was not a factor with them; their initial expense for equipment was very small and usually commensurate with the size of the orebody which they mined out. They could then move on to the next prospect with but little expense.

This is not to discourage investments in Mexico but rather to suggest that one study their problems carefully; be conversant with them from every available angle, before making the investment; look facts square in the face before starting, and then if the investment is sound the chances for success are good. A careful investigation and analysis of conditions is half of the battle.

Americans as a people do not understand either the customs or environments of Mexicans any too well, and for that reason it is often best to look the "home fields" over carefully before undertaking the development of foreign lands and problems. C. A. PIERCE.

Patagonia, Ariz.

The Original Alchemist

I have been also reading with major concern the artikles by both Dr. Davis and the sekondary Mr. John Hirtman of Rathdrum Idaho because they are both guilty of plagerism and nether of these so called scientists have any thing on me because I made gold and platnum and silver and merkury out of cheap metals and barren quartx long before they did as I can prove any time and besides nether of these so called scientists rite like they was real scientists or deep chemists like me. For may years I have been a deep scientist and chemist and I no all about that H too O makes water and such things as are to deep for most mining engineers and most any day if you would drop around to my caben in the Gulch you could see me pouring acids together to recearch science and discover the lost arts as how already I diskovered gold & transmooting like alkemy which is lost art and you would be amased to see the row of deep chemicals on my slelves way out here in the wilderness you would see muratic acid and rock vitrel acid and varous tinctures and several genuine emulshens that I made all alone and I have gone so deep I have made perceptitates that are deeply visible to the eye by a powerfull mikreskope I have. Now this is my own discovery that the deep books dont know or say nuthin about that perceptitates and mollekules are one and the same thing that I diskovered and Dr. Davis or Mr. John Hirtman dont know nothing about this subgect like I do which proves they are faking and now this is the basik principal of my diskovery of transmooting base metals to high grade and I can tell you just how I do it and prove it except there is one thing

I keep sekret and I will put up for fortit one of my best claims in the Gulch that I can make gold. Now everybody knows gold kloride is not real gold now of Dr Davis and Mr Hartman will read this closely and follo me they may see the inner lite. Now follo closely. I will frankely revel all but one vitel pint. I can take some iron or brass fileings and put them in my vitrel acid for a moment onlty to cote them with a laer of rearanged mollekules then i take them out and dri them and emerge them with gold kloride. This is the first or primary step in transmooting and is the basic principal of alkemy. Then I put it all back in some H too O then is where my own sekret comes in for I add some stuff which is gassy in its fundemenatel mollekule perception and which I make in a mystical manner out of base metal pyrite and on of my secret acids and when I add this strong smelling mysterous gassy the final or secondery stage of the transmooting takes place and very visebely one can see the mollekules come out and make the clear sulution full of floting mollekules where there was none before which proves I fundementely made mollekules out of nothing viseble and transmooted. Now I cook it all till there is no more licker and and when I give the dry mass to any of your high fangled assayer fellers they inverbly return high assays and if Dr Davis or Mr. Hartman dont beleve me or any other parteys dont ether just rite me and i will show assay certificates as high as $9,000 to the ton and if that all isent convencing you can just rite to the assayer feller at the Great Eagle Flourspar company who are operating in the next gulch to me and for farther absulite proof you can rite to the manager of this company who witnessed while visiting at my caben and saw my rows of bottles and who was astonished and amazed as he admitted to see my real tinctures and emulsions and see me make molekules out of cler H too O suliten with only gassy as a regent. Now this gassy is the secret I wont tell to nobuddy and if gold kloride was only cheaper and would drop in prices as beens and other cummodetys have done I could transmoot tons of base metals to alloys runnin thousnads of dollars per ton and I no all about mollekules and gasseys and I read all kings of chemists books and I know all about transmooting which they books dont tell of and how different mollekules make eliments like gold and thalium and platnum and how gasseys change one into another more [illegible] on the later metals so eventuly platnum will be as cheep as copper and I have one bull quartz ledge running up my gulch bigger than all Mr Hirtmans 75 ledged put together as they are most likely stringers and pinch [illegible] and platnum will be cheep as soon as the trust stops overcharging robber prices for gold kloride and I pro- [illegible] Sherman ante trust law for when I have to buy a [illegible] of those witch sticks your magezine writes of some- [illegible] I havent got it working yet but will rite you a descriptive on it in a few weeks for publecion and I also use a secret gassey in this also. I will close by aserting that I am the real original transmooter since the art was lost by the Egeptions and I protest agenst giving Dr Davis or Mr Hirtman these honors as I am the originator and I alone know the gassey secret and I wont tell.

JOSUA HARBREN

Lordsburg, N. M.

Mine Taxation in Ontario

Mr. Drury, Premier of Ontario, has been touring the northern part of the province, and has been speaking before several audiences, more particularly to the farmers, which party he represents. He has stated on more than one occasion that the natural resources, forests, and mines must contribute a greater share of the provincial revenue.

Mr. Drury is like a number of other partly educated people who fail to realize that a mine is a wasting asset, and who talk as if the large returns made by some of the northern mines were dividends in the strict sense of the term, and would go on forever. The Cobalt mines have made the largest returns, but the camp has now reached the stage where comparatively small profits are being made from the mining and treatment of its ores.

It is probable, however, that the mining companies themselves, through carelessness and poor accounting methods, are partly to blame for the attitude of such men as Mr. Drury. When they make disbursements to shareholders they always call them dividends. In addition, the Ontario law does not permit the companies to make any allowance for depletion, in making tax returns.

In order, however, that the public and public men should be better informed on this matter, it would seem to be a good policy on the part of the companies, when making disbursements to the shareholders, to state what percentage represented the return of capital and what percentage was profit. Some of the companies intend to make capital disbursements, but though this may be of some assistance, from the point of view of the person who pays income tax, it will have little effect on the public ignorance of what constitutes profit from a mine.

June 25, 1921. A CORRESPONDENT

Experts for the Mining Society Business?

Observance of the editor's reaction to the *National Geographic Magazine* membership idea, and later his temptation to adopt this idea in defense against *Mining and Metallurgy* moves me to the following quotation:

Vice is a monster of so frightful mien,
As to be hated needs but to be seen;
Yet seen too oft, familiar with her face,
We first endure, then pity, then embrace.

[illegible] fully to adopt this vice, I [illegible] technic or procedure today, [illegible] methods into business, is to h[illegible] [illegible]

[illegible]

[illegible] PAUL S. [illegible]

[illegible]

1—THE BULLY HILL SMELTER IN 1901. 2—STALL ROASTING AT BULLY HILL IN 1901.
3—THE AFTERTHOUGHT PLANT AT INGOT

Metallurgical Progress in Shasta County, Cal.

Operations at Keswick, Martinez, Coram, Kennett, Ingot, and Winthrop—New Plant of Shasta Zinc & Copper Co—Zinc Burning In a Reverberatory—The Treatment of Zinc-Copper-Silver-Gold Ores

BY GEORGE J. YOUNG

Western Editor, Engineering and Mining Journal

THE INTERDEPENDENCE of mining and metallurgy is shown in a striking way in the progress of the copper-mining industry in Shasta County, Cal.; also, the conflicting interests of farmer and miner. Important mining operations have taken place at Iron Mountain, Kimberly, Mammoth, Winthrop, and Ingot. The present larger companies are the Mountain Copper Co., Ltd., the First National Copper Co., which took over the Balaklala Consolidated Copper Co.; the U. S. Smelting, Refining & Mining Co., the Shasta Zinc & Copper Co., and the Afterthought Mining Co. Smelting plants were operated at Keswick, Coram, Kennett, Winthrop, and near Ingot. Branch railroad lines were constructed from Pitt to Winthrop and from Bella Vista to Ingot.

The Balaklala properties were connected by a 16,130-ft. Bleichert aërial tram to Coram. Transportation from Mammoth to Kennett was by a narrow gage electric railroad, a 4,000-ft. gravity incline and a standard-gage track with locomotive haulage. At Iron Mountain an eleven-mile, narrow-gage track connected with Keswick. At present, except for the construction and development work of the Shasta Zinc & Copper Co. at Winthrop and the operations of the Mountain Copper Co., Ltd., little activity is to be recorded, and the mines, smelters, and mills are idle.

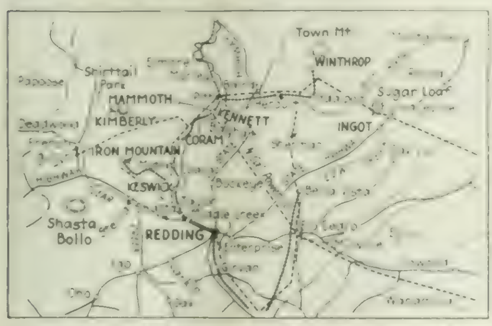
METALLURGICAL PROGRESS

The significant metallurgical development is sketched in the following:

Keswick and Iron Mountain.—A pan amalgamation mill was operated in the 80's at Iron Mountain. It was shut down in 1888. A chlorination plant, the Butters Ore Milling Works, was operated at Kennett in 1889. These were early attempts directed at the oxidized surface ores. The Mountain Copper Co., Ltd., established successful blast-furnace smelting of the high-sulphur copper ores in the late 90's. Pyritic smelting with the aid of hot-blast stoves became the established practice for a time.

The smelting plant at Keswick was discontinued about 1908, and smelting was conducted at a plant not far from Martinez, Cal. This plant contained roasters, a sulphuric-acid plant, and reverberatories. A 150-ton leaching plant for treating low-grade cupriferous calcines was installed in 1917 at Martinez and successfully operated. Near Iron Mountain a 250-ton flotation mill was put in operation in March, 1915, and successfully operated on siliceous chalcopyrite ores, the concentrates being shipped to Martinez. The flotation mill was enlarged in 1917 by a second unit, but this unit was not operated, and the first unit was closed down in March, 1919.

Government restrictions on pollution of stream flow began about 1902, and restrictions on smelter smoke took effect in 1905, although agitation by smoke farmers began in 1898. Since closing down, the operations of the Mountain Copper Co., Ltd., have been restricted to mining and marketing pyrite from its Hornet mine and the manufacture of sulphuric acid and superphosphate at its Martinez plant.



COPPER AND ZINC MINING REGION OF SHASTA COUNTY, CAL.

Coram—The Balaklala Consolidated Copper Co., since taken over by the First National Copper Co., started a smelter in 1908. The equipment was three 600-ton blast furnaces, 56 x 240 in., one 17 x 96-ft. reverberatory, and converters. Fume litigation shut the plant down in 1909. A Cottrell precipitator, then neutralization of fumes by zinc oxide, and the Young, Hall, and Helsewood processes were successively tried out without meeting the requirements of the courts. The mine was closed down in 1914, reopened in 1915, and until May 13, 1919, shipped ores to the Mammoth smelter, at Kennett. Difficulty of meeting the smelter-smoke problem and low metal prices stopped operations. The smelter was recently dismantled.

Kennett—The Mammoth Copper Mining Co. of Maine, subsequently a subsidiary of the U. S. Smelting Co., operated a copper smelter at Kennett. The plant consisted of five blast furnaces and converters. Fume litigation interfered with the operation of this smelter also, and various efforts were made to make the effluent gases innocuous. A Cottrell precipitator was tried, but finally a baghouse and neutralization of the fume by zinc oxide enabled the smelter to operate. An electrolytic zinc deposition plant was erected to recover zinc from the baghouse product. Custom ores from copper mines in Shasta County and siliceous ores from California, Nevada, and Oregon were treated. About two years ago the smelter was shut down, and the mine was closed down in March, 1921. The demoralized condition of the metal market was chiefly responsible.

Ingot—The Afterthought Copper Co. presents an interesting metallurgical sequence. A blast furnace of seventy-five tons' capacity was first installed, and under S. E. Bretherton, as general manager of the enterprise, a fair profit was made. Mr. Bretherton operated the furnace with hot blast and a hot top. The difficulties were many. Coke was obtained from Australia and was hauled over twelve miles of bad roads. A sufficient profit was made to further develop the mine and construct a blast furnace unit of 300 tons' capacity. This was put into operation at half capacity, as sufficient fuel could not be hauled in to operate at full capacity. Until the price of copper dropped below normal, profit was made. The plant was then closed, and the directors of the company determined to make no further effort to operate until some method of saving the zinc had been worked out, as the ores averaged from 14 to 18 per cent of that metal.

In 1917, under a new management, a flotation plant was installed with the object of recovering as concentrates all the metals in the ore and then giving the concentrates a light roast. The roasted concentrates were treated by the Horwood process for the separation of the zinc from the copper concentrates. After considerable expenditure in an effort to make the process work, it proved a failure and was abandoned. Selective flotation was also tried thoroughly, and proved a failure. A reverberatory furnace was constructed, and experimental operation continued for several months, but the low price of metals prevented profitable operation, and the enterprise was closed down. Tests proved the Afterthought ore to be favorable for zinc electrolytic treatment, and a plant for this process was included in the equipment plans, but it has not been constructed. The ore is stated to average approximately 3 per cent copper, 14 per cent zinc, 5 oz. silver, and 40c. gold per ton.

Winthrop—On the Bully Hill property a small blast-furnace and converter plant was operated by J. R. De Lamar until 1905. Stall roasting was practiced, and the flue dust was briquetted and smelted. The capacity was 150 tons per day, and the plant operated successfully. The General Electric Co. assumed control by purchase in 1905, and increased the capacity of the smelter. Matte was shipped to Kennett. A small reverberatory, 35 x 16 ft., was erected for flue-dust smelting.

An increasing amount of zinc in the ores interfered in smelting operations. Litigation over smelter smoke and fume also contributed to the difficulties, and the smelter was closed down in 1910. During this period a branch railroad was completed connecting Winthrop with the Southern Pacific. After closing the smelting plant, ores were shipped to Kennett. A small experimental plant for electrolytic recovery of zinc was installed. Experimental work was concentrated upon electrolytic deposition from zinc sulphate solutions, and the experiments were carried to a successful conclusion. A production of 300 to 400 lb. of zinc was made per day. This campaign of experimental work started in 1911 and continued until 1915.

It is of general interest that the work of J. E. [illegible] as general manager and C. A. Hansen and H. R. Hanley, metallurgical engineers, was in part pioneer work in the hydrometallurgy of zinc and was of material assistance to the subsequent work at Kennett. Great

Falls, Trail, and in Tasmania. In 1917, Walter Arnstein and his associates bought the Bully Hill property and developed additional ore. During 1918, a total of 30,000 tons of copper ore was shipped, and large tonnages of zinc ore were exposed.

A 150-ton flotation mill was completed in 1919 in a building adjacent to the old blast-furnace building. Attempts at selective flotation resulted in the indifferent separation of the copper and zinc minerals. High freight rates to zinc smelting centers also compelled consideration of other methods.

The flotation mill was shut down, and experiments were carried out with the object of finding a more direct method of treating the "complex ore" and of recovering all of the marketable metals. Following initial tests, working-scale experiments were conducted at a Colorado plant, and promising results were obtained. Subsequently, the Shasta Zinc & Copper Co., a new corporation formed by Hayden, Stone & Co., and D. C. Jackling, acquired an interest in the property from Walter Arnstein, and continued the preliminary work, which finally reached such a point that the erection of the plant a description of which is given in this article was begun.

The first difficulty which acted to restrict smelting operations in earlier times was the litigation engendered over smelter smoke and fume. The companies west of the Sacramento River attempted to solve the problem in various ways. The Iron Mountain Copper Co., Ltd., constructed a new plant near Martinez, and avoided further trouble by making sulphuric acid. At Coram and Kennett, exhaustive attempts were made to control the waste furnace gases, with the result that only the Mammoth plant continued to operate. This plant served for a while as a general custom plant for the various mines, but the stagnant metal market eventually caused discontinuance of operations.

The Bully Hill group and the Afterthought, constituting the principal properties east of the Sacramento River, developed important tonnages of zinc as well as of copper ores. The copper ores were handled without much difficulty, but as these ores became scarcer and a greater and greater proportion of zinc obtruded itself, an effort was made to turn the zinc to some account. The intimate association of the zinc and copper made differential flotation a doubtful solution of the difficulty. The cost of railroad transportation for zinc concentrates to smelting centers threatened to eat up whatever profits there might be from flotation concentration. Treatment of zinc ores on the [illegible] by hydrometallurgical processes and electrolytic deposition of the zinc had been experimentally developed and commercially applied to the baghouse fume at Kennett. Electrolytic zinc deposition appeared to offer a solution of the zinc difficulties, but neither company attempted the process on a working scale.

It is an open question whether the electrolytic zinc process as usually practiced can be satisfactorily applied to the zinc-copper-silver-gold ores characteristic of the Winthrop-Ingot area. The ore is low-grade with respect to zinc, and contains a high gangue and iron content, and, in the Ingot ores, calcite. A relatively high copper content is also present. Up to the present, clean, high-grade zinc concentrates have been successfully treated in other places. At both Great Falls and Trail more complex concentrates containing about 30 per cent zinc have been treated, and the successful practice at these points indicates that lower-grade ores of 20 to 25 per cent zinc could be treated.

THE COUNTRY ABOUT WINTHROP. RISING STAR MINE OF THE SHASTA COMPANY AT LEFT CENTER

A clean separation of the zinc mineral by flotation would yield a product that could be handled, but although some of the ores undoubtedly did give good results by flotation, others did not, and a process that would be inclusive of all of the zinc ores did not appear to have been developed. If flotation and zinc hydrometallurgy had been decisively indicated, supplementary smelting of residues could not have been avoided. This would have resulted in a complicated process and plant. Direct treatment of the ore by the zinc electrolytic process and smelting the residues would give a simpler method. Recent improvements in the zinc electrolytic process by U. C. Tainton and N. C. Pring indicate important economies in applying the electrolytic zinc process and render lower-grade zinc ores more amenable to treatment. This might therefore change the status of the electrolytic zinc process as applied to the low-grade zinc ores of Shasta County.

LATER OPERATIONS AT WINTHROP

Investigations at Winthrop, as mentioned before, offered another way out. The method to be used by the Shasta Zinc & Copper Co., in brief, consists of charging a mixture of fine, roasted ore and coal dust into a copper-smelting reverberatory. The heating of the mixture to the temperature of the reverberatory will reduce zinc oxide to zinc and volatilize it. The volatilized zinc will oxidize in the furnace gases and pass off with them to be recovered in the flues. The residual ore mixture will be smelted in the reverberatory in the usual way.

The process is in part protected by patent No. 1,276,058, granted to R. G. Hall, and was developed under that patent in its practical applications by the River Smelting & Refining Co. at Florence, Col. It is evident that the method thus briefly described offers means for the separation of the zinc from the zinc-copper-silver-gold ores available. Experiments at Winthrop and records of its use at Florence indicate its success, but until the present plant has been thoroughly tried out, the future of the process cannot be safely predicted.

The Rising Star Mine, of the Bully Hill group, has been opened down to the ninth level. Large tonnages of ore have been blocked out, with prospects of materially increasing the present tonnage. From assay maps of the old company, which operated several mines, there is good reason to expect greater tonnage, and especially so in the so-called Bully Hill mine. Over one-half of the calculated value of the present ore lies in its zinc content, which averages 22.5 per cent. The copper, silver, and gold in the ore are less than in that mined by the old company. The aggregate value of these metals is such, however, as to make the per-pound cost of the zinc recovery very low.

Clean mining is necessary, and as a consequence square-set stoping or some modification of it will be practiced. The ore will be hoisted to the No. 5 level of the Rising Star, and from this point will be trammed over an 18-in. gage mine track, 1½ miles long, to the crude-ore bins of the smelter. Over the crude-ore bins also are tracks for the receipt of custom ore and ore from the Bully Hill mine. In addition to the crude-ore bins, several bins are allotted for fluxes and a two-day supply of coal. The coal bins are lined with "gunite." The bulk of the coal, principally slack, will be stored in yards. In all there are eight receiving bins constructed of timber and provided with steel chutes and tightly closing gates.

GENERAL VIEW OF SHASTA ZINC AND COPPER CO. PLANT AT WINTHROP

1—Crude-ore bins. 2—Crusher buildings. 3—Old mill and blast-furnace building. 4—Fine-ore and charge bins. 5—Reverberatory building.

DESCRIPTION OF THE NEW PLANT

From the receiving bins a belt conveyor carries the ore to a 10 x 20-in. jaw crusher, where it is reduced to 2 in. size. A 20-in. belt feeder draws the ore from a small surge hopper and discharges into a 37½ x 15-in. set of rolls, where it is reduced to ½-in. size. The discharge from the rolls is conveyed by a 16-in. bucket elevator to a vibrating screen, the oversize going to a second set of 37½ x 15-in. rolls and being returned to the elevator. The rolls are of the heavy-duty type. The screen undersize is automatically sampled and delivered to a conveyor, which is equipped with a weightometer. The coal may be sent through the crusher or bypassed around it. The undersize ore is finally conveyed to any one of eight storage bins of a set of sixteen bins, set back to back in two rows and each having a capacity of 2,200 cu.ft. The remaining eight bins are used for the reverberatory furnace charge, consisting of calcines, flux, and coal. Under each fine-ore bin is a belt feeder which permits a predetermined flow to the conveyors leading to the McDougall roasters.

THE SHASTA PLANT

1—Conveyor from crusher building. 2—Fine ore and storage bins. 3—Roaster building. 4—Reverberatory building. 5—[illegible] 6—Flues. 7—[illegible] 8—[illegible] 9—Baghouse.

The four McDougall roasters are housed in an all-steel building. The roasted ore is discharged to steel-flight conveyors and conveyed back to the opposite side of the storage bins, cooling en route, and sprayed if necessary for further cooling. The calcines are stored in five bins, the remaining three being used for coal and flux. All bins are "gunited" with a lining 3 in. in thickness.

The furnace charge is made up by belt feeders which deliver to a conveyor. A bucket elevator elevates and assists in mixing the charge before it goes into the hoppers of the reverberatory. The reverberatory is of a type common in copper-smelting plants. It is housed in a steel building 55 x 110 ft. Fuel oil will be used for firing. The slag is to be handled in five-ton hand-operated slag pots hauled to the dump by storage-battery locomotives. The matte will be handled in matte cars, cooled, and loaded for shipment in railroad cars.

The waste gases are drawn off into cooling flues and are handled according to the practice prevailing at a modern zinc-oxide plant. Exhaust fans are used to draw the gases through the flue system. All gases are filtered through bags. The baghouse is a steel structure containing four fireproof compartments, each compartment having four transverse hoppers which connect with eighty-eight bags. The bags are 18 in. in diameter and 25 ft. long. Mechanical shaking apparatus is used. The zinc oxide is collected from the hoppers by a vacuum collector which discharges into a rotary air trap. The zinc oxide is discharged from the air trap by a screw conveyor, which delivers to cars, and these in turn to the storage building (93 x 141 ft.)

The storage building contains a number of bins in which the zinc-oxide product can be distributed according to analyses. The object of this selection and distribution is to secure uniformity in product. The capacity of the bins in the aggregate is equivalent to a month's run. A bolting machine, a mixer, and a packer complete the equipment of the storage house.

The buildings, roasting, reverberatory, packing and storage, were constructed of the material salvaged from the dismantling of the Balaklala smelter at Coram. The plant was designed by Bradley, Bruff & Labarthe.

The results of the operation of the new plant, which was started June 7 of this year, will be awaited with interest, as its success will go a long way toward solving the "complex-ore" problem. In connection with the general aspects of zinc burning in the reverberatory, it is worthy of mention that W. R. Ingalls, in his discussion of "Zinc Burning as a Metallurgical Process" (St. Louis meeting of the A. I. M. E., October, 1917), commented on efforts to remove zinc by volatilization in the reverberatory and stated that "It remained for Frederick Laist, at Anaconda, Mont., to make zinc burning in the reverberatory furnace a successful large-scale process. This was done early in 1917 for the extraction of the zinc remaining in the residues of the leaching for electrolytic zinc extraction." Commenting further, he stated: "As between Wetherill-grate burning and reverberatory-furnace smelting and burning, I think it impossible to lay down any hard and fast rules. The subject has been insufficiently studied and analyzed. Reverberatory smelting follows the same lines as for the treatment of copper ore, but sufficient carbon is mixed with the charge to reduce the zinc oxide. No great excess over the theoretical quantity is needed, the conditions being very different from those of the retort for distillation. Nor does it appear that the quantity of coal that must be burned in the fire-box is greatly in excess of what is used in smelting an ordinary copper ore." It would thus appear that the new plant, in its broader aspects, is not without precedent.[1]

Chromite in 1920

Domestic chromite amounting to 2,502 long tons, valued at $44,857, was sold in 1920, according to the U. S. Geological Survey. Before the war the United States produced annually about 250 long tons of chromite. By 1918 the output had risen to 82,430 long tons, the largest ever recorded by any country. In 1919 it had fallen to 5,079 long tons, valued at $129,302. Only nineteen mines shipped ore in 1920, as compared with thirty-three in 1919. Of these nineteen mines seventeen are in California, one is in Oregon and one is in Wyoming. Although California still led in production in 1920, her part was reduced from 64 to 57 per cent of the total. The proportion of the total furnished by Oregon increased from 11 to 38 per cent, but that furnished by Wyoming decreased from 24 to 5 per cent. A small quantity of ore was mined in Montana and in Maryland, but none was shipped from either of these states.

The imports of chromite in 1920, as reported by the Bureau of Foreign and Domestic Commerce, were 150,275 long tons, valued at $1,921,824. This quantity is 30 per cent more than that imported in 1916, the year of next largest imports, when they amounted to 115,945 long tons. Only 61,404 long tons was imported in 1919. Much of the ore imported in 1920 is reported to be carried in stock, and the large imports appear to be due not to any insistent demand for ore for immediate consumption but rather to the extremely low price at which the ore could be purchased in the countries of origin. Rhodesia and New Caledonia supplied 71 per cent of the ore imported.

Ontario's Mineral Production for the First Quarter of 1921

Returns received by the Ontario Department of Mines from the metalliferous mines, smelters, and refining works of the province for the three months ending March 31, 1921, are tabulated below. For purposes of comparison the quantities and values are given for the corresponding period in 1920. Tons throughout are net tons of 2,000 lb.

SUMMARY OF ONTARIO METALLIFEROUS PRODUCTION, FIRST QUARTER OF 1921

	Quantity		Value	
	1921	1920	1921	1920
Gold, oz.	111,096	142,840	$2,296,522	$2,953,036
Silver, oz	2,106,045	2 280,665	1,226,551	2,954,695
Platinum metals, oz.	445	100	19,179	7,172
Copper, lb	1,562,150	1,508,014	206,064	242,630
Copper in matte exported (a) tons	222	1,976	35,520	553,280
Nickel in matte exported (a) tons	519	4,571	259,500	2,285,500
Iron ore exported, tons	22	44	99	322
Iron, pig (b) tons	16,208	13,428	467,538	344,241
Cobalt, metallic, lb	81	46,479	365	108,430
Cobalt, oxide, lb	27,242	213,024	70,075	340,232
Nickel oxide, lb	5,133	1 788,183	2,105	413,944
Nickel, metallic	2,855,698	2 159 316	1,000,240	753,169
Other nickel compounds, lb	2,364	159,183	189	15,308
Other cobalt compounds	..	1,417		1,417
Lead, pig	809,440	509,075	42,832	48,278
Totals			$5,626,779	$11,021,654

(a) Copper in matte was valued at 14c. per lb. in 1920, and 8c. in 1921. Nickel was valued at 25c. per lb. for both years.

(b) Total output of pig iron was 147 345 tons, worth $4,250,347. Figures in the table represent proportional product from Ontario ore.

The mineral industry, with the exception of gold mining, has experienced depression and a general lowering of values in common with most other industries. The nickel-copper and silver producers in particular have been affected—the former owing to lack of a market and the latter because of the prevailing low price of silver. Hydro-electric power shortage, as a result of unusually low water during the fall and winter months, had the effect of seriously curtailing the output of gold and also, to some extent, of silver. The iron and steel trade was quiet during the early part of the year. More recently, however, there has been a decided improvement. The price of lead shows a marked decline, although the output is considerably in excess of the first quarter of 1920.

Algerian Phosphate Industry

According to a report from David C. Elkington, vice-consul at Algiers, there was a total production of 502,931 metric tons of phosphate in Algeria during 1920. Of this amount, 351,221 metric tons was exported.

During the first quarter of 1921 the production amounted to 133,106 metric tons, an increase from the production of the corresponding period of 1920, which was 88,826 metric tons. The statistics, however, show a decrease from the last quarter of 1920, during which period 172,494 metric tons was produced. The exports of the first quarter of 1921 are given as 82,595 metric tons, compared with 44,335 metric tons for the corresponding quarter of 1920 and 128,769 metric tons for the last quarter of 1920.

---

[1] The paper of George C. Stone on the subject "Oxide of Zinc," St. Louis meeting, A. I. M. E., October, 1917, is well worth reading in connection with this article, as it gives full details of zinc burning and the handling of the zinc oxide.

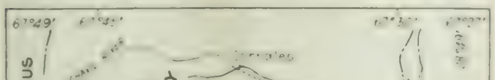
Mining in Argentina

Famatina Copper Mines, in Chilecito District, Most Important Mineral Project in Country, Aside From Petroleum—Gold, Silver, Lead, Mica, Asbestos, and Coal Also Found—Placers at Corrales—Climate Dry—Present Exchange Situation Curious

BY MYRON R. WALKER
Written for Engineering and Mining Journal

THE FAMOUS COPPER MINES of Famatina are on the eastern slope of one of the highest mountain ranges in western Argentina. The Famatina Range lies east of the main Andean Cordillera and rises in the central part of the Province of La Rioja, the plateau at its eastern base having an elevation of about 3,600 ft., the ridge above the mines 19,700 ft., and the highest peak, called Mexicana, 20,300 ft.

The mineral region is roughly a right triangle with a northern base five miles long and an eastern base six miles, and a southwestern hypothenuse eight miles in length. It is locally divided into four minor districts, called, respectively, Mexicana, in the western corner; La Caldera, in the northeastern corner; Cerro Negro, in the southern corner, and Los Bayos midway along the hypothenuse. Of these the Mexicana is the most important and best known and lies at latitude 29-00 South, longitude 67-47 West. The elevation at the mine workings is from 15,100 to 16,500 ft.



MAP OF CHILECITO REGION, SHOWING FAMATINA MINES

EXTREME NATURAL CONDITIONS IMPEDE PROSPECTING AND DEVELOPMENT

The general geology of the region has been roughly plotted in the accompanying sketch. The core of the range is an intrusive rock ranging from quartz diorite through quartz porphyry to dacite porphyry. On the eastern slope of the mountains the adjacent Paleozoic rocks are usually metamorphosed to some extent and include conglomerates, sandstones, quartzites, slates, and schists. Limestone is rare above an elevation of 10,000 ft. In the Mexicana district, which is all above 15,000 ft., the rare atmosphere of 8.2 lb. per sq.in., the steep trails of from 10 to 50 per cent grades, the mean temperature of about 40 deg. F., and the almost daily gales of fifty miles per hour have all contributed to deter leisurely geological studies. The same is true to a lesser extent of the districts of Los Bayos, La Caldera, and Cerro Negro.

It is known that several of the veins in the Los Bayos district occur in the igneous rock. In the sedimentaries the regional surface maps show no mines (except placers) that are more than 7,000 ft. from the igneous contact. It is extremely probable that at the most outlying mines vertical exploration would encounter the igneous contact within 7,000 ft. depth. All the Mexicana mines are on intrusive veins, where the main mineralizations are on veins striking east and west, approximately normal to the line of igneous contact. In veins parallel to the contact, ore is generally found only at and near the intersection with normal veins. The western prolongation of the Mexicana veins toward the diorite contact has not been sufficiently explored. The location of the contact is plainly visible from a distance of two to three miles, as it is marked by a broad belt of yellow to brown limonite. All the Mexicana veins are pyritic. The evidence, then, so far as it goes, points to a body of pyrite at the contact with a capping of oxides, and intrusions from this ferruginous mass into the known vein systems.

LONGEST CABLEWAY KNOWN CONNECTS MINES AND RAILROAD AT CHILECITO

The mines are connected by a thirty-five-kilometer Bleichert cableway with the railroad at Chilecito. The cableway is government owned and constructed, and is operated in connection with the government railroad. It is said to be the longest cableway in the world. About twenty-eight kilometers from the mines there is a short branch cableway, privately owned, connecting the main line with the copper smelter at Santa Florentina, latitude 29-08 South, longitude 67-33 West. Buckets are of one-half-ton capacity. The cableway is operated only during daylight, and this limits its capacity to 300 tons of ore per day. Other considerations, connected with government operation, limit its capacity to 6,000 tons per month.

The severity of the wind currents above parts of the cableway is indicated by cases in which the haulage cable, with its suspended buckets, was wrapped around the rail cable. As the cableway is of use solely to the mines, it has had its ups and downs of maintenance according to mine periods of boom and depression. All machinery and supplies for the mines must be limited to pieces of half a ton or less and must pass the clearances provided for buckets. During regular smelter operations the cable freight cost about 3 pesos per ton. Passengers are carried only by special arrangement and at exorbitant price, and then at their own risk. The trip is sufficiently thrilling during quiet weather and is positively dangerous even apart from wind accidents.

From the railroad at Chilecito, where the elevation is 3,600 ft., there is a seven-kilometer wagon road running northwest to the smelter at Santa Florentina, at an elevation of 4,600 ft. The grade is fairly uniform, at the maximum probably not exceeding 5½ per cent, but the road is not kept in repair, and as it crosses a delta of gravel subject to freshets it is difficult to maintain. The only heavy freight carried over the road is machinery that cannot be handled by the cableway or casual freight requiring transportation during interruptions of cableway service. It requires a twelve-mule team to haul two tons.

FAMATINA AND CHILECITO CONNECTED VIA AUTO

From Chilecito there is a twenty-eight-kilometer road running nearly north to the town of Famatina. This road is kept in fair enough repair to permit the passage of autos except during freshets, when there are certain fords which cannot be passed by any vehicles. The auto trip takes an hour and costs 50 pesos.

From Famatina one travels by bridle trail thirty-five kilometers nearly west to Mexicana. In fair and mild weather the trip can be made on good mules in seven hours. Horses are seldom used, as they more readily develop blind staggers on reaching high altitudes. Pack trains require one and a half days for the climb. The return trip can be made in four to seven hours, depending on the animals and the riders.

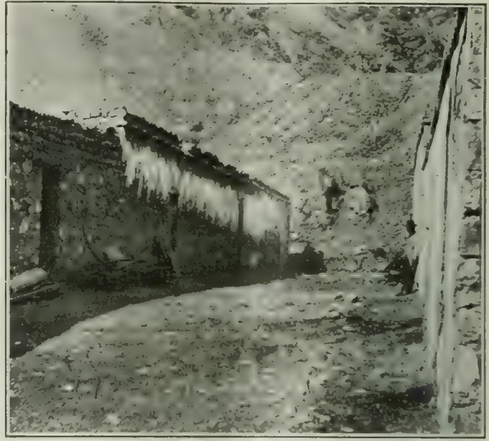
During June and July there are often days when the trail is impassable. The snowfall is not heavy, but the trails lie for the most part along the beds of gulches, into which the snow drifts to depths which prevent passage. At certain fords even a two-foot covering of snow over thin ice is a barrier dangerous to the life of both animal and rider. Snowslides present a further element of danger, both at the mines and along the approaching trails.

The mines are connected by private telephone with the village of Famatina, and here the government telegraph system connects to Chilecito. The mines are further connected by government telephone along the cableway to the various stations en route, including the smelter and the railroad at Chilecito. This line is primarily for the operation of the cableway and will be of little use to the mining operator unless relieved of red tape.

MEXICANA MINES FIRST WORKED BY PORTUGUESE

At the Mexicana mines, the San Pedro vein has been opened along the strike for about 1,100 ft., and along the dip for 600 ft. It was first worked from surface at its intersection with the Espiga vein, a short cross-fracture worked for silver. The date of discovery is not known, but the mine is said to have been worked for silver by Portuguese before Argentine independence. What was once the Espiga mine is now partly open stope and partly dangerous caved ground without accessible approaches. This forms the most eastern development of the San Pedro vein, and it is not known that the vein extends beyond it. Below the original Espiga entrance to San Pedro there are seven levels at intervals of about 100 ft. along the dip of 68 deg. South. The total amount of drifting is approximately 5,000 ft., with raises on 190-ft. centers. There are two crosscut adits. Through the lower of these on No. 6 level all ore passes to the top of a surface gravity tram connecting with the loading yard at the cableway station. The vein when fully explored is seen to be fairly regular, but during exploration frequent hanging-wall slips deceive the miner.

The average vein width is 24 in. and the stoping width 33 in. The line of maximum secondary enrichment in copper is approximately 400 ft. below surface. The silver values fluctuate in the same sense but to a lesser extent than those of copper. The gold is fairly constant and may be constituent of the quartz gangue. There is a tendency to enrichment at wide vertical chimneys. At the lowest level the values are about 6 per cent copper, 5 dwt. gold, and 1 oz. silver.



AT LA MEXICANA MINES, FAMATINA, ARGENTINA, SHOWING WAREHOUSE, STORE AND DWELLINGS. STOCKPILE IN BACKGROUND

The Upulungus vein lies south of and nearly co-extensive with the San Pedro, their strikes converging slightly toward the east. The veins dip toward each other. The uppermost level on the Upulungus is at about the elevation of the deepest San Pedro level. The explored length of the Upulungus along the strike is over 2,000 ft. There are five levels at intervals of about 100 ft. along the dip of 73 deg. North. The total drift development is about 6,300 ft. with raises every 240 ft. Several adits connect to surface.

About 200 ft. above the uppermost formal working, and connected to the west end of the Upulungus by old native workings, is the Mellizas vein, which is doubtless the western prolongation of the Upulungus. No zone of secondary enrichment has been positively identified, as no sharp change in values is to be noted, but there is a tendency toward lower values and greater width with depth. An adit from No. 5 level leads to the loading yard at the cableway station. At this lowest level the values are roughly 2.5 per cent copper, 11 dwt. gold, and 6 oz. silver. The average vein width throughout the mine is 33 in. and the breaking width in the stopes is 45 in. With the high precious-metal content, such stripping of the walls is a wise precaution, but one suspects the motive when it is known that contractors have been paid by the ton, and that the walls drill and break more readily than the quartz vein.

Some work has been done on the Placillas vein where it cuts the east end of Upulungus. At various old adits the Placillas has been cut, but it has not been worked to any extent. This vein strikes southwest from the east end of the Upulungus, and it seems probable that it is identical with the Atacama vein on the south side of Mexicana gulch, the midway portion in the gulch being covered by a heavy filling of detritus from the not infrequent avalanches. The Atacama vein has been developed by two adit drifts for a length of 300 ft. The ore runs about 4 per cent copper, 7 dwt. gold, 4 oz. silver, and is 26 in. wide.

The Gibraltar, White, Anduesa, Verdiona, and Elsa veins have all been worked, but apparently no development was carried ahead of stoping, so no ore is at present blocked out.

UNDERHAND STOPING EMPLOYED THUS FAR

On all veins stoping has been underhand, but portions are prepared for shrinkage stopes with preparatory timber stulls. The scarcity and cost of timber will eventually cause a change from timber stulls to ore pillars, and either mining these pillars, re-treating or possibly abandoning them. On main haulageways the track gage is 60 cm.; on other levels it is 50 cm. The grades are from ½ to 1 per cent. Ore-bin capacity is about 240 tons. There is no working shaft in the district, as the Mexicana gulch supplies the readiest point of attack to all veins by means of adit crosscuts and drifts.

Labor is low-priced but expensive, the production being less than three-fourths of a ton per underground shift. Material placed at the mines costs about 3 pesos for each ton of unsorted ore mined. Man-power only is used. The total cost of sorted ore placed at the smelter is about 14 pesos per ton.

THE SMELTER AT SANTA FLORENTINA

The smelter has been recently overhauled. The present equipment includes 1,500-ton ore bins, 500-ton coal bins, two McDougall roadsters of 75 tons each, two blast furnaces, an 80-ft. reverberatory furnace of 150 tons' capacity, two copper converters, a coal pulverizing and distributing plant, and the necessary mechanical charging apparatus.

The power plant consists of Babcock & Wilcox boilers for an engine capacity of 300-hp., direct-connected Pelton wheels estimated to give 580 hp. at the line shaft, and waste-heat boilers utilizing reverberatory gases. These latter are installed on separate flues, their combined capacity being about 800 hp., but it is possible that they could not both be used to capacity at the same time. Under ordinary conditions it is possible that about 900 total horsepower would be available, of which 560 is needed at the smelter, the remainder to be transmitted to the mines. The proposed transmission line is about thirty kilometers long, using 25-ft. poplar poles spaced 195 ft. and carrying a three-phase circuit at 13,500 v., besides telephone wires.

Under proper supervision the smelting should cost about 15 pesos per ton of sorted ore and recover in the bullion 85 per cent of the metal.

Total overhead charges for all operations in Argentina are about 3.50 pesos per ton. Marketing and refining cost about $82 United States currency per ton of bullion. At normal exchange of 2.30 pesos per dollar, the above costs determine a low limit of mined ore when the contained minerals are worth $17 United States currency per ton. When exchange is around 3 pesos per dollar, as during the early part of 1921, $14 United States currency is the low limit.

The present condition of exchange has resulted in one oddity not generally commented upon. There now occurs the anomaly, practically unknown elsewhere, of United States paper money commanding a 13 per cent premium over United States gold coins. This ratio has existed for some time and is due to the prohibition of the export of gold from Argentina. Departing passengers are allowed to take with them only $500 United States currency in gold coin each, on which they make a profit of about $65. There is very little gold on the general market in Argentina, but plenty in the government treasury, which is accumulating a large reserve to cover its paper issues. Undoubtedly in the aggregate a considerable amount of gold is smuggled out, but it must be in such separate driblets as not to alarm the treasury officers.

OPERATIONS IN LOS BAYOS, CALDERA AND CERRO NEGRO

The veins principally worked in the Los Bayos district are the Los Bayos, Desamparados, San Pedro, Confianza, Irlandesa, San Miguel, and Aida. The Los Bayos mine, after considerable development and sale of ores, finally built a concentrator two miles down the Oro gulch and a cableway to connect mine and mill. The concentrates came back over the same cableway and were sent by pack trains to the government cableway for shipment to the smelter. Operation of the concentrator is said to have been stopped by court injunction against fouling the waters of Oro gulch, as they eventually reach the water supply of the town of Chilecito. None of the mines is now working.

In the Caldera and Cerro Negro districts occur the veins called Aragonesa, Caldera, Caldera Nueva, Espiritu Santo, Peregrina, and others. They were worked from surface for silver, gold, and copper, and are now idle. North of the Caldera district about three miles lies the Encrucijada mine, where a small blast furnace was once operated but on too small a scale of operations for economy. Four miles further north along the contact is the San Juan mine, which has maintained operations for many years on a rather small scale. The copper ore is sent down to Totoral, seven miles by pack train, and there subjected to a chloridizing roast before leaching.

PLACERS LONG WORKED AT CORRALES

Seven miles northwest of the town of Famatina is Corrales, a district of gold placer mining. This is at the confluence of the Achavil, Marco, and Amarillo rivers, all draining the Famatina Range. Gold has been washed from these gravels since the first European expeditions to this district, when the country pertained to the viceroy of Lima, and is being recovered today. These are typical one-man operations. A man or a family can make a good living, but only so long as no hiring is done. Several companies have attempted the work, with disastrous results. Only a few years ago a modern dredge was transported at immense cost and installed here. Today it would be hard to find a piece of the equipment. The simple explanation is that high grading is the accepted prerogative of the placer worker, and every hired man reduces the opportunity for profit. The local inhabitants naturally welcome any enterprise which gives them a chance to get a wage in addition to the gold they recover.

In the provinces of La Rioja, Catamarca, Cordoba, and San Luis there are deposits of merchantable mica. It occurs in pegmatite dikes, nearly vertical in the surrounding schist, the so-called veins varying in width from that of a knifeblade to several yards. The quality is that of stained block, and blocks up to a square yard in surface and several inches thick have been mined. During the war the mining of mica received a great impetus, and many poorly advised concerns went "broke." Those who have stayed in the game and continue to make a profit have not been blessed so much by having any remarkably better deposits to exploit, but owe their prosperity to their more honest business methods and consequent better reputation for reliability.

The current prices for trimmed mica in Buenos Aires are about one-sixth of those quoted in the *Engineering and Mining Journal*. The reason for this is manifold. The dealers feel obliged to reclassify all mica as to grade and size in order to be sure that their deliveries will be accepted, and this reclassification costs money. Then there is a fairly close agreement among dealers as to what they will pay, this agreement amounting at present to a virtual monopoly. Although the export duty on mica from Argentina is negligible, the import duty into the United States is about 30 per cent *ad valorem*. Properties of fair possibilities are easy to acquire, and there is an open field for concerns which can handle their product direct to the United States or Europe without the intervention of various dealers and commission men.

SMELTER OF FAMATINA MINING CO. AT SANTA FLORENTINA, ARGENTINE

In the Province of Jujuy and at possibly other parts of the republic there are lead mines and prospects. The good territory for metallic minerals has been little prospected in Argentina. In the southern provinces are beds of coal sufficiently good to cause the newspapers of the country repeatedly to urge the government to adopt some settled policy regarding the coal fields and their exploitation. They ask government aid because it is hard to interest private capital in ventures which pay less than 25 or 30 per cent per year on the investment, this being the return on the cattle industry, which supplies the criterion for other lines of business that have been established in Argentina.

Some fine asbestos specimens with fibers 14 to 18 in. long have been brought in from the Province of Mendoza, near the Chilean border.

Along the Atlantic coast south of Buenos Aires and about half way to Cape Horn are the Rivadavia oil fields. These were explored by government geologists, and the district was largely reserved for naval use by the government. Recently others have entered adjoining fields, notable among the new-comers being a company associated with large Argentine railway interests which look forward to the use of oil on their locomotives.

CLIMATE DRY IN MINING REGIONS

With the exception of the *pampa*, which corresponds to our western plains and comprises most of the immense republic of Argentina, and of the foothills of the Andes devoted to agriculture, the country is a mountainous desert. In the Andes the annual precipitation is about 10 in., and the altitude prevents the growth of any vegetation except a low mossy grass. In the foothills at 7,000 ft. there is a fog belt, and here are occasional small shrubs. Through the valley from Famatina to Chilecito the annual rainfall is about 5 in., and the only vegetation worth mentioning on this delta terrain is due to irrigation. The mountain streams become lost underground before proceeding far across these deltas, so any irrigation water has to be caught before the streams strike the deltas.

In parts of the country at 3,500 ft. altitude there has been a decided change during the last seventy-five years in either the precipitation or the drainage. A noticeable evidence of this change is at Capayan, about five kilometers east of and midway between Chilecito and Famatina. Here sixty years ago was a smelter handling the Mexicana ores, and there was a thriving farming community. The smelter ruins, the old slag piles, and marks of cultivation still exist. The surface flow of water stopped, and the inhabitants and industries were obliged to move where water was to be had. Darwin's figure of one inch per year for the rate of rise of the Andean mountains could easily explain a diversion of watercourses by the formation of a 4-ft. barrier in fifty years. Where two generations ago the soil produced wheat, corn, barley, grapes and other fruit, there is now only sufficient vegetation to support an occasional armadillo or an ostrich.

Production of Bauxite Declined in 1920

According to the U. S. Geological Survey, 521,308 long tons of bauxite was produced in the United States in 1920, valued at $3,247,345, as compared with 376,566 long tons, valued at $2,201,747, in 1919. The mines in Saline and Pulaski counties, Arkansas, produced 481,279 long tons, or 92 per cent of the total output in 1920. The production from these mines in 1919 was 333,490 long tons.

Georgia ranked second, Alabama third, and Tennessee fourth in production, and the combined output of these three states was 40,029 long tons in 1920, as compared with 43,076 long tons in 1919. In Georgia the bauxite-producing counties, arranged in order of quantity produced, were Sumter, Wilkinson, Floyd, Randolph, Meriwether, Macon, and Bartow. A number of the mines in Bartow and Wilkinson counties that were worked in former years have been abandoned, but new deposits in Randolph County were opened in 1920.

The bauxite imported in 1920, most of it from South America and France, amounted to 42,895 long tons.

1—MORNING CLUB BUILDING AND SECTION OF MULLAN, IDAHO. 2—BILLIARD AND CARD ROOM, MORNING CLUB. 3—BOWLING ALLEYS, MORNING CLUB. 4—A CORNER OF THE READING ROOM, MORNING CLUB

Welfare Work in the Coeur d'Alenes

Extensive Outlay for Improvement of Social Conditions by Two Largest Mining Concerns—Value of Effort Demonstrated—Kellogg and Its "Y"—New "Morning Club" a Model of Its Kind

BY HILLIARD W. POWER

Written for Engineering and Mining Journal

NOTEWORTHY RESULTS in welfare work have been achieved by certain mining companies operating in the Cœur d'Alenes, in northern Idaho, even though the necessity for such work does not exist here to the same degree as in less fortunately situated and more isolated districts. The Cœur d'Alenes are exceptionally favored as to climate, possessing neither extreme heat nor cold, wetness nor dryness. The district is traversed from end to end by one of the finest auto highways of the United States, and can be reached by rail within a few hours from such centers as Spokane, Missoula, and Butte. The population is sufficient to afford the best educational facilities, and the district as a whole possesses residential advantages rarely found in a section where mining operations constitute the main industry. The two chief towns, Kellogg and Wallace, have substantial business blocks and modern paved streets, as well as other facilities that make life in larger cities so desirable to many. Another important town, Mullan, possesses a beauty of location not enjoyed by the others. Burke and Wardner alone retain the picturesque aspect of the early-day mining camps.

Although such advantages make mining community welfare work to a certain extent unnecessary on the part of the corporations directly concerned, efforts to improve housing and general community conditions have been made by two of the largest operators of the district. These are the Bunker Hill & Sullivan Mining & Concentrating Co., at Kellogg, and the Federal Mining & Smelting Co., at Mullan, which at present are employing upward of [illegible] and [illegible] men, respectively.

No effort has at any time been made by either of these two companies to establish company or "closed" towns. But the methods adopted by them differ markedly. Bunker Hill became interested in welfare work over ten years ago; the Federal at a much later date. The latter expended in one allotment over $100,000 for a club building and equipment, itself undertaking all subsequent supervision; the former increased its expenditures by degrees, as if experimenting, but at the same time left details of management and supervision to a national and state organization having no connection with the corporation.

Kellogg, because of recent growth, threatening to rival Wallace, the county seat, as the largest town of the Cœur d'Alenes, has been built up almost entirely because of Bunker Hill's activities. Adjoining it is Wardner, born about 1884 because of preliminary, and now historic, operations up Milo Creek. With the completion of Bunker Hill's great bore, the Kellogg tunnel, just west of Kellogg (and which until then possessed no distinction save as a railway passenger station and freight and ore transfer point), the business life and activity of Wardner, as if by common impulse, moved down the gulch and settled at Kellogg.

Among the fraternal and social organizations involved in this wholesale migration was the "Improvement Club," given over chiefly to cultivation of a good time along intellectual lines. In looking for some means of investing Bunker Hill money in the building up of a model mining community, F. W. Bradley, president, and Stanly A. Easton, general manager, extended an invitation to the Idaho State Y. M. C. A. officials to assist in the establishment of a "Y" at Kellogg. That was over ten years ago. The Y. M. C. A. men stepped into the field, and annexed the late Wardner "Improvement Club," using it as a nucleus for their local organization. The understanding was that the mining company would provide the necessary accommodation for a thoroughly modern Y. M. C. A. and take care of other expenditures where ordinary membership fees were not sufficient for maintenance. Kellogg citizens provided the site for the building through popular subscription. The institution has therefore, appropriately enough, become triangular in its scope, with a national organization, local residents, and the mining company as the three sides of the triangle. All interested testify to the admirable way in which the scheme has worked out. The tenth anniversary of the club's establishment was formally celebrated last February.

GYMNASIUM, KELLOGG Y. M. C. A., KELLOGG, IDAHO

The building, a handsome brick structure, faces the main business street of Kellogg. The initial outlay for construction was $35,000, and $10,000 more was invested in furniture and equipment. There are three stories. The two lower floors are used exclusively by the Y. M. C. A. On the main floor is a reading room, a circulating library with 1,200 volumes, the secretary's office, administration offices, and class rooms. On the lower floor are baths, showers, a plunge, bowling alleys, auditorium, and gymnasium. A Y. M. C. A. secretary and assistants are in charge. The upper floor of the building contains lodge and banquet rooms, the use of which is subject to direct supervision of the Bunker Hill company. The corporation takes care of all ordinary overhead charges, as far as the building is concerned, together with maintenance, and provides each year for additions or renewals. Expenditures on extension and new equipment last year amounted to $7,373.12.

READING ROOM, KELLOGG Y. M. C. A.

Nearly every Kellogg business and professional man, as well as Bunker Hill technical and executive men, hold Y. M. C. A. membership tickets. But with a paid membership of over 400, it is evident the dues would fall far short of taking care of running expenses, considering the scale on which the institution is conducted. All matters are left in the hands of committees, just as in similar institutions elsewhere, nor does the company seek to influence in any way the choice of committees or matters of policy. But one requirement was laid down in the beginning, and that was maintenance of the institution along regulation Y. M. C. A. lines.

Membership is not required of those availing themselves of the advantages of the Kellogg "Y." Those who maintain membership do so more from a sense of civic pride and a sense of appreciation than because of necessity.

Undoubtedly the Bunker Hill company's expenditures on this work have proved a profitable investment. Its influence is noted in the comparative freedom the company has enjoyed from serious labor troubles. Within the last year, and following the tendency of the price of lead to seek a corner in the basement, two sharp cuts in wages have been made, and nothing has been heard in the nature of complaints about capital grinding down the laboring man. Labor radicals, so common and troublesome at times elsewhere, create no interest in Kellogg. Outside agitators, armed with I. W. W. and similar destructive economic doctrines, are allowed every freedom provided by the Constitution, but invariably bump up against a stone wall of absolute indifference when they try to start trouble in Kellogg or among Bunker Hill's employees. And there is nothing that will break an agitator's heart so quickly as cold, stony indifference. Of course, this community welfare work is but one factor, but the Bunker Hill company has an enviable record for loyalty and length of service of employees, and of a high degree of efficiency in all departments of its organization.

FEDERAL COMPANY'S METHODS DIFFERENT

Radically different methods have been adopted by the Federal Mining & Smelting Co. in undertaking a similar achievement at Mullan. The scope is more pretentious, expenditures have been larger, and more direct supervision is exercised over the enterprise. In this institution the company not only provides all the money necessary for the building and equipment of what is probably one of the most luxurious "workingmen's clubs" in the country, but does not permit any individual or organization to assist in its maintenance. This project has appropriately been named the "Morning Club," after the Morning mine, itself located at Mullan, and representing the chief activity of the Federal Mining & Smelting Co.

This institution has no dues. Primarily intended for the use of company employees and their families, its hospitality and advantages are extended to all residents of Mullan on equal terms, as well as to the casual visitor.

The club building is a three-story red brick structure, conveniently situated. It is presided over by a manager and assistants, who devote full time to the work. There is also a ladies' department, and no facilities are provided for the men that the opposite sex does not share.

The building is 50 x 100 ft. in dimensions. On the main floor are the library and reading rooms, a lounging room for men, and a ladies' parlor, as well as the office, a canteen, and lockers for those using the gymnasium.

A large part of the building is taken up by the auditorium, 36 by 65 ft. in plan and two stories high. It has a seating capacity of about 500 and is so arranged as to be available for entertainments of various kinds as well as for motion picture shows. When not required for social affairs, the auditorium is in demand for basket ball, indoor baseball, and similar sports. An orchestra and band have been organized.

On the top floor a large banquet room has been provided. This room is also used for dancing and is a popular place for card parties or table games of various sorts, so that it is much in demand by various town organizations. Adjoining it is an electrically equipped kitchen and pantry.

Much of the space on the second floor is devoted to educational work, and here at certain times each evening may be found Jan Okusklies and Ole Larson endeavoring to improve their knowledge of the English language. Public and high school teachers of Mullan assist in the educational work. Other classes deal with subjects intended to help the mine workers advance in general and technical education. English, naturalization, applied mechanics and drawing are the chief subjects taught.

There are bowling alleys on the lower floor, where contests are held between members of an eight-team league, representative of the various interests of the town and of the Morning mine. Billiard and card rooms are also on the lower floor.

Many of the miners felt a little backward at first about availing themselves of the advantages of the club. They could hardly understand it. Soon after the formal opening, a group of muckers, after coming off shift one day, decided to put on their best and look the institution over. Getting as far as the lobby, they twisted their heads around to see what they could, evidently being somewhat afraid to move. One of them edged toward the main entrance. "Hey, where you goin'?" inquired a companion. "Goin'?" he replied. "I'm goin' home; that's what I'm goin' to do. This layout's too —— swell fer us!"

Happily, they have got over feeling that way by now, and there is hardly a man among the Morning's big crew who does not know of some way of getting personal enjoyment out of the Morning Club. Since it was opened a few months ago, its functions have been expanding and its usefulness has been increasing.

Ontario's Nickel-Copper Industry Quiet In First Half of Year

Both the International Nickel Co. of Canada and the Mond Nickel Co. are operating on a greatly reduced scale from that of the war period. No shipments of nickel-copper matte were made during the first quarter of 1921 by the Mond company to its refinery in Wales, according to the Ontario Department of Mines. Surplus stocks of nickel are gradually being absorbed. The British America Nickel Corporation shut down its smelter on Feb. 26. A reorganization of the company is probable before work will be resumed. Meantime a small force has been doing some underground development work at the Murray mine. During the period 153,387 tons of ore was smelted and 7,568 tons of Bessemer matte produced. The latter contained 3,861 tons of nickel and 2,315 tons of copper. Of the total matte product 3,367 tons was shipped to Canadian refineries at Port Colborne and Deschenes, and 896 tons to the United States. The two refineries treated 2,554 tons of matte for a recovery of 2,853,512 lb. of nickel and 1,562,150 lb. of blister and ingot copper. The average New York price for electrolytic copper was 12.66c. per lb. for the first quarter of 1921, as compared with 18.93c. in 1920.

Advisable Precautions in Reopening Flooded Mines*

There is no assurance that methane will always be encountered in dewatering or recovering long-flooded caved shafts and mines, but in such work it is advisable to take reasonable precautions at all times. Ample air circulation should be provided, and, in general, this can be obtained only by use of mechanical ventilation equipment such as fans, tubing and complementary equipment. When necessary to explore recovered timbered territory which has been under water a number of years, it is advisable to use an approved type of coal miners' safety lamp to test for explosive gas, and if it is found to be present, not only should ventilation be supplied, but the workers should use only the best types of electric safety lamps until it is certain that precautions have been taken against all explosive gas or until such gas has been wholly removed.

---

*[illegible]

BY THE WAY

A Snake Story

G. G. Dobbs, mine superintendent for the Tata Iron & Steel Co., of India, tells the following story:

"The Tata steel plant band was giving a concert from the club house veranda at Jamshedpur and during the concert a large audience was sitting on chairs on the lawn enjoying the music. Near the front of the audience a young American engineer was sipping a '*chota* peg' (whisky and soda) and on reaching down to put his glass on the grass beside his chair, his hand touched something cold and clammy. On glancing down he saw the tail of a snake protruding from his trousers leg, a snake which had just crawled up. Letting out a frantic howl he jumped to his feet and the amazed audience were electrified to see him reach down and with one fell swoop rip his trousers from his body. Then, attired lightly in a B.V.D. outfit, he raced across the lawn and into the club house. Inside the club house he dashed into a room and proceeded to examine his legs for snake bite, much to the interest and consternation of three elderly ladies who happened to be occupying the room at the same time. However, all ended well and no fatality resulted, and, although the young man is still being jollied, he looks happy."

There are many snakes in India and perhaps almost as many stories about them. Snakes, of course, are very fond of milk, which fact lends color to another version of Mr. Dobbs' anecdote. According to this, it was a young cobra that elected to explore the young man's trousers. Quickly grasping the situation, our hero poured the glass of milk that he had been about to drink into a saucer and placed it on the ground, whistling as he did so. Down slid the cobra without delay, making for the milk, where he was promptly dispatched. This version, we think, is much to be preferred for parlor entertainment. The substitution of milk for a *chota* peg and the retention by the young man of his trousers *in situ* are decided improvements. He also kept his composure as well as his trousers, which makes him look more like a hero than ever, or so we think.

We Wonder

Mr. Kreuzpointner's recent article on "The Fatigue of Metals" makes us wonder if copper won't get tired of being in the cellar after a while.

Pennsylvania or Bust

In these days, while domestic silver still enjoys the benefit of the Pittman Act, foreign mines must wait their turn. And just now the wild and woolly West may tremble; for there comes a dispatch from Kinzua, Pa., to the effect that a stampede of horny-handed prospectors is daily expected, trudging along with their mule-loads of all the little conveniences required by men of their humble calling. In due time decrepit Fords may arrive from points more distant than the mine-and-smelter supply centers of Warren County. Kinzua, noted for lumbering and consumption of hard licker, is experiencing the symptoms of a silver-mine boom. Some mysterious strangers have visited a hardware store at Warren, Pa., making inquiries as to the construction of a furnace to treat ore as per samples exhibited. It is reported that assays indicate the ore to be of high grade, with silver in commercial quantity. Old inhabitants are refreshing their memories as to legends that they heard in their childhood days, as the family sat about the fireplace during the long winter evenings. Many tales are current, of ancient mines where the Indians obtained silver to make wampum beads and an occasional god or two. One favored tribe held the secret of the richest mine, a treasure spot rivaling those of the Incas or of Montezuma. Some frightful cataclysm or ordinary landslide closed the entrance and entombed the primitive miners. May we not hope that the recent discovery is that one best bet? Ho! Ye idle consulting engineers of the dark cañons of Wall Street and vicinity. Pack up your hammers and your sample bags, and smile.

Judging by Appearances

"With h'election commin' on, m'son," said Cap'n Dick, "remin's me o' one time in Colorado w'en Benjamin h'Eaton wuz runnin' for Governor o' tha state. Coorse 'ee 'ad to gaw roun' makin' speeches an' shakin' 'ands with the voters, an' 'is manager made h'arrangements for one o' these 'ere big rallys at Central City. Mister h'Eaton wuz a large red-faced chap an' 'ad no trouble makin' friends anyw'ere. H'after tha speech-makin' wuz h'over tha 'ol crowd gaws to one o' tha pubs, w'ere a lot o' tha boys 'oo 'ad jus' come h'off shif' wuz too. Walkin' h'up to tha bar tha manager sez, 'Ere boys commes on an' 'ave somethin', an' shake 'ands with tha Governor, Ben h'Eaton.' 'Been h'eatin,'' sez Jimmy Treloor, 'W'y, dam-me, m'son, 'ee look to me like 'ee been drinkin'.'"

The Deserted Mining Camp

W. O. CLOUGH

Deep in the silence of a mountain vale there lies,
Forgotten and forlorn, a mining camp,
Where once the voice and toil of men were known—
Of men who mined and undermined and delved
And burrowed and dug for precious ores within
The mountain sides. But now no sound is there
Save winds, and birds and beasts that, bold become,
Make home where fear of men had once proscribed.
The one-time streets are grassy lanes today.
The buildings, few and ever fewer, lean
This way and that, scarce struggling now
Against the certain ruin. And on the breath
Of winter winds there shriek the ancient ghosts
Of yesteryear. They wail and moan about
The shattered window frames. Adown the shafts
Of mines long since forgot, they peek and peer
And mock the echoes there. And shrill and high
The winds seem to deride the works of man:

"A-ha and O-ho, little man, so you thought to wrest
From the bosom of earth the secrets hidden there.
You dreamed of conquering the everlasting hills.
Where now your victory—your petty gain?
The lofty peaks scarce felt your feeble scratching
Toil upon their sides. The mighty forest
Was hardly stirred at your advent; the vale
But briefly troubled at your shouts and blows.
A-ha and O-ho, Dame Nature's not to be
So easily won, her riddle solved so soon."

And so the snows of winter howl about.
And down the crumbling chimneys, drops of rain
Patter their scornful laughter in summer time.
And leaves and trees are whispering 'mong themselves
Sly, satiric thrusts at man's defeat.
And ever the winds deride and jeer and shriek
And howl and laugh, mocking vain dreams of men.

CONSULTATION

Imported vs. Domestic Kaolin

"As a constant reader of *Engineering and Mining Journal* I wish you would tell me something about the virtues of the kaolin that is found in the United States. Is it as good as the imported material and about how many localities produce it?"

Most of the china clay or kaolin used in this country is imported from England. In fact, the U. S. Bureau of Mines estimates that about fifty-six per cent of the kaolin consumed in the United States is foreign material. Domestic kaolin resources have never been thoroughly investigated, although this country is reported to contain more white clay than any other. The English china-clay reserves have been heavily depleted, and English potters have attempted to persuade the British government to prohibit the exportation of china clay so that it might be conserved for home use. This circumstance, coupled with the difficulty American potters had during the war in obtaining foreign clay, has led to a more intensive search for a good grade of clay in the United States and has stimulated interest in the subject.

The ceramic station of the U. S. Bureau of Mines at Columbus, Ohio, has undertaken the investigation of the white clays east of the Mississippi River, in order to determine their physical characteristics and to develop better methods of blending and refining. It has been felt in the trade that one important reason for the superiority of imported clay is the more careful treatment and washing given the product and a better general foreign understanding of the technology of clay production and use. According to a recent report of the Bureau, the physical properties of 100 clay samples have been determined and an improved method of clay refining worked out, by means of which the fine grit and most of the objectionable impurities can be removed. Pottery has been made from some of the domestic clay which appears to be equal to that made from imported material.

The production of kaolin, the purest form of clay, is principally confined to the Southern States, although California, Colorado, and Nevada also have produced this material. North Carolina, Virginia, Georgia, Delaware, Indiana, Maryland, Mississippi, Missouri, and Vermont are the chief producing states.

During the war and under the auspices of the Government, Messrs. Bleininger and Ries issued a report on the examination and sampling of clay deposits, in order to stimulate a systematic search for ceramic raw materials in the United States. A copy of this report will be found in "Clay-Working Industries, Silica Brick, and Building Operations in the Larger Cities in 1918" by Jefferson Middleton, issued by the U. S. Geological Survey. Miners and users of clay will find much of interest in this report, which points out that the location, workability, extent and thickness of deposit, visible impurities affecting commercial value, and facilities for purification are important matters to be considered in the prospective operation of any clay mine. Briefly, a good clay deposit should not be located more than six miles from transportation lines, overburden must not be too heavy in proportion to the thickness of the deposit (provided it is to be worked by open-cut methods), and impurities affecting commercial value, such as sand, concretions of limonite, siderite, pyrite, calcite, gypsum, and chert, should be looked for. Most impurities can be eliminated by washing, but to be of commercial value, the clay should contain at least fifteen per cent of refined product if it is of white-burning character. Water supplies are necessary if washing is to be used. The deposit should be carefully sampled and its uniformity ascertained.

It has been found that for some requirements, such as the coating of high-grade papers, clay fillers for paints, and clay for oilcloth, imported clay is superior to domestic. The production of kaolin, paper and ball clay for 1919 is estimated by the U. S. Geological Survey to have been about 280,000 tons, whereas imports for the same period amounted to 180,600 tons, a figure which includes the kaolin and paper and ball clay imported. Imports were little more than half the 1914 rate. Persons having a domestic kaolin deposit will do well to get in touch with the work of the U. S. Bureau of Mines and the Bureau of Standards in the development of the domestic ceramic industry.

Conductivity Standard of Copper

"What is the standard used for measuring the conductivity of copper? Is copper's conductivity compared with silver, and how is it that copper conductivity is sometimes rated as being more than 100 per cent?"

The conductivity of a lot of copper is usually referred to a standard adopted by the International Electrotechnical Commission in 1913, which specified a standard value for the electrical resistivity of annealed copper as 0.15328 ohm at 20 deg. C., for a piece one meter long and one gram in weight. This value is based upon the average values obtained by the various national physical laboratories for ordinary high-grade commercial refined copper in the annealed state.

The Bureau of Standards has investigated the conductivity of commercial copper and has found that even in the purest grades of copper the variation in purity and physical state are sufficient to cause variations in resistance of annealed samples of about plus or minus 1.5 per cent from its own average resistivity, given as [illegible] ohm and determined from tests of many copper specimens. Considering these variations, it is not surprising that copper is found running over 100 per cent in conductivity when referred to either of the above values.

According to the American Society for Testing Materials, electrical conductivity was formerly expressed as a percentage on the basis of a determination made by Matthiessen, about 1860, of the electric resistance of supposedly pure copper. Standard specifications for copper may sometimes refer to a resistivity limit above which copper purchased must not go.

HANDY KNOWLEDGE

Inverted Siphon Tap for Matte Settler

By Julius H. Gillis

Written for Engineering and Mining Journal

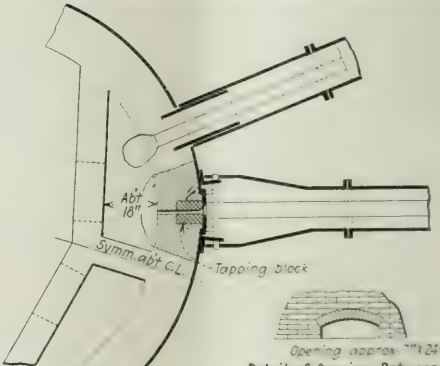
In starting the operation of the copper-nickel smelter of the British America Nickel Corporation near Sudbury, Ont., it soon became evident that the handling of the large flow of low-grade matte was to become a serious problem. The copper-nickel content of the matte averaged slightly over 10 per cent. It is very corrosive, and the large quantities to be handled made the problem especially difficult. As many as twenty-five taps in twenty-four hours from one settler were common practice, and the mechanical and chemical action on the tap hole were accelerated on account of the front of the settler being kept so hot by the continual tapping.

Four tap holes were provided, but they were close together, and although the destructive action of the matte was divided among these holes, they did not give much relief from the heat. In fact, by the better distribution of the heat, they may have made conditions somewhat worse and caused the whole front wall to tend to disintegrate. This would partly explain the frequency with which breakouts occurred around the tapping blocks when the block itself was still apparently sound.

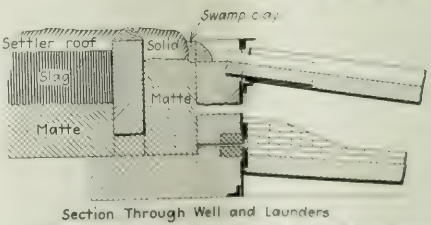
Various arrangements of the tap hole were tried, and the most satisfactory seemed to be with it in the center of a chrome or magnesite tapping block about 8 in. square, the block extending about 10 in. into the settler wall. The block was held in place on the outside with a heavy removable cast-iron plate. This plate had a hole about 5 in. in diameter concentric with the hole in the tapping block. The plate was used simply to hold the block in place, the matte being stopped in the block itself. The cast-iron plate was wedged rigidly to the front of the settler, and various arrangements of air and water pipes were tried to keep it cool, but these were generally found to be of little use.

When the hole in the tapping block became so large as to become dangerous, the cast-iron plate was removed and the tapping block gradually chipped away, being kept cool by a stream of air blown against it. When enough had been removed, the new block was inserted, the cast-iron plate replaced and the tap hole opened up with oxygen.

Although this arrangement was fairly satisfactory, or would have been under ordinary conditions, it was still difficult to keep the settler in working order, and after some disastrous runaways I obtained permission to install what we called the siphon tap. This is shown in the accompanying drawing, and, although the idea is not new,[1] it illustrates an interesting and successful application. The principle on which it works is quite clear from the drawing. Two siphons were installed in each settler and two of the four tap holes omitted. The matte was forced under the arch, and would rise in the well nearly to the level of the slag in the settler. When it was desired to tap, the clay in the overflow was broken away and the slag overflow stopped, and the matte was forced out at about the rate at which the combined slag and matte flowed in from the furnace spout. When sufficient matte had been tapped, the slag overflow was opened, the matte almost stopping of its own accord. A chunk of swamp clay was then dropped in and tamped down. Trouble was seldom experienced in starting the flow, even though no tap had been made for twenty-four hours previously. In case of a freeze-up owing to a long interval between taps, if it were desired to change or relieve the launder, it was always easy to open up the tap hole with oxygen, and after one or two taps the well was sufficiently heated so that there was no trouble in opening the overflow.



Detail of Opening Between Well and Settler



Section Through Well and Launders

ARRANGEMENT OF INVERTED SIPHON FOR TAPPING MATTE SETTLER

Ordinary swamp clay was used for stopping the matte flow, and although much of it was required, it was cheap, being available at the plant in unlimited quantities. By no means the least of the advantages of the siphon was that any helper around the furnace could operate it. If the regular tapper was absent, the helper would generally carry on the work, using the siphons exclusively.

The ordinary practice was to use the siphons for most of the work, and take one tap per shift out of the tap hole so that it would be in condition to use should an emergency require the settler to be drained.

---

[1] Peters, "Practice of Copper Smelting," Pp. 136-137.

When the furnace was blown in, the opening under the arch was stopped with ordinary clay, and a bent bar inserted through the clay. This bar was withdrawn as soon as matte had accumulated to a sufficient depth to cover the arch. It is quite important to keep the slag out of the well, as it becomes sticky and will not flow freely. It is also much more difficult to burn out with oxygen in case of a freeze-up.

The walls of the well are of chrome brick, and originally were built with cooling pipes in them, with the intention of cooling with air, but this proved unnecessary and the air was soon shut off. The well always outlasted the campaign of the furnace, and it would be shut down for other reasons. After one settler had been in continuous use for about seven months, the longest campaign we had, one siphon was in perfect condition and the other would slag occasionally when the settler was nearly empty, indicating that there was probably some failure in the arch. The arched opening in the wall was made rather large, as it was thought that there would be less erosion on the soft hot bricks if the velocity of the flowing matte was kept low.

The launder was a half-round cast-iron trough, about 18 in. wide and in sections about 5 ft. long, connected in makeshift fashion to the settler. The launder proper was held against the outside of the settler and a smaller half-round section laid inside and projected about 8 in. into the settler wall. The whole was lined with magnesite and firebrick. Occasional break-outs would occur around the launder connection, but these were usually easily stopped. If they persisted, the slag overflow would be opened and perhaps the blast would be shut off the furnace a few minutes and a tap taken from the lower tap hole. This was in decided contrast with the procedure when there was a break-out around one of the lower tap holes and the 16 x 30-ft. settler started to empty itself.

Whether the siphon would be of practical use where conditions were such that the quantities handled were less, would, of course, have to be determined by trial, but for the conditions described it solved a serious problem. The element of time has much to do with the capacity of a matte tap hole. This is well demonstrated by the fact that a tapping block will last months when one or two taps are made per shift, but the same block will last hardly a day if used every hour.

A Cheap and Efficient Rod-Mill Lining

BY M. S. PRESLER

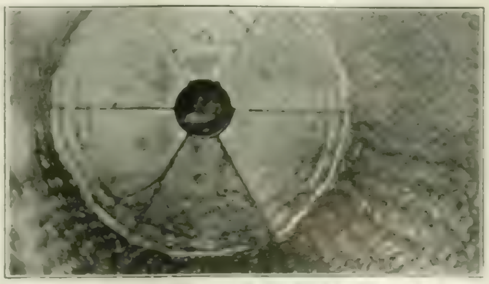
Written for Engineering and Mining Journal

An improved form of lining for the rod mills at the C. O. D. concentrator at Kingman, Ariz., has recently been devised. The ore treated is hard and tough, containing 75 per cent silica, and the mineral is finely disseminated. As a result it is necessary to crush to 200 mesh.

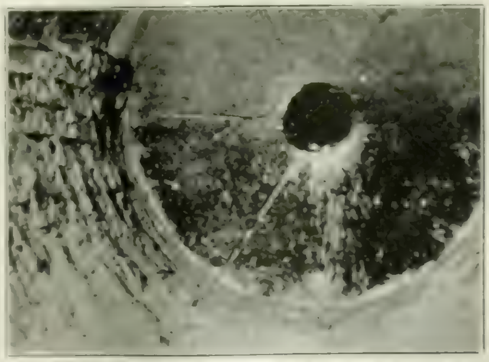
To determine, among other things, what went on in the rod mills while working on this ore, the side manhole plate of one of the mills was removed. A great amount of slipping could be seen taking place with the rod load, the lining used being the smooth plate lining commonly used in rod mills.

I then designed a lining, made up from 16-lb. rails and 1¼-in. cruciform drill steel, cut up in pieces three inches long. The pieces of drill steel were heated red hot, then plunged in cold water, thus making them very hard. By marking the lengths of rails and drill steel every three inches with an Ox-Welding torch the pieces broke off easily. The pieces were cemented in the mill, end up, with a piece of drill steel between the web of each piece of rail, using a quick-setting cement.

The results have been very satisfactory. The smooth plate liners formerly used had lasted approximately sixty days, and the consumption of rods was three pounds per ton of ore ground. The new lining has been in the mill forty days, all indications pointing to a life of twelve months or more, and the consumption of rods has been reduced to two pounds per ton of ore ground. The improved results are due to the fact that the rails, being soft steel, wear slightly below the pieces of drill steel; the butts of drill steel protruding, prevent the rod load from slipping and cause the rods to cascade properly. This was more noticeable after the mill had been in operation about three weeks.



THE NEW LINING AFTER EIGHT DAYS OPERATION



A PART OF THE NEW LINING MADE OF CUT RAILS AND DRILL STEEL

The total cost in making up a set of this lining with new material is approximately 10 per cent below the manufacturer's price of cast lining. This is an ideal way to use up the odd lots of old rails and pieces of drill steel that accumulate around every mine.

To carry drinking water to stopes and other working places, water kegs are often used. A three-gallon oak keg is used for the purpose by the Carson Hill Gold Mining Co. at Carson Hill, Cal. An iron strap is formed to fit the keg. This is bolted at the top by a single bolt, and a double hook is also held by the bolt. By means of the hooks the keg can be hung from the edge of the skip and can thus be conveniently taken off at the levels. A handle is also attached to the keg.

THE PETROLEUM INDUSTRY

Oil-Bearing Rocks of Lower Mackenzie River Valley

Work of Canadian Geological Survey Indicates Excellent Possibilities in Oil Field Now Being Explored in Northwestern Canada

THE SUMMARY REPORT for 1920, Part B, of the Canadian Geological Survey, includes a report by E. M. Kindle and T. O. Bosworth on the "Oil-Bearing Rocks of Lower Mackenzie River Valley."

The district covered by the paper includes the valley of Mackenzie River, from the mouth of Great Bear River in latitude 64 deg. 54 min. and longitude 125 deg. 45 min. to a point a few miles below the site of old Fort Good Hope in latitude 67 deg. 30 min. These limits coincide with the disappearance of the Devonian rocks beneath a Tertiary basin on the south and a Cretaceous basin on the north.

The river route by way of the Athabasca or Peace river affords the only practicable means of reaching this region. The area covered by the report falls within the limits of two rather sharply contrasted physiographic provinces. The Mackenzie a few miles below Carcajou River passes out of a mountain province into a region bordered by a rolling plateau, where the maximum elevation of the lands adjacent to the river is generally between 200 and 700 ft. above it. The Mackenzie Valley from the southern margin of the plateau region above the head of the Ramparts to the mouth of Great Bear River is for 130 miles within the confines of the Rocky Mountains system, which, in this northeasterly region, is called the Mackenzie Mountains. In this area mountain topography alternates with basins floored with Tertiary and Cretaceous beds.

At two or three places in the Mackenzie Valley seepages of oil attracted the attention of explorers, and have long been known. Inland from the river other seepages were reported by the Indians. The tar springs of the Athabasca region were noted as early as 1789 by Sir Alexander Mackenzie. The first report of the Canadian Geological Survey on the Mackenzie Valley states that "the Devonian rocks throughout the Mackenzie Valley are nearly everywhere more or less petroliferous, and over large areas afford promising indications of the presence of oil in workable quantities." The remarkable character of the rocks, and the discovery of advantageous structures rather than the seepages, led one of the authors in 1914 to mark out certain areas as probable commercial oil fields.

Extending over a large area two thick and richly bituminous members exist within the Devonian. The lower of these is the Beavertail limestone, having a thickness of 300 to 400 ft. This limestone is more or less black with solid bituminous matter. It is thought that the bitumen is a fixed component of the limestone and not a variable constituent dependent on the migratory movements of the hydrocarbons in the rocks. In all the exposures of Beavertail limestone at present known the rock is bituminous. All, however, are on the crests or flanks of anticlines. No fluid oil was detected within these beds and no oil seepages emanate from them. All the way northward from Bear Mountain to Beavertail Point—a distance of 125 miles—this bituminous limestone is frequently conspicuous and presumably underlies a large area. The most accessible exposures of the Beavertail limestones are seen at the water's edge at Beavertail Point and near East Mountain and also in the river cliffs of Carcajou Mountain. This limestone is exposed on all the anticlinal mountains, and a few miles inland from the Long Reach along the southwest flank of Discovery Range it has an outcrop 100 miles in length. At depth under favorable structural conditions it is possible that some of the beds in this series may be found to hold accumulations of fluid oil.

It is evident from the geology of the region that the conditions conducive to the formation of oil fields are here very favorably fulfilled. Extending over a large area are 1,000 ft. or more of highly bituminous limestone and shales, from which an immense quantity of the petroleum might readily be generated. And overlying these beds are 2,000 or 3,000 ft. of clay shales and sandstones from which numerous seepages of oil arise. Finally, this mass of petroliferous deposits is traversed by large bold anticlinal folds. The high parts of anticlinal hills are not favorable for oil, since denudation has removed the oil-bearing formations from them. But these main anticlines pitch up and down and probably in some parts of the low flat land on the west side of the river, perhaps along the prolongation of these axes of folding, similar great arches of the petroliferous formations may be present underground. Such would be ideal situations for the accumulation of pools of oil. Away from the crests the dip slopes of the main anticlines present considerable possibilities; for changes in dip or porosity, faults, and minor flexures may result in the accumulation of many oil pools, at quite a distance from the main anticlinal axes. Apart from the large folds the minor undulations may also prove important. In such deposits as these it is probable in any case that oil accumulations will be formed. If large structures are not available the oil will find the small ones. These smaller structures, similar in dimensions, for instance, to the anticlines of the Oklahoma and Texas oil fields, probably occur throughout the territory, both on the dip-slopes and also at a distance from the axes of the main folds.

The discovery oil well is on the flank of one of the large anticlines eight miles distant from the crest. The location of this first test well was chosen in 1914, not as a spot where great production was hoped for, but as a site where a hole of moderate depth could not fail to penetrate the petroliferous formation which had been discovered.

The report is accompanied by a sketch map showing the geology along the Mackenzie River between the Ramparts and the Delta.

Book Reviews

Economic Aspects of Geology. By C. K. Leith. Cloth; 8¼ x 5¾; pp. 431; 13 figures. Henry Holt & Co., New York. Price, $5.

This is a book to which we can heartily recommend the geologist and the engineer, as well as the general reader; the former groups with the assurance that they will find in it an up-to-date discussion of the subject and a novel method of presentation, and the latter for their general broadening in education. This is not a textbook, nor yet a technical book: we have come to anticipate inevitably that books on economic geology will turn out to be treatises on ore deposits; but the title accurately states the field, which is surveyed briefly and lucidly and in all its phases. This is the only book which has ever attempted this, and the work is well handled, with great breadth of vision and with incisiveness.

The first chapter, an introductory one, surveys briefly the economic applications of the several branches of geology. The second treats of the common elements, minerals and rocks of the earth and their origin; the third, of the geology and classification of mineral deposits; the fourth, of the world's mineral resources, quantitatively considered; the fifth, of water as a mineral resource; the sixth of the common rocks and soils as mineral resources; the seventh, of the fertilizer group of minerals; the eighth, of the "energy resources"—coal, oil and gas; the ninth, of the "ferro-alloy" group of minerals; the tenth, of the copper, lead and zinc minerals; the eleventh, of the "precious metal" minerals; the twelfth, of miscellaneous non-metallic minerals; the thirteenth, of miscellaneous non-metallic minerals; the fourteenth, of exploration and development; the fifteenth, of valuation and taxation of mineral resources; the sixteenth, of laws relating to mineral resources; the seventeenth, of the conservation of mineral resources; the eighteenth, of the international aspects of mineral resources; the ninteenth, of "geology and man"; the twentieth, of geology and engineering construction; and the twenty-first, of the training, opportunities and ethics of the economic geologist.

This synopsis will show how broadly the author has viewed his subject, putting into the volume a greater horizon than has before been comprised in any one book. In a little over four hundred pages, it is evident that only the general aspects of each subject could be taken up, but all have been handled pithily and accurately.

Dr. Leith's conception of the field of economic geology is a broad one:

"In short, economic geology includes the consideration of man in reaction to his physical environment. There are some earth materials and some conditions of the earth environment which do not yet come within the field of economic geology. But so large a proportion of them do, that the 'complete economic geologist' should indeed be almost omniscient. When one considers what an insignificantly small portion of this field can be covered by any individual, it is apparent that the title of economic geologist implies no mastery of the entire field. There is yet no crowding" (p. 11).

Students of the development of thought on the origin of ores will be interested in Dr. Leith's opinion as to the origin of the Lake Superior copper ores, that they "were deposited by hot solutions related to the igneous rocks," since this has been by no means the generally accepted explanation.

Though a large part of the volume is necessarily an abridgment or compilation, as all general treatises must be, the general chapters cover phases many of which have not been before summarized; and the author's observations and communications are keen and sound. And he tersely expresses many things that we are familiar with but that will bear printing. "To any one familiar with the mineral field," he says (p. 329), "it is often surprising to see the rashness with which a conservative business man, who would not think of entering another industrial field without close study of all the factors in the situation, will invest in minerals without using ordinary methods of analysis of values."

Regarding apex litigation, Dr. Leith summarizes very effectively the argument to the geologist as a witness in apex cases (p. 354). Many will not agree with him, but his case is well put. Regarding conservation (p. 360), he truly states that "an initial step is obviously a careful taking of stock." But we are perhaps not yet quite ready to adopt the international standard as Dr. Leith appears to be, as a test of conservation, though we perhaps may find it necessary to do it gradually. Dr. Leith says on this (p. 363), "We might work out a program for the United States which would not be the best conservational plan for the world as a whole and which would ultimately react to the disadvantage of the United States. The wisest and most intelligent use of mineral resources seems to call unquestionably for their consideration in their world relations, rather than for a narrow interpretation of local requirements."

Altogether, a book you should read and have handy on your shelf.

J. E. S.

Limestones and Marls of North Carolina. By G. F. Loughlin, E. W. Berry, and J. S. Cushman; 7 x 10; pp. 211. North Carolina Geological and Economic Survey, Bull. 28, 3 figures, 17 plates (including maps). Raleigh, 1921.

The bulletin aims primarily to cover economic phases of the limestone and marl situation, the chief deposits having been mapped and described in previous publications. Part I covers the general properties of limestone, marl, dolomite, marble, and lime. The arrangement is somewhat confusing, as the texture, structure and weathering of limestone appear as subheadings under lime. Part II is devoted to the limestones of western North Carolina. They vary in geologic age from Archean to Cambrian, and are described geographically by counties. They lie in valleys and are mostly concealed beneath soil. Part III comprises a description of the limestone and marl deposits of eastern North Carolina. The marls are the more important. They are discussed from the standpoint of their geological age ranging from Upper Cretaceous to Pleistocene, and are described according to their geographic distribution.

The present and prospective commercial importance of North Carolina's marble and limestone industries is outlined in Part IV. The state's resources in these minerals are limited as compared with those of the surrounding states, with the exception of South Carolina, and there is no prospect of any decided increase in present activity. The most promising fields for expansion are in the production of crushed stone for road building, agricultural lime and limestone, and the manufacture of lime for building purposes, any marked increase in the latter industry being dependent to a considerable extent on the education of builders in the use of high magnesium lime, as the available limestones are chiefly dolomitic or highly magnesian.

The subjects are covered adequately, the treatment of their economic aspects being particularly noteworthy. The bulletin will no doubt be of great practical value to prospective producers, and should lead to a broader development of North Carolina's limestone resources. The publication was prepared in cooperation with the U. S. Geological Survey.

O. B.

Creative Chemistry. By Edwin E. Slosson. Cloth; 5½ x 8; pp. 311. The Century Co., New York. Price, $3.

Mr. Slosson is well known to magazine readers as an entertaining and instructive writer, but he is an authority on chemistry also, and so is particularly well fitted to write such a book as this. The text is in simple language which presupposes not even a knowledge of chemical symbols on the part of the reader, and the book is therefore not too technical for anyone. On the other hand, the trained engineer will not find the subject treated in so popular and superficial a manner as to be unendurable. The subjects of the chapters include Nitrogen, Feeding the Soil, Coal-Tar Colors, Synthetic Perfumes and Flavors, Cellulose, Synthetic Plastics, Rubber, Sugars, Corn Products, Vegetable Fats, Poison Gases, Electric Furnace Products, and Metals. Many other interesting developments of chemistry are not included, but the list is well chosen. We can recommend this as an excellent book for the purpose for which it was written.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

A. I. M. E. To Hold Semi-Centennial at Wilkes-Barre Sept. 12 to 15

Varied and Interesting Program Arranged—Coal Mining Not the Only Subject To Be Discussed—Entertainment for the Ladies

The American Institute of Mining and Metallurgical Engineers will hold its 124th meeting at Wilkes-Barre, Pa., beginning Monday, Sept. 12, and ending Thursday, Sept. 15, 1921. Arrangements have been made to carry the meeting over to Friday in order to enable members to visit points not provided for by the schedule. This meeting will also be known as the 50th anniversary gathering of the A. I. M. E. Anthracite coal and its production will be the chief subject under discussion, and it is one of prime importance to every citizen of the eastern United States. The program is not limited to coal but also includes sessions on metals and geology at which other subjects will be discussed.

Headquarters will be maintained at Irem Temple, and the local committee requests that all members expecting to attend the institute meeting will correspond direct with the chairman of the Hotel Committee, Robert A. Quin. R. V. Norris is general chairman of Committee on Arrangements.

The program, subject to slight change, is scheduled as follows:

MONDAY, SEPT. 12

A.M.

Registration at Irem Temple.

2:30 P.M.

COAL

"Mechanical Mining of Anthracite," by H. D. Kynor.

"The Ashley Planes," by C. H. Stein.

"Anthracite Preparation," by D. C. Ashmead.

"Anthracoal," by Donald Markle.

"The Slush Problem," by John Griffen.

8:00 P.M.

"The Lynch Plant," by Howard N. Eavenson.

"General Description Anthracite Field," with maps and sections, by E. W. Parker.

8:00 P.M.

METAL SECTION

"Application in Rolling of Effects of Carbon, Phosphorus and Manganese on Mechanical Properties of Steel," by W. R. Webster.

"Thacher Process for Molding and Casting Propeller Blades and Wheels," by E. Touceda.

"Making a 5 Per Cent Nickel-Cast-Iron Alloy in an Electric Furnace," by D. N. Witman.

TUESDAY, SEPT. 13

A.M.

Automobile trip through Wyoming Valley, visiting breakers and mine plants. Leave Irem Temple 9 a.m. sharp.

LUNCH

As guests of the International Correspondence Schools, Scranton.

2:30 P.M.

TECHNICAL SESSION

In International Correspondence Schools auditorium.

Discussion on "Mine Fires," by Douglas Bunting.

"Electric Power a Factor in the Anthracite Field," by W. A. Thomas.

"Determination of Electrical Equipment for a Mine Hoist," by Graham Bright.

"The Automatic Substation for Coal Mines," by R. J. Wensley.

AMERICANIZATION SESSION

Meeting of Committee on Industrial Relations for Discussion of Papers. Discussion will be introduced by E. E. Bach, Director of Americanization for State of Pennsylvania, and chairman of institute subcommittee on Americanization.

Return to Wilkes-Barre by special train on Laurel Line.

8:00 P.M.

"The Hoisting Plant of the Pittsburgh Terminal Railroad-Coverdale Mine," by M. D. Kirk.

"Power Installation at Coverdale," by C. M. Means.

"Octagonal Ventilation Shaft of Davis-Daly Copper Co.," by J. L. Bruce.

"Application of Pulverized Coal to Boilers," by J. M. Fuller.

WEDNESDAY, SEPT. 14

9:00 A.M. and 2:30 P.M.

General joint meeting conducted by Society of Economic Geologists.

Papers of the Society of Economic Geologists and the following papers of the institute:

"Stratigraphy of the Anthracite Region." Discussion led by James F. Kemp.

"Petroliferous Rocks in the Sierra da Baliza," by E. P. de Oliveira.

"General Geology of Catorce Mining District," by C. L. Baker.

"Geology of the Namma Coal Field," by Edel Moldenke.

9:00 A.M.

SESSION ON MINE ACCOUNTING

"Capitalization and Valuation of Mine Development," by J. B. Dilworth. (Discussion.)

LUNCH

Complimentary to members and guests of the institute at the Wyoming Valley Shovel Works.

TECHNICAL SESSION 2:30 P.M.

"Queen Nine-hearth Roaster," by J. Moore Samuel.

"Flotation of Pyrite," by W. S. Morley.

"Relation of Gypsum Supplies to Mining," by D. H. Newland.

(Instead members may attend trips as arranged by the Ladies' Committee.)

8:00 P.M.

Dinner and ball at the Irem Temple, given to the visiting institute members by the Anthracite Section.

THURSDAY, SEPT. 15

All-day excursion by automobile, starting from Irem Temple at 9 a.m. Lunch en route.

ENTERTAINMENT OF LADIES

The ladies of the anthracite region are preparing for the entertainment of visiting ladies.

Tentative arrangements have been made for a tea Monday afternoon at the Wyoming Valley Country Club; Tuesday evening a meeting of the Woman's Auxiliary at Irem Temple. The ladies are invited to accompany the excursions of Sept. 13 and 15 and to attend the dinner and ball on Wednesday. In addition, visits will be made to the silk mills and numerous interesting points.

The detailed program of entertainment for ladies will be announced later.

Rossland Section C. I. M. M. Discusses Lead Smelting

The local branch of the Canadian Institute of Mining and Metallurgy held a session at Rossland, B. C., on July 28, attendance being mostly from Rossland and Trail. Papers read included one by James Buchanan, superintendent of the Trail smelter, who dealt with the smelting of lead ores. R. W. Diamond, superintendent of concentration at the Trail smelter, contributed a paper on general ore concentration, and Frank E. Lee, head of the Consolidated M. & S. Co.'s research department, discussed in detail the elements of zinc cells.

C. I. M. M. Will Visit Cons. M. & S. Co.'s Sullivan Mine

Plans are developing for entertainment of the Canadian Institute of Mining and Metallurgy and Columbia Section, A. I. M. E., members of which will gather at Cranbrook, B. C., Aug. 21, for four days of combined business and pleasure. Details are in the hands of the East Kootenay division of the British Columbia Prospectors' Association and the Cranbrook Board of Trade. The main excursion, it is announced, will be to the Consolidated M. & S. Co.'s Sullivan mine at Kimberley, the trip to the mine to be made by auto.

MEN YOU SHOULD KNOW ABOUT

Waldemar Lindgren returned to New York on Aug. 11 from Bolivia, where he has been for several months.

WALDEMAR LINDGREN

W. S. W. Kew is on a trip in lower California.

J. E. Spurr is in New Hampshire for two weeks.

W. Waters Van Ness has returned to the United States from Mesopotamia.

H. D. Phelps has opened an office in the Bashford Building, Prescott, Ariz.

K. C. Heald is investigating reported seepages of gas near Grand Island, Neb.

J. B. Mertie, Jr., is studying the placers in the vicinity of Livengood, Alaska.

Eduardo Enriques has established an office at Paseo Bolivar 802, Chihuahua, Mexico.

G. C. Martin is making a study of mining conditions in the Koyukuk River region of Alaska.

Walter L. Maxson has been appointed assistant professor of metallurgy at the Colorado School of Mines.

Edmund N. Hobert, of the American Smelting & Refining Co.'s Mexican department, is in Los Angeles.

L. B. Weed, general superintendent of the Colorado Fuel & Iron Co., at Pueblo, Col., was in Duluth recently.

Prof. H. E. T. Haultain, of the University of Toronto, is spending part of his vacation in northern Ontario.

A. L. Flagg, of Phoenix, Ariz., was in New York last week. He expects to return to Phoenix about Sept. 1.

Theodore Pilger, mining engineer with the Allis-Chalmers Manufacturing Co., has been in Ohio recently on professional business.

C. E. Newton, of Corvallis, Ore., has arrived in New York after making an automobile trip across the continent in twenty-eight days.

George Roll, mining engineer, who has been in Arizona and New Mexico recently on professional business, has returned to New York.

Dr. Stanley Smith has been appointed assistant in the departments of mineralogy and geology at Queen's University, Kingston, Ont.

Edward B. Durham, engineer for the Standard Chemical Co., at Canonsburg, Pa., has taken a leave of absence and gone to Pachuca, Mexico.

H. S. Munroe, general manager of the Granby Consolidated Mining, Smelting & Power Co., is in New York and will soon return to Anyox, B. C.

Prof. H. L. Smyth, of Cambridge, Mass., consulting geologist of the Cleveland-Cliffs Iron Co., is spending the summer in Ishpeming, Mich.

Horace V. Winchell recently visited the plant of the Mesabi Iron Co., at Babbitt, Minn. Mr. Winchell is a director of the operating company.

W. Lee Heidenreich, who is in charge of the Nipissing Mining Co.'s oil-well operations in Kansas, is in Utah on other business for his principals.

A. E. Fath has been designated as acting geologist in charge of the oil and gas section of the U. S. Geological Survey during the absence of K. C. Heald.

Fred Carroll, vice-president and general manager of the Atlas Mining & Milling Co., and formerly Commissioner of Mines of Colorado, was in New York last week.

M. E. Cassidy, who has been in the employ of the Phelps Dodge Corporation at Bisbee, Ariz., for many years, has been appointed prohibition director for Arizona.

Dr. R. B. Moore, of the U. S. Bureau of Mines, is paying a visit of inspection to the western stations of the Bureau. He will be away from Washington a month.

F. W. Gray has resigned the editorship of the *Canadian Mining Journal*, having accepted a position on the staff of the British Empire Steel Corporation in Montreal.

A. W. Newberry, having completed examination work in Montana, will spend some time in Idaho and other Western states visiting the prominent mining districts.

Harry Mills, Ontario Minister of Mines, has returned from a trip through Minnesota, where he has been making investigations as to the treatment of low-grade iron ores.

M. G. Gulley expects to discontinue his work in the Wyoming oil fields by Sept. 1. W. T. Lee and J. B. Reeside have already concluded their season's field work in that state.

S. R. Elliott, assistant general superintendent of the Cleveland-Cliffs Iron Co., at Ishpeming, Mich., visited the properties of the company and those of the Mesabi-Cliffs Iron Company, a subsidiary, on the Mesabi recently.

O. M. Schaus, superintendent of the Montreal mine for the Oglebay-Norton company, at Hurley, Wis., has been appointed assistant to **E. W. Hopkins**, manager for the company on the Gogebic Range; **R. A. Angst**, superintendent of the Woodbridge mine, at Buhl, Minn., has been appointed general superintendent, with headquarters at Montreal, Wis., with **John M. Price** as superintendent and **V. D. Johnson** as assistant superintendent.

Oliver Bowles, of the staff of the U. S. Bureau of Mines, has been assigned to study means of stimulating slate production and of eliminating waste in its quarrying. Mr. Bowles has been with the Bureau since 1914 as a quarry and mineral technologist. His legal residence is in Minneapolis, Minn. He is a native of Ontario and was educated in the public schools of that province. His higher education was obtained at Lindsay Collegiate Institute and at the University of Toronto. He was graduated from the latter institution in 1907. Following his graduation, he spent two field seasons investigating iron and gold properties for the Ontario Bureau of Mines. He then went to the University of Michigan, where he served for one year as an instructor in mineralogy. He then joined the faculty of the University of Minnesota, where for four years he served as instructor in geology and mineralogy. Just before joining the technical staff of the Bureau of Mines, he was engaged in a survey of clay and building stone for the Minnesota Geological Survey.

[illegible]

OLIVER BOWLES

Mining engineers and metallurgists recently in New York City included: Arthur K. Seeman, [illegible]; Fred B. Ely, Fort Worth, Tex.; O. H. Rheinhold, Washington, D. C.; Bruce G. Middlemiss, Chuquicamata, Chile.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

Walter Fitch, Jr., Co. Claims 427½ Ft. Sunk in Thirty-one Days

The *Engineering and Mining Journal* has received the following telegram, dated Aug. 15, from the Walter Fitch, Jr., Co., which set out on July 15 to break the world's record for shaft sinking in the Water Lily shaft at Eureka, Utah:

"At 8 a.m. today total depth Water Lily shaft 543 ft., making net total advance in thirty-one day period of 427.5 ft. Certified measurement mailed."

New Copper Queen "Congress" Elects Speaker

Grant H. Dowell Addresses the Newly Organized "House of Representatives"

The Copper Queen "Congress" has been organized at Bisbee, Ariz., under the employee representation plan adopted June 28 by the employees of the Phelps Dodge Corporation there. Sam Verran has been elected speaker of the "House" and Robert McCartney secretary. Both are members of the mine force.

In his address to the new "House of Representatives," Grant H. Dowell, general manager, made the plain statement that the organization has not been formed for the purpose of overriding the authority of the foremen and bosses. The constitution was for the purpose of assisting in the enforcement of the square deal for all, he said. "It is the duty of the company to see that the employee is paid a living wage. It is, likewise, as much the duty of the employee to earn that wage. And it is the duty of the foreman and bosses to see that he does earn it." He added that the success of the new representation plan will depend in large measure upon the actions of the representatives whom the men have elected.

Negotiations With Men Succeed at Port Pirie

"Special Cable by Reuters to Engineering and Mining Journal"

Adelaide, Aug. 17—The negotiations for a resumption of work at the smelter of the Broken Hill Associated Smelters Prop., Ltd., at Port Pirie, Australia, have succeeded. It has previously been reported that the men had agreed to accept lower wages. The plant has been closed for some time.

WEEKLY RÉSUMÉ

No developments of note are reported from Washington for the last week. The Rules Committee has declined to advance the war minerals relief measure on the calendar. Representative Rhodes has introduced a bill calling for an investigation into the non-metallic mineral industries with a view to stimulating production. An amendment to the Tariff bill has been introduced which places certain duties on barytes.

It is announced from Mexico City that the government has restored the duties on imports and exports which, as previously announced, had been removed as an aid to mining. A coal strike is again threatening in Coahuila. In Durango construction of the Tepehuanes-Guanaceví railroad has been started. In South Africa, a serious strike is said to be pending at the mines on the Rand over the question of wages.

Reduction in freight rates on smelter products between various western points in the United States and the Atlantic seaboard has been announced. The miners at Tonopah and Divide have declared the strike there lost and have returned to work. In Arizona the employees of the Phelps Dodge Corporation at Bisbee have organized their "Congress" under the newly adopted employee representation plan. The Salida smelter in Colorado has finally been taken over by the Shaw-Davis interests. It is reported that the Alaska-Treadwell interests have entered the Keno Hill district in Yukon Territory.

Freight Rates on Lead and Other Smelter Products Cut

On Aug. 5 the Pacific Coast North Atlantic Eastbound Conference reduced the freight rate on pig lead from all Pacific ports to all Atlantic ports from $8 per ton to $6 per ton. The minimum weight is 6,000 lb. The rate on copper bullion had been similarly reduced the previous week.

G. W. Luce, freight traffic manager of the Southern Pacific, announces that, effective Sept. 12, the rate on smelter products from Cananea and Arizona points to New England points will be reduced from $21.10 to $17.60 per ton, and to Baltimore the rate will be reduced from $20 to $16.50 per ton. These rates apply on shipments via New Orleans or Galveston in connection with the Southern Pacific Atlantic Steamship lines. The rates are intended to compete with those possible via Pacific Coast ports and the Panama Canal.

Mexico Restores Taxes on Imports and Exports as on June 15, 1919

Drops Paternalism Toward Mining Companies—Latter Must Paddle Their Own Canoe

Mexico City—The Federal government has announced that from now on the mining industry must work out its own salvation, free from special tax exemptions on imports and exports as well as special considerations in the way of ground taxes. Every tub on its own bottom. For the future the governmental attitude toward mining will be applied also to oil and agriculture. In brief, the present officials are fed up on paternalism and propose to try the merits of self-help.

A prominent official of the Department of Industry and Commerce in speaking of the situation says: "During the six months that the decree in question has been in force exempting mines from taxes, our products have had more than ample time to secure the readjustment of their exploitation and bring expenses and sales nearer together. That there has been a big drop in expenses favorable to the miner cannot be denied and the government feels that, as it has had part in the readjustment work, it is proper now that the mining companies recognize the necessities of the government by paying with good grace reasonable taxes. It must be recognized that the mining industry cannot consistently claim exclusive rights to be carried when it is known that all the other industries of the country are having their individual problems in the general reorganization of economic conditions."

The official then calls the attention of mine operators to the fact that the mining crisis which affected the country in 1907 was attributed to the monetary reform of 1905 and led mining men to predict a total paralysis of the industry. Contrary to these assertions the crisis was solved without obliging the government to grant any special exemptions in the way of relief from taxations and producers succeeded in working the matter out by economies which caused production of gold and silver, at least, to again become profitable within a short period.

The department believes that the exemption of taxes as a medium of relief for the industry is an economic error. It believes that so long as the miners are permitted to lean on the government they also permit the government to do the worrying; that is, they are disposed to allow the readjustment to work its own way rather than taking an active interest in forcing the situation.

The mining companies do not accept the official view of the situation and insist that unless the government continues its paternal assistance, at least for a time, disaster faces the most important industry of the republic.

The new decree went into effect Aug. 1 and mines are now paying export taxes and import taxes on supplies, consular fees, etc., as per the old decree of June 15, 1919. In view of the fact that metal prices have considerably improved during the past thirty days it is not probable that the tax will interfere with the actual operations in any of the important properties of the country. In fact some of the largest operators concur in the government's contention that the industry will be better in the end without artificial respiration.

Salida Smelter Taken Over By Shaw-Davis Interests

Colorado Operators Hopeful That New Plant May Compete With A. S. & R.

There is much speculation among Colorado mine operators regarding the recent acquisition of the Salida smelter by the Shaw-Davis interests, who are reported to be the principal owners of the Rawley mine, in Saguache County. The Salida smelter was built in 1901 by the Ohio & Colorado Smelting & Refining Co., a subsidiary of the American Metals Co., and was operated continuously until February, 1920. Soon after closing, the smelter was sold to Morse Brothers Machinery & Supply Co., which kept the plant intact subject to a contract for sale.

The Rawley mine is an extensively developed lead-silver-copper property, situated in the Kerber Creek district of Saguache County. It is developed by a 6,000-ft. crosscut tunnel with a 1,200-ft. upraise to the surface. Ten levels have been driven on the vein, with something over 500 ft. of drifts.

At present the American Smelting & Refining Co. operates the only smelters in the state, one at Leadville and the other at Durango. Since 1919 the company has closed down two of its plants in Colorado, the Denver plant in July, 1919, and the Pueblo plant following the flood in June of this year. Ores originating in the southern districts must be shipped to Leadville, resulting in an increased transportation charge of about $1.50 per ton.

Owing to limited production and high transportation and smelting rates, the situation is unsatisfactory to both the operator and the smelter, and the advent of an independent smelter, more centrally situated, will no doubt result in keen competition, and, it is believed, higher prices for the output of the mines.

Strike Off at Tonopah and Divide

Miners Vote To Return, in Spite of Efforts of Radicals—Tonopah Mining Co. Resumes Operations

The strike in the Tonopah and Divide districts in Nevada against a decrease in wages of 75c. per shift, affecting all classes of day labor, and which has delayed operations in practically all mines in the districts since April 16, has been lost by the mine workers. On Aug. 6 the hoist engineers' union announced officially that it considered the strike lost and that all members were free to apply for positions. On Aug. 7 other crafts' unions did the same, and the miners' organization, there being no regular miners' union in these districts, deputized a committee to meet with the operators on Aug. 8 to determine whether old employees would be accepted without discrimination in case they applied for work. On receiving assurance that no discrimination would be shown, they reported back to the miners in open meeting, and after a stormy session the strike was declared off.

The radical element, for personal reasons, attempted to keep the strike in effect, and succeeded in preventing all men from having a vote who are working, even those who have been on strike for almost four months and who went back to work Aug. 7 on assurance that the strike would be called off. The first ballot was a standing ballot and resulted in a vote of 89 to 80 to continue the strike. The conservatives then called for a secret ballot, with the result that the vote stood 95 to 63 to call the strike off. The small vote shows how a few radicals have been controlling the situation; there are about 1,000 miners in the district at present, and at least 400 of these are not working at present.

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Durango, Col.	to New York

Crews are being assembled by all the mines which were affected by the strike, and there appears to be no doubt that conditions in both the Tonopah and Divide districts will be normal within a few weeks. The Tonopah Mining Co. resumed work Aug. 8 with about fifty men. The settlement of this strike will undoubtedly have a beneficial effect on the mining industry throughout all the mining districts in the state.

Recent bullion shipments, representing the results of operations for the two weeks ended July 31, were as follows: Tonopah Belmont, [illegible]; Tonopah Extension, $40,000, and West End, [illegible]. The clean-up at the West End mill was larger than usual, on account of the Halifax company shipping some very high-grade ore to the mill during July. Bullion shipments this month are expected to increase.

Colorado Operators Benefit

American Smelting & Refining Co. Lowers Treatment Charges for Lead and Copper Ores

As a result of the recent reduction in freight rates on lead and copper bullion from Western smelting points to seaboard refining plants, the American Smelting & Refining Co. announces a reduction in treatment charges for lead and copper ores of between 4c. and 5c. per unit of metal contained.

The movement to secure a readjustment of bullion rates initiated by the Colorado Metal Mining Association last October and later joined by the mining organizations of Western smelting states has brought results of wide-reaching effect. The reduced cost of moving bullion to seaboard refining points will be reflected back in reduced smelting charges throughout the West, and means an annual saving of several million dollars to the lead and copper producers.

The following table gives the pre-war rate, the Aug. 10 rate, and the new rate applicable to the principal western smelting points. A differential of $2 per ton in favor of rail and water shipments via Pacific Coast points or from Galveston is also announced:

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
12 [illegible]	22 00	[illegible]
12 00	22 00	[illegible]
[illegible]	22 00	16 50
[illegible]	[illegible]	[illegible]
[illegible]	19 00	[illegible]
[illegible]	22 00	[illegible]
[illegible]	[illegible]	16 50

Based upon the 1920 shipments of bullion, the saving to Colorado operators will approximate $200,000 annually, and to Utah operators upward of half a million dollars.

Tax Dispute at Chisholm, Minn., Still Unsettled

The dispute between the village council of Chisholm, Minn., and the three mining companies, namely, the Hanna Ore Co., the Oliver Iron Mining Co. and the Shenango Furnace Co., over the failure of the mining companies to pay their taxes, is still far from settled. The situation is about the same as it was months ago.

A proposal submitted by the merchants of the village and acceptable to the mining companies, that the tax be fixed at [illegible], with a stipulation that the village limit its expenditures to [illegible] per month and the remaining [illegible] go toward the payment of the village's indebtedness, was rejected by the village council. It is contended by the mining companies that the village can legally levy only a tax of [illegible], which is the limit of taxation on their properties. A counter proposal requesting a larger amount of total taxes and a larger expenditure per month was not acceptable to the mining companies, and to date no other action has been taken by either side. The companies have stated that they will permit the law to take its course.

Utah Power Company To Develop More Power on Bear River

Planned To Add 21,500 hp. to Present Generating Capacity

Unusual interest attaches to the plans of the Utah Power & Light Co., under preliminary permit issued by the Federal Power Commission on July 19, for extensive power developments on Bear River, in southeastern Idaho, as the projected works will impound water for irrigation as well as power, and will complete the utilization of the river for power purposes at all practicable points from Bear Lake, in the mountains of Idaho and Utah, to Great Salt Lake. This will make Bear River one of the most completely utilized streams for irrigation and power purposes in the West.

The completed project will add 21,500 hp. of hydro-electric energy to the generating capacity of the company's system, now capable of developing about 165,000 hp., and will be connected with the big main transmission system now operating at 130,000 volts, extending from Grace plant, in Idaho, to Salt Lake City, a distance of 134 miles, and supplying a population of 300,000 with power, much of which is used in mining and manufacturing. This additional development will give added reliability in power supply, and will serve to steady some of the company's smaller plants located on other streams having variable flow. The company has 33 months to study the amount of water available at each site.

Engineers' Registration Board Organized in Minnesota

Paul Doty Appointed Chairman—Many Expected To Register Promptly

The organization of the Minnesota state board for registration of professional engineers, architects, and land surveyors is practically complete. At the initial meeting all members were present, and the following officers were appointed: Paul Doty, of St. Paul, chairman; N. Y. Tylor, of Litchfield, vice-chairman; and H. T. Downs, of Minneapolis, secretary-treasurer. The other members present were: A. F. Gauger, St. Paul; F. M. McKellip, Faribault; F. G. German and Dwight E. Woodbridge, Duluth. Committees have been appointed, and soon after a procedure for registration is decided upon the board will be able to receive applications for registration. It is expected that many engineers, architects, and land surveyors will avail themselves of the registration privilege. It is possible, under a provision of the law, that applicants who have been in actual service for a stipulated time, and who can conform to the standard set by the board, can register without an examination.

British Iron Mines Reopened

Special Cable by Reuters to "Engineering and Mining Journal"

London, Aug. 9—The Cleveland iron mines, which have been idle since March, were reopened this week, the miners having accepted a further reduction in wages.

Mt. Morgan's Proposal To Resume Work Fails

Unions Reject Offer To Pay Men on Sliding Scale Based on Price of Copper

Brisbane, July 4—A conference that has just taken place between the Mount Morgan directors and the union representatives, which it was hoped would have ended the present stoppage of work, has unfortunately proved abortive. The company's proposal was for the men to be paid on a sliding scale based on the ruling price of blister.

Furnaces in Blast

At the beginning of August the following furnaces were in blast at the plants named (the list is by no means complete):

Plant	No. of Copper Furnaces	Cop. Furnaces in Blast	No. of Lead Furnaces	Lead Furnaces in Blast
Trail	3	1	4	2
Granby (B. C.)	4	4	..	
Calumet & Hecla	24	2	..	..
Quincy	6	1	..	..
Michigan	5	2	..	..
Peñoles Co., Torreon	1	1	8	3
Peñoles Co., Mapimí			6	.
A. S. & R., [illegible]	3		3	
A. S. & R., Chihuahua			8	8
A. S. & R., Aguascalientes	8	2	2	1
A. S. & R., Monterrey			8	
A. S. & R., Matehuala	4	4		
Midvale, Utah				4*
International, Utah				0
Murray, Utah				4
Tacoma, Wash.	4	1		
Northport, Wash.	..	..	3	..

* Also one on matte concentration. No furnaces were in blast in Arizona.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Assessment Work Bill Awaits President's Signature

The Senate has passed without amendment the bill changing the assessment work year from a calendar to a fiscal year basis. The bill has already passed the House and now goes to the President for signature, which is assured.

Hearings on Mining Law Bill Expected in December

Ample Opportunity in Meantime for Thorough Discussion of Its Merits —Many Copies Distributed

Hearings on the bill providing for fundamental changes in the mining law are expected to begin in December. Representative Arentz, who introduced the bill, states that he will request that the hearings begin about the middle of December. This will give ample time, he believes, for all concerned to study the bill and make any suggestion desired as to its amendment. He has made arrangements with Director Bain of the U. S. Bureau of Mines to classify these suggestions as to amendments which should be made in the bill as drafted. All letters received in connection with this legislation will be studied by the legal division of the Bureau of Mines and a digest made of all suggestions.

Mr. Arentz points out that the matter of revising the mining law has been agitated for a number of years and that the purport of this legislation now should be well understood. Since July 12 the draft of the law as recommended by a committee headed by W. R. Ingalls has been available for distribution to anyone interested. By the middle of December a reasonable length of time will have been allowed for study of this draft. At that time a further opportunity will be given for an oral presentation of any objections which may be advanced. An opportunity also will be afforded for proponents of the legislation to point out the urgent needs for its prompt enactment. Mr. Arentz believes that the matter will have been pending long enough at that time to have given everyone concerned a fair chance to present his views. He expects to press the legislation and anticipates that the Committee on Mines and Mining will recommend his bill for passage after such amendments as may be found necessary to meet the objections which may be raised.

The revision of laws bill was introduced by Mr. Arentz in exactly the form that it was submitted by the Ingalls committee. Mr. Arentz himself expects to have some amendments to offer when the bill comes up before the committee.

About 2,500 copies of the bill already have been distributed, and requests for the document are being received in increasing numbers each day. Arrangements have been made so that all legitimate requests for a copy of the bill can be filled. Copies may be secured by applying to Representative S. S. Arentz, Washington, D. C.

No Preference for War Minerals Relief Bill

Measure Must Await Turn in Regular Order, Says Chairman of the Rules Committee

Refusal by the Committee on Rules to grant any preference to the bill liberalizing the War Minerals Relief Act disposes of any possibility of securing early action on that measure. The bill will not be reached in the regular order before the Congressional recess. Representative Rhodes, the chairman of the Committee on Mines and Mining, did all in his power to induce the Rules Committee to provide for priority in the consideration of the war minerals relief amendment. The chairman of the Rules Committee pointed out that many matters of greater importance to the people as a whole are before the House and could not be deferred for the consideration of the war minerals bill.

Tariff Amendment Changes Duty on Barytes

An amendment to the tariff bill providing that barytes ore is to be dutiable at ½c. per lb. has been introduced by Senator Spencer, of Missouri. In addition, the amendment provides that the ground product is to be dutiable at ¾c. per lb., and the precipitated barium sulphate is to be dutiable at 1c. per lb.

Production of Non-Metallic Minerals Needs Stimulating, Says Rhodes

Introduces Bill Authorizing Investigation of These Industries—Should Heed Lesson War Taught

With Congress prescribing particularly high rates of duty to foster the chemical industry, Representative Rhodes, the chairman of the House Committee on Mines and Mining, believes the Government should undertake a comprehensive program looking to the stimulation of the production of non-metallic minerals from which the chemical industry draws much of its raw material. It is Mr. Rhodes' intention to concentrate his efforts toward securing such action. He is assured of the unanimous support of the Committee on Mines and Mining.

As the first step of this program, Mr. Rhodes has introduced the following bill:

"That the United States Bureau of Mines be authorized and directed to carry on investigations as follows:

"1. To conduct inquiries and scientific and technical investigation in the United states and its territories concerning the mining, treatment, and utilization of non-metallic minerals, such as sulphur, phosphate rock, feldspar, potash, mica, graphite, talc, barytes, limestone, and so forth with the main object of elimination of waste both in their production and utilization.

"2. To conduct investigations for the purpose of aiding in the efficient production of the non-metallic and other mineral raw materials for the chemical industry, and to investigate and obtain fundamental data needed for the efficient production of chemical products from mineral sources."

Mr. Rhodes points out that no other industry was developed during the war to the same extent as was the chemical industry. A natural complement of tariff protection for the industry is the stimulation of the production of such domestic raw materials as that industry can utilize, Mr. Rhodes believes. He contends that the development of the non-metals has lagged far behind that of the metalliferous minerals. As evidence of that contention, Mr. Rhodes points to the action of Congress during the war in authorizing an appropriation of $50,000,000 in an effort to stimulte the prompt production of a number of minerals then urgently needed for war purposes. Among them were about forty non-metals. "Now that the war is over," said Mr. Rhodes, "we are content to settle back comfortably and allow ourselves to follow the line of least resistance and continue to buy our non-metals from foreigners. When the country needed these minerals most we found that they were undeveloped. We have had our lesson. Now there is no excuse for our failure to achieve economic independence in practically all of the non-metals."

NEWS BY MINING DISTRICTS

London Letter

Strike Possible at Mines on Rand; White Workmen Resisting Proposed Wage Reduction—Globe & Phoenix Ore Reserves Declining

By W. A. Doman

London, Aug. 2, 1921—At the time of writing it would appear that a strike is threatened in connection with the mines of the Rand. The position has become serious for the Chamber of Mines insists upon a reduction of the wages of white workers, and the latter are resisting. Cablegrams on the subject from Johannesburg are of a somewhat misty and conflicting character. Last year when gold was selling at a high price and the cost of living was rising the men demanded, and obtained, advances in wages amounting to [illegible] per week. As at least half the number of mines are only kept going by the gold premium the chamber is alive to the necessity for reducing working costs, and it is apparently mainly in wages that this can be accomplished. The suggestion put forward was moderate, 2s. per shift, to be accompanied, however, by a fair day's work, for it is recognized that the men do not give this. Simultaneously with the proposal the price of gold rose again, and the matter appeared to the men to be unwarranted. The reduction was consequently made 1s. 6d. per shift. To this, however, the miners will not agree, and after numerous meetings the executives of the various unions concerned have recommended a strike. The attitude they adopt is that half the 48s. weekly, and any advances based upon it, should be consolidated as wages, the balance to vary according to the cost of living. An immediate strike is not contemplated, as the leaders have approached the chamber to find a way out of the difficulty. So far as can be gathered the chamber is rather [illegible] and from this side is being urged to stronger action. In London, where the bulk of the money is found, it is rumored that the [illegible] per shift conceded last year should come off.

Matters are made rather more difficult in this way. Directors of some mining companies contend that operations cannot continue, while the management of others is looking to the future and arguing upon profits that will be made owing to the probable continuance of the gold premium for several years. In the latter respect they are doubtless correct, but at least half the companies will never re-enter the dividend list, even with the premium. Investors in Kaffirs have become heartily sick of hearing of the high price at which the product can be sold, and of getting no return upon their outlay. The result is that the share market is quite lifeless. Only the high-grade mines report a divisible surplus, and with two or three exceptions they are unable to reduce their level of costs. Sir Lionel Phillips has left for the Cape and it is hoped that he may be able to find a solution to the problem.

A steady but serious decline is taking place in the ore reserves of the Globe & Phoenix mining company. This may be shown as follows:

	Tons	Value at standard price
Dec., 1918	[illegible]	[illegible]
Dec., 1919	[illegible]	[illegible]
June, 1920	[illegible]	[illegible]
June, 1921	[illegible]	[illegible]

As the mine has produced the whole time it is expected that a serious mantity of new ore has been added, but a distinct drain is noticeable. The position, too, is affected by the fact that at the end of 1920 rather more than 50 per cent of the reserves was in the form of pillars, and consequently is not immediately available for treatment. A few months ago some very high-grade ore was being opened up. The reef, however, was narrow, and as little has lately been heard of this development it may perhaps be inferred that its importance is not great. The directors have not led shareholders to expect great things, as much depended upon whether this new reef junctioned with the old, and so made a good solid orebody. As things go, the value of the reserves is high—30.39 dwt. per ton—but on the present occasion no mention is made of the tonnage of ore in pillars, nor its gold content.

CANADA

British Columbia

California Mine at Nelson Resumes Operations

Nelson—Announcement has been made of resumption of active operations at the California mine and Athabasca mill, the latter being under lease to the California operators. Considerable money has been spent during the last two seasons in modernizing the mill.

Sandon—The Silversmith Mines, Ltd., continues to employ about thirty-five men in making the changes involved in amalgamating the Silversmith and Ivanhoe milling equipment, and in the construction of the new tramway from the Silversmith mine to the Ivanhoe mill site.

Greenwood—Local residents have begun active development of the Riverside property near Rock Creek.

Trail—Shipments received at the Consolidated smelter the week ended Aug. 7 totaled 7,837 tons and were as follows:

Mine	Locality	Tons
Freddy Lee,	Sandon	24
Knob Hill,	Republic	85
Kokomo,	Beaverdell	8
North Star,	Kimberley	46
Majestic,	Sandon	5
No. 1 Mine,	Ainsworth	33
Surprise,	Republic	322
Skyline,	Ainsworth	20
Whitewater,	Retallack	39
Bingo		826 lb.
Company Mines		7,255

Nelson—Free milling gold is reported as having been found on the Gold Tread claim of Terzian Bros., at Mankin Siding, on the Nelson & Fort Shepherd branch of the Great Northern Ry. Sampling gave an average of $10.40 per ton in gold. The owners have refused to consider a bond for a substantial sum, it is reported.

Invermere—The Toby Creek Mining Co., Ltd., owning claims on the creek of the same name, is making a test shipment and upon the results will determine whether or not to proceed with mill construction.

Ontario

Results at Silver Islet Disappointing—Temiskaming May Be Reopened

Silver Islet—The syndicate which recently unwatered the old Silver Islet mine on the north shore of Lake Superior has found that the old Cornish miners who worked this property did not leave much behind. It was thought that all of the roof of the stope under the lake was in high-grade ore, but when the mine was pumped out high-grade ore was found in only one place. While there is little question but that the old roof does contain ore it has been decided that it would be too expensive to mine. The company will however drive a 1,200-ft. crosscut in the hope of picking up other veins. This property was opened in the earlier 60's of the last century and produced about 3,500,000 ounces of silver.

Porcupine—In the last three months profits from the Dome Mines, Porcupine, have been in the neighborhood of $250,000. The company can easily pay 20 per cent dividend and in addition can make a capital reduction if it seems desirable. The president has stated that the latter is probable and it is known that some of the directors are favorable to it.

Porcupine still continues to be the high wage camp of northern Ontario, and operators in other camps are beginning to wonder if the intention is to maintain them and draw the best miners to the Porcupine mines. The Porcupine scale is now about 75c. a shift higher than other camps. When the silver and nickel camps reduced wages, the gold camps did not follow suit, because with six years of unfavorable operating conditions behind them they did not want to do anything to stop the supply of men from coming to the camp. It is now felt, however, that with a plentiful supply of labor and operating conditions in favor of the companies, something should be done. It has, however, always been difficult, due chiefly, it may be said, to the Hollinger, for the operators in Porcupine to get concerted action, and this case will probably be no exception.

Cobalt—W. J. Post, who has a lease on the Silver Queen, has started to ship ore to the Bailey concentrator.

The Castle property in Gowganda, which lost its power plant by fire some time ago, has closed. The company has some good ore, but needs to be refinanced before operations can be started again.

There is some talk of reopening the Temiskaming. The company has a considerable supply of broken ore in the stopes in addition to a large tonnage of old tailings. A plant was constructed to treat these a short time before the property closed.

The Nipissing company during June mined ore of an estimated value of $166,363, of which $140,983 was silver and $25,380 cobalt, and shipped bullion from Nipissing and custom ores of an estimated net value of $223,057. The low-grade mill treated 7,258 tons and the high-grade plant 185 tons.

Toronto—It is stated that the Northern Light Railway Co. has completed the sale of its bonds issued to finance the construction of a narrow-gage railway to the outlying mining camps east and west of Swastika. Engineers will be at work in a few days, and actual construction will begin soon, with the object of completing the line east to Larder Lake and west to Fort Matachewan before winter sets in. The sale is understood to have been made to a bond house, and it is thought that the financial arrangement provides for a weekly payment from the purchaser to the railway company.

MEXICO

Federal District

Mexico's Mineral Output in Year Ended June 30, 1921

The mineral output of Mexico for the twelve months ended June 30, 1921, is given by the Department of Commerce and Labor as follows: Gold, 10,420 kg.; silver, 922,312; copper, 46,056,900; lead, 121,434,066; zinc, 14,363,057; mercury, 77,229; antimony, 1,572,376; graphite, 2,911,529; tungsten, 34,917; tin, 1,588; arsenic, 1,198,806, and manganese, 838,624.

The same authority announces that there are 70,000 mines in the country, many of which are not being actually worked for one reason or another. It is also stated that about 3,000 properties are to be declared vacated for failure to pay taxes.

In the above connection statistics regarding the production of gold and silver since and including the year 1917 will prove of interest:

1917, gold 23,542 kg.; silver 1,306,988 kg.
1918, gold 25,313 kg.; silver 1,944,542 kg.
1919, gold 23,586 kg.; silver 2,049,898 kg.
1920, gold 22,864 kg.; silver 2,058,938 kg.

The decrease of the output for the last fiscal year may be attributed to a variety of causes, to the heavy drop in price of metals, unsettled political conditions and very largely to radical legislation which has been officially encouraged in many sections, and has naturally discouraged capital from going full swing.

Hidalgo

U. S. Smelting & Refining Co. To Build Bleichert Tramway at Pachuca

Pachuca—Edward B. Durham, engineer for the Standard Chemical Co. at Canonsburg, Pa., has taken a leave of absence from his own firm and gone to Pachuca, Mexico, for the U. S. Smelting, Refining & Mining Co., to supervise the designing of a wire-rope tramway of the Bleichert type, 5.8 miles long and to carry 75 tons of ore per hour. The tramway crosses a high ridge, so that with the large tonnage carried it will develop heavy stresses and will require 340 hp. in motors on its various sections. Most of the machinery will be furnished by the American Steel & Wire Co. The field engineer for the work is O. M. Sackett, of Colorado.

Coahuila and Durango

Coal Strike Again Threatening—Work Begun on Tepehuanes-Guanacevi Railroad

Saltillo—A general strike is again threatened in the coal fields of the state as a protest against the companies' efforts to reduce their working forces. As a consequence fuel shortage will no doubt soon be felt. It is said that steps are already being taken by the larger industrial enterprises to procure their coal from the United States.

In the meantime, the state officials are making an effort to arrange a satisfactory settlement between the owners and miners.

Torreon—Albert Genty will shortly begin shipping silver-lead ore from his Calaverita mines in the San Juan de Guadalupe district to the American Smelting & Refining Co.'s plant at Aguascalientes. Mr. Genty is constructing a broad-gage spur from the main line of the National Railways at Rivas station to the Sierra Ramirez, where his mines are located. This road is to be about 12 km. in length and all but about 1½ km. is finished. As soon as it is completed, large, regular shipments of ore will be made from the Calaverita as well as other mines in that vicinity.

Work is being started on the construction of the Tepehuanes and Guanacevi railroad which will give the Guanacevi camp facilities for ore and supply shipments. Smith Bros. have the concession for building this line and according to statements of reliable mining men, the material and necessary machinery are being placed on the ground.

Chihuahua

Las Plomosas Properties Taken Over by Rio Conchas Company

Chihuahua—Cia. Minera Rio Conchos, S. A., a Belgian concern, has taken over the properties of the Cia. Minera Las Plomosas y Anexas, S. A., named Las Plomosas, and situated in the eastern part of the State of Chihuahua. The geological formation is of a purely sedimentary character belonging to the Jurassic and Triassic period. Marble overlays black slate, and the ore is found in blanket veins situated between the two above named formations. These veins are carrying zinc, lead and silver values, being mined mostly for zinc. The ore is a high grade calamine running 40-50 per cent zinc. The mines have already produced 64,000 tons of zinc ore and [illegible] tons of lead oxides. Extensive development work amounting to about 5,000 ft. was done in previous days. At present a new vertical shaft is being sunk to the depth of 100 meters and crosscuts will be run at the blanket vein, which has a dip of 35 deg. A new headframe, 42 ft. high, has been built and a 25 hp. Fairbanks-Morse hoist, a new 75-hp. Otis boiler, a 55 hp. Fairbanks-Morse air compressor and one No. 7 Cameron vertical pump were installed. Sullivan P. D. 53 air drills will be used at the mine.

The mine is equipped with a large office and staff house, a warehouse, and many workmen's houses accommodating about 200 families. A new water conduit about one-mile long is supplying the mine with abundant boiler and drinking water.

The wagon road to Picachos, a railway station of the Kansas City, Mexico & Orient Ry., has been rebuilt in its total length of seven miles, and large trucks will be used for hauling the ore. At present over ninety men are being employed and a far greater number will be used as soon as the main shaft is completed. Raoul Glockner is the general manager of the Chihuahua division of the company.

SHAFT ON PROPERTY OF CIA. MINERA RIO CONCHAS, CHIHUAHUA, MEXICO

(Via El Paso)—The stockholders of the Erupcion Mining Co. have authorized an increase in the capital stock from $1,000,000 to $1,500,000, at par, $1, to build a railroad from the Mexican Central line to the Erupcion property in Los Lamentos district, Chihuahua.

Jalisco and Nayarit

Many Projects Entered Upon a Year Ago Now Suspended—Cinco Minas and Amparo Mills Running at Capacity—Mining at Standstill in Nayarit

Via Guanajuato—The low price of all metals has very seriously affected mining operations in the states of Jalisco and Nayarit. A year ago there was a great deal of activity and a mining boom was confidently expected. The large mining companies of El Oro and Pachuca, in their search for fresh fields in which to invest their surplus capital, turned their attention to the West Coast and many options were secured by them and much development and prospecting work was done. Today, a good deal of that work has either been suspended or curtailed, pending more favorable conditions, such as either a rise in the metal markets or a fall in the cost of the materials used in mining. Local conditions are favorable, as there are no political troubles and all banditry has disappeared.

The Esperanza Company, of El Oro, took a bond and lease on a large group of old mines in the mining district of Cuale, not far from the port of Las Peñas. The Cuale district was extensively worked by the Spaniards, and since their time Mexican miners have operated sporadically, producing silver by the use of the old patio process, the working of which can still be seen at an hacienda in the district. The Esperanza Company undertook a vigorous prospecting campaign in which diamond drills were widely used. Results are said to be favorable and it is believed that large tonnages of ore can be made available. A mill and cyanide plant of large capacity is projected. A road to the port of Las Peñas will be built, and a steamer will be purchased by the company to bring in its supplies from the Pacific ports of the United States. Freight communication with the present railroad system of the country is impossible, as the nearest station is Ameca, distant four days, and only pack trains [illegible] can be [illegible]. At present, all this projected work is being held up for the reasons expressed in the opening paragraph of these notes. There is no doubt, however, that as soon as conditions warrant, work on a large scale will be started. The veins in the district carry values mainly in silver. Gold is present but in small quantities.

The El Oro Mining & Railway Co. has an option on the famous old [illegible] mine in the Hostotipaquillo district of Jalisco, and is at present unwatering the mine for examination.

The [illegible] mine, also in the Hostotipaquillo district, is being examined by a company having large interests in the neighborhood. For some time past, shipments in fair quantities of high-grade ore have been made from this mine, which is an old producer. In the same district work on a number of smaller prospects is being carried on at present.

The San Rafael y Anexas Co., of Pachuca, is proceeding, although latterly on a reduced scale, with the equipment of the old San Pedro Analco mines on the Santiago River. The company has owned these mines for some time, and it is understood that the properties are very valuable. Enough ore is in sight to warrant the construction of a mill, work on which was started not long ago. The company will generate its own power, utilizing the water of the Santiago River for the purpose. Work on the power scheme is well advanced and completion in the near future is anticipated.

The Magistral copper mine near Ameca is being examined by strong interests. Considerable interest is manifested in this mine, as many believe that it will turn out to be one of the largest, if not the largest, copper properties in central or southern Mexico. The vein is very wide, running in places up to 400 ft. in width and carrying orebodies up to 80 ft. wide. The ore is said to be of good grade with sufficient values in gold and silver to pay the expenses of treatment and realization of the product. It is of a clean siliceous nature, and has been proved by large scale tests to be unusually amenable to treatment by flotation, very good recoveries being reported. There is a small plant on the property where the metallurgical tests that were made were carried out.

The Piedra Bola mine, near Ahualulco, is shipping a fair amount of high-grade ore to the American Metals Co.'s smelter in Monterrey. This mine belongs to Mexican interests.

The El Favor Mining Co., operating in the Hostotipaquillo district, was obliged to shut down its mill a few months ago owing to the low price of silver and the high cost of supplies. The company has large reserves of good ore in sight, but the presence of a high percentage of manganese makes the ore expensive and hard to treat, and the recovery has always been very low. All conditions must be very favorable to enable this company to operate at a profit.

Only two mills in Jalisco are at present running, that of the Cinco Minas Co., in the Hostotipaquillo district, and that of the Amparo Mining Co., near Etzatlan. Both are running at full capacity in spite of the general difficulties confronting mining today. In spite, also, of being located in isolated districts, both companies have been unusually successful in maintaining a practically uninterrupted continuance of operations throughout the various revolutionary troubles of the past ten years, furnishing a fine example of what can be done by determination and skillful management.

In the State of Nayarit, mining is practically at a standstill. The Espada Mines Co., operating in the Ixtlan del Rio district, closed down its mill a few months ago. There is a little prospecting and development work going on in the same district. In the rest of the state there appears to be complete inactivity.

Oaxaca

General Electric Co. Seeking To Purchase Local Power Company

Oaxaca—Mining denouncements here are steadily increasing, and several representatives of American companies are on the grounds making examinations and reports.

The General Electric Co. is treating for the purchase of the Oaxaca Light & Power Co. and planning large extensions. This would include the stringing of power lines throughout the Oaxaca Valley and the erection of a large customs mill at camp Taviche. The company has taken options on some of the largest properties there in order to guarantee sufficient tonnage.

The Cornejo Blanco mine, Taviche district, has recently developed a body of high-grade ore. The Escuadra mine is also now producing ore.

The local government has begun the construction of a cart road to connect with the Tehuantepec coast section of the state. This will open up an extensive mining region.

ARIZONA

May Open Benson Smelter — Night Hawk at Bisbee Developing New Sulphide Ore

Patagonia—The Blue Nose is resuming operations after a shut-down of more than a year. New hoisting equipment is being installed. Richard Kingdon is in charge.

The Andes tunnel has cut 12 ft. of copper ore reported to run better than 3 per cent. The tunnel has passed through this ore into material of lower grade.

Superintendent Wrenn of the Three R has gone to Searchlight to take charge of a property there.

Diamond drilling at the Hardshell has been started. Hall and Farley, who are leasing on the company's property, have made several shipments of a lead-silver ore of good grade.

Bisbee—Concreting of the Campbell shaft has been completed.

The Boras Leasing Co. has completed enlarging its shaft for a distance of 300 ft.

The Night Hawk Leasing Co. is developing a new find of low-grade sulphide ore. At present the body is 35 ft. by 25 ft. and contains a considerable amount of bunchy high-grade ore.

Tombstone—G. M. Butler is in Tombstone to determine conditions with reference to the tonnage that will be available for the Benson smelter if this plant is reopened. He represents eastern capital who will finance this proposition providing the desired tonnage can be guaranteed.

An accident to the engine at the Solstice mine has caused it to close down until parts can be shipped from El Paso.

Johnson—All the machinery, buildings and surface equipment of the Thouderbolt Copper Mining Co. is being sold to pay the debts of the company.

Clifton—In anticipation of possible purchase, the property of the Arizona Copper Co. is being checked by John McNair, comptroller, and W. K. Flora, assistant secretary of the New York office of the Phelps Dodge Corporation, assisted by H. M. Gallegher, auditor of the Douglas office; W. A. Meyer, manager of the Bisbee store, and O. M. Palmquist, purchasing agent for the Old Dominion Co. at Globe.

Douglas—The Arizona Corporation Commission has authorized the sale of 100,000 shares of the stock of the Dolores Copper Co., of Douglas, at $1. The company holds, under a Mexican corporation, a large tract of copper-bearing ground, three miles from Nacozari, Sonora, this being developed with a 500-ft. tunnel and several shallow shafts.

NEW MEXICO

Baltic Mine in Chloride Flat Leased to Silver City Men

Lordsburg — The Co-operative mine shipped a carload of silver ore to the El Paso smelter Aug. 10. It reports two cars of high-grade ore at the mine ready to ship as soon as roads are passable.

Silver City—The old Baltic mine, in Chloride Flat, belonging to the C. Amory Stevens estate, will be opened under a lease by Ira L. Wright, I. J. Stauber, James Bell, and E. W. Armstrong, of Silver City. The first shipment of ore from this property since 1893 will be made at once to the El Paso smelter.

A lease has also been secured in the Flat by Blackwell & Co., who have a small force working.

COLORADO

Vindicator Extending Roosevelt Tunnel From Portland Mine

Victor—The Vindicator Consolidated Gold Mining Co. has begun the work of extending the Roosevelt deep drainage tunnel from the Portland mine to the Vindicator mine, a distance of about 3,000 ft. The connection is to be made 5 x 7 ft. and will require about a year. Two headings are now being driven, one from the Vindicator mine and the other from the Portland. The total cost is estimated at $60,000. The tunnel will greatly reduce the heavy expense for pumping at the Vindicator.

Cripple Creek—The Cheyenne Leasing & Development Co. has secured a lease on part of the property of the Isabella Gold Mining Co., for five years, and will install new hoisting equipment at the Lee shaft, and begin a campaign of active development.

A new 700-ft. shaft will be sunk on the Elkhorn property on Tenderfoot Hill. Electrical equipment will be installed, including hoist and compressor, suitable for sinking to a depth of 1,000 ft. The property is owned by the Denman Brothers, of Colorado Springs, and is under the management of Thomas Shaw.

Cripple Creek.—The new orebody recently opened in the Cresson mine is regarded as particularly important because it is located on the west run of the ore zone, with almost virgin ground to the surface, whereas most of the ore mined heretofore has come from the eastern part of the mine workings. The strike was made on the 16th and 17th levels. The ore shoot has been opened for a length of 130 ft. and is about 25 ft. wide. Much of the material can be shipped without sorting, and will assay over one ounce gold per ton. Stoping is in progress on both levels, and further development is under way.

Ophir.—The Summit property is being developed and operated by R. H. Wilson, lessee. A shoot of $20 ore has been opened and shipments are being made to the Suffolk mill, where ten stamps and ore flotation unit are employed in treating the ore.

Ophir Loop.—A 3-ft. vein of payable ore has been opened in the upper level of the Butterfly mine, by the Matterhorn Mining Co., under the management of P. J. Dills. Shipments are being made to the Butterfly mill, where ten stamps are in operation.

Telluride.—An automatic mucking machine, patented by H. B. Dennis, of Denver, has been installed at the Smuggler-Union and preliminary trials have been satisfactory.

UTAH

Bingham Galena on Trail of California Corporations Commission

Bingham Canyon—The Bingham-Galena Mining Co., which has been in the limelight for the last month or so, through the Utah Securities Commission is seeking an investigation by the United States Attorney General of an alleged violation of the Sherman anti-trust law on the part of the California Corporations Commission and other phases of the case growing out of the issuance in California of a warrant for the arrest of J. S. Herzig, known as George Graham Rice, and the Salt Lake brokerage firm of Child, Barclay & Co., associated with Herzig or Rice in the promotion of the Bingham-Galena. The Bingham-Galena stock was offered in a circular letter a few weeks ago to stockholders in the Broken Hills Corporation of California by Child, Barclay & Co., which quoted George Graham Rice as favoring the purchase of such stock so that losses incurred through the Broken Hills might be recouped. The stock of the Broken Hills corporation was raised from almost nothing to 50c. a share by the operations of Rice, and later fell to 4c. It will be remembered that the issuance of a license to the Bingham Galena by the state securities commission was protested by the Utah Chapter of the American Mining Congress and by a well-known Salt Lake brokerage firm.

Alta—The Emma mine is being worked on company account and by lessees, one of the latter having recently made a shipment of silver-lead ore of good grade.

Ophir—The Ophir Hills is allowing the concentrates from its mill to accumulate.

Eureka—Shipments for the week ended Aug. 5 amounted to 152 cars as compared with 153 the week preceding. Shippers were: Tintic Standard, 38 cars; Chief Consolidated, 35; Iron King, 14; Eagle & Blue Bell, 13; Victoria, 12; Iron Blossom, 8; Dragon, 6; Swansea, 4; Sunbeam, 4; Mammoth, 3; Alaska, 3; Colorado, 3; Eureka Hill, 2; Eureka Mines, 1; Bullion Beck, 1, and Primrose, 1.

Park City—Shipments for the week ended Aug. 5 amounted to 1,563 tons as compared with 1,397 the week preceding. Shippers were: Silver King Coalition, 606 tons; Judge allied, 566; Ontario, 399.

The Spiro tunnel, which is being driven to prospect the Thaynes canyon section of the Silver King Consolidated, and to connect with the California-Comstock workings, is advancing at the rate of 4½ ft. daily. Exceptionally rich ore is reported in a raise from a drift extending to the southwest and starting about 13,400 ft. from the portal of the tunnel.

Salt Lake City—A tariff on lead is greatly desired by Utah operators; and Utah representatives in the Senate and House of Representatives are making every effort to obtain protection for the industry. As is well known, it is the silver with the ores in the lead mines of the state which keeps them going.

IDAHO

Coeur d'Alene District

Callahan Reaches Vein on 11th Level, Finding Better Ore Than on 9th and 10th

Wallace—John Borg, president of the Callahan Zinc-Lead Co., who is making the annual inspection of the company's properties, reports that the crosscut on the 11th level has just opened up 19 ft. of high-grade milling ore averaging 12 per cent zinc. This is the most important strike in four years and proves the big vein at depth, with higher values across a much greater width than the two levels directly above.

Other Districts

Elk City—Interest in gold mining is reviving in this district. A number of outsiders have been in lately, inspecting ground. Completion of a deal was made the first week in August when James Penman received a balance of $25,000 for the Homestake, Pennsylvania and Sadie H. quartz claims Nos. 1 and 2, in the Orogrande section, purchasers being the Homestake Gold Mining Co., which took an option on the property several years ago. The Orogrande Mining & Milling Co. has about completed the addition to its mill. The South Fork property, credited with a production of $250,000 in gold bullion, has arranged for deeper development.

Warren—The Idaho Mines Syndicate Co. has purchasd the ten claims owned by the L. T. Holte Mining Co., and which lie midway between Burgdorf and Warren. In 1917-18, the ground produced $350,000 in gold, it is stated. Underground work has not been done at any great depth, and the purchasing company proposes running a crosscut tunnel 1,600 ft., attaining approximately 400 ft. vertical depth. This work is to be undertaken this winter. The consideration involved is $250,000.

Boise—The Montrey Metals Co. has awarded a contract for driving a 3,000-ft. tunnel on the property of the company in the Boise Basin. The tunnel is projected to tap the bottom of the 565-ft. shaft in the Washington mine, which is being operated in conjunction with the Subrosa by the Montrey Metals Co.

WASHINGTON

Submarine Property in Nighthawk Section Leased—Iron Ore Deposits in Colville Valley To Be Tested

Colville—State geologists are conducting a survey to determine the iron ore possibilities of the Colville Valley. A number of deposits, including hematite and limonite, are known to exist, and plans are being considered by capital with a view to testing the commercial possibilities.

Oroville—A five-year bond has been taken by San Francisco people on the Submarine property, in the Nighthawk section of Okanogan County. The amount involved is $250,000, to be paid in instalments. This ground has been under development by the Southern Minnesota & Washington Mining Co. for some time. Under the provisions of the bond the new owners agree to build a mill and maintain continuous development.

Springdale—Recent shipments from the Queen and Seal mine, of the Deer Trail district, have shown values of about $100 per ton. The property was inactive through litigation until recently.

Chewelah—Returns from crude ore shipments being made by United Silver-Copper mine have been materially increased lately through stoping of a high-grade streak of ore, reported as about 18 in. in width, on the [illegible] level. It is stated that the streak was opened up through a 200-ft. winze sunk from the [illegible] level. Values in silver are reported as ranging from 80 oz. upward.

OREGON

Psyche Property Sold to S. W. Windsor

Baker—The Psyche property, two miles from Greenhorn, which has been under development by J. [illegible] for several years, has been sold by him to S. W. Windsor, of Oakland, Cal.

CALIFORNIA

Yuba Company Gets Contract for Three Dredges—Afterthought Sued as Weak Company

Marysville—The Yuba Manufacturing Co. has secured a contract for three large dredges. One is for the La Grange Gold Dredging Co., and will be completed about the first of next year. The other two are for delivery in Idaho and Colorado, and will be completed about June, 1922.

Grass Valley—It is reported that the Eureka-Idaho-Maryland lode was recovered in the Maryland when the water was lowered below the 2,000 level recently.

Sonora—At the Patterson mine a twenty-stamp mill and new office building are being erected under the supervision of J. L. Whitney. It is also planned to install a 150-hp. hoist.

San Francisco—Suit for infringement of patent has been brought against the Afterthought Copper Co. by George C. Carson, as reported briefly last week, the patents involved apparently covering side feeding in reverberatory furnace practice. On Jan. 15, 1907, the plaintiff applied for a patent in which he claims, "In a metallurgical furnace having receptacles arranged above the roof thereof, passages from said receptacles leading to said furnaces are arranged in such manner that the material in said receptacles passes out into said furnace by gravity and forms the lining thereof." The patent was not granted until Aug. 10, 1915 (No. 1,149,495). Just before the application was granted Mr. Carson applied for a "divided" patent, covering the use of water-cooled blocks in the roof for charging ports and the protection of the walls of reverberatory furnaces by feeding the ores and fettling into the furnace through the roof and upper part of the walls.

Mr. Carson's original application for patent antedates the construction of the Inspiration plants and L. D. Rickett's publication of this method of feeding at Cananea.

The Afterthought reverberatory has been operated for only a short time, smelting perhaps 15,000 or 20,000 tons, so it would seem that suit had been brought against it merely because it is a weak company and not liable to make so vigorous defense as a larger one. The case will be tried on Aug. 17.

Colfax—A mining company of which J. Boggs is superintendent has leased the Sim Jordan property, near Iowa Hill, on the North Fork of the American River. It is planned to divert the river from its bed for about a mile by a bedrock tunnel 1,500 ft. long.

Sonora — The Juniper California Mines Co. has given an option to G. L. Holmes, agent, on the Juniper, New Era, Golden Rule, Forquero and Bogan properties for $100,000, payable before July 8, 1924, and 20 per cent of the gross output of gold extracted is to be applied on the purchase price

NEVADA

Ely—The Boston & Ely Consolidated Mining Co., which recently took over the property of the Ely Northern Co., situated between Ely and Lane City, is developing a body of commercial copper ore 160 ft. in length and 15 ft. wide. The ore is impregnated limonite in contact with monzonite porphyry and the upper and lower limits have not yet been reached. The ore samples 6.3 per cent in copper as mined. All ore taken out will be stored for future treatment.

The recent rich strikes of gold-silver ore in the new Spring Valley district continue to attract prospectors. The greater part of the work now being done in the district is location work on the new discoveries. Development at the Millick mine continues.

MICHIGAN

The Copper Country

Seneca Starts New Drift on 6th Level—Tamarack Reclamation Plant Not To Be Built Now

Houghton—But little copper is moving out of the district. The only metal to be shipped in two weeks was taken out by a boat on Aug. 5. It consisted of 600,000 lb., from the Calumet & Hecla, Copper Range and Quincy smelters. Half of it was C. & H. metal made up of 200,000 lb. of small cakes for a Detroit concern and 100,000 lb. of billets for France.

Calumet & Hecla has no orders on its books at present, but will continue to keep two furnaces in operation. There is still a considerable number of cupola blocks to smelt, and these will be made up into anodes for the electrolytic plant, being returned as cathodes and held in readiness for smelting into such shapes as may be ordered. C. & H. still has a large amount of mass copper and some mineral at the smelter, and this, with the cathodes, will permit filling of orders for special shapes without the necessity of recasting stock shapes. Recent orders have been comparatively small, and it is believed little difficulty will be experienced in handling all business, under present market conditions, with two furnaces.

Calumet & Hecla has stopped exploratory work on the Kearsarge vein encountered by a crosscut from the 81st level of the Red Jacket shaft. It will be taken up again when general operations are resumed. Though no copper ground of unusual character has been opened, the lode is considered worthy of further investigation, even at this great depth.

Seneca has started a drift south on the 6th level toward Ahmeek, to test the ground in that direction. Although it is only a short distance, the copper showing is most encouraging. The north drift continues in excellent ground. All other openings are favorable, including the 4th level stope and the north drifts on the 3d and 5th levels. The 3d level drift, north, proceeding toward Gratiot, is in 1,700 ft. with good values all the way. An electric pump will be installed on the 5th level, replacing air- and steam-driven pumps and centralizing the pumping in the one level.

If the state board of equalization adopts the suggestion of the state tax commission in fixing the equalized values of the counties of the state, the mining companies will pay considerably less in state taxes this year. Although the tax commission has recommended that about two billion dollars be added to the state's equalized valuation, it has recommended that Houghton County's valuation be reduced from $99,000,000 to $90,000,000. If the commission's estimates are adopted, Houghton County's tax rate will be .01343 instead of .02208, as at present.

A decision has been reached not to erect the proposed Tamarack reclamation plant this year. Much of the material is on the ground, but the work will not be started until there is a general recovery in the copper industry.

MINNESOTA

Mesabi Range

Pioneer Mine on Half Time—Shipments Resumed at Northwestern Docks

Ely—The Pioneer mine, of the Oliver Iron Mining Co., has been cut to half time. The Pioneer has long been a steady shipper.

Chisholm—The report of the directors of the Great Northern R.R. states that a quarter interest in the Bruce mine has been leased to the International Harvester Co. The report further states that negotiations were made with the Tyler Iron Mining Co. and the Meade Iron Mining Co. for a lease of the Carmi mine property. The shares held by the Arthur Iron Mining Co. in the Producers' Steamship Co. have been sold to Butlers Brothers, mine contractors and operators.

Owing to the more general curtailment of the Oliver Iron Mining Co., in the Chisholm district, and to the transferring of many of its staff to the Hibbing district, it is anticipated that little work will be done at Chisholm by the company this winter.

Hibbing—The shipments from state-owned mines the week ended Aug. 13 continue to decrease. The tonnage sent forward was 95,096, in comparison to 112,825 tons the previous week. Shipments made in the week mentioned were: Missabe Mountain, 82,957 tons; Leonidas, 1,866; Woodbridge, 3,827; Wanless, 3,209; Philbin, 3,237.

Ashland, Wis.—After a shutdown of many weeks at the Northwestern docks, owing to very light ore shipments, work has been resumed. Five boats loaded in the last week, with cargoes totaling approximately 50,000 tons.

At Port Arthur, Ontario, the two bylaws confirming a fixed assessment for ten years on the blast furnace of the Palatine Mining & Development Co. and the sale of 200 acres of water-front were ratified at a local election.

THE MARKET REPORT

Daily Prices of Metals

Aug	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
11	11.75	25.50	26.50	4.40	4.20@4.25	4.20@4.25
12	11.75	25.50	26.25	4.40	4.20@4.25	4.20
13	11.75	25.375	26.25	4.40	4.20@4.25	4.20
15	11.65@11.75	25.375	26.125	4.40	4.20@4.25	4.20
16	11.60@11.75	25.50	26.125	4.40	4.20@4.25	4.20
17	11.50@11.75	25.625	26.125	4.40	4.20@4.25	4.20

*These prices correspond to the following quotations for copper, "delivered": Aug. 11th, 12th and 13th, 12c.; Aug. 15th, 11.90@12c.; Aug. 16th, 11.85@12c.; Aug. 17th, 11.75@12c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. **Copper is commonly sold "delivered," which means that the seller pays the freight from** the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wirebars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the **basis of spot American tin, 99 per cent grade, and spot Straits tin.**

London

Aug	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
11	70	70¼	75	157¼	158	23½	23	25½	26¼
12	69¾	70	74½	155½	156¾	23½	23¼	25½	26¼
13									
15	[illegible]	70½	74	155¼	156¼	23¼	23¼	25½	26¼
16	[illegible]	[illegible]	73½	154½	156	23¼	23¾	25¼	25¾
17	[illegible]	[illegible]	72½	151½	152½	23¼	23¼	25	25½

The above table gives the closing quotations on the London Metal Exchange. All **prices in pounds sterling per ton of 2,240 lb.**

Silver and Sterling Exchange

Aug	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	Aug	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
11	365	99¼	60⅝	37½	15	364	99¼	61¼	38
12	364	99¼	60⅝	37½	16	364	99¼	61¼	38
13	365¼	99¼	61	37¾	17	363¼	99¼	62	38½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, Aug. 17, 1921

With the sole exception of lead, the metal markets have been quiet. Copper and zinc have declined, the drop in copper being partly due to the heavy drop in copper on the London exchange, from £75 last Thursday to £72 10s. today. The importance of the weakness in the **London market has been accentuated by the drop in sterling exchange. Tin has also declined in London and New York. Altogether, it has not been a cheering** week for metal producers.

Copper

The copper situation at the end of **last week appeared brighter than it had** been for some time. The market had **recovered from a low point, and producers had gotten under the market for** the first time in many days. A different complexion has been given it now, **however, by the behavior of the London metal market, where prices dropped £2** per ton during the week. Today it is re**ported that Australian copper was sold for £73 in London, a price equivalent to about 11.80c. c.i.f. or 11.15c. f.a.s. at a refinery on the Atlantic seaboard. Such** prices can only result in killing export **trade if the market stays at its present level. It is much cheaper, in filling Eu**ropean orders, to ship copper from London to the Continent than to buy it here **and ship it abroad directly. Most of** the domestic sales were made during the week at a 12c. delivered level. **Several September requirements of con**sumers were filled on this basis. It has not been difficult at any time during the **week to obtain copper at this price. Today copper has been offered for 11.75c. delivered, but none has been reported as sold.**

Lead

The American Smelting & Refining **Co. is continuing its official contract price at 4.40c. The strong position of lead has been maintained throughout the week, and sales have been made at the prices we quote, with but little variation. The volume of sales has** been good, and the [illegible] **rather well distributed. Consumption is** on a sound basis, and producers are in a **favorable position to take advantage of any improvement that might take place. Should demand increase only slightly, it would not be surprising to see the market react quickly and prices rise. The strength of lead and its sensitiveness are one of the features of the market. Inquiries are keeping up, and several producers are not disposed to sell lead at present levels, being well caught up on production.**

Zinc

There has been little change in the zinc market, which is still in the deplorable state in which it has been for months. The St. Louis zinc and lead markets are almost on a parity, with zinc selling at slightly lower prices. The heavy zinc stocks in the country and the fact that domestic consumption is smaller than production are serious handicaps for the market to overcome. Inquiries are a bit more numerous, but sales are light. It is reported that some zinc has been sold as low as 4.15c., but we have been unable to locate any actual transactions at that level. High-grade zinc is being sold to brass manufacturers at 6c., with freight allowance.

Tin

Owing to the heavy drop in the London market and in sterling exchange, **prices of tin have dropped daily. The market is lifeless, and the only en**couraging element has been an improved buying from automobile manufacturers [illegible] manufacture of alloys entering into the making of their products. Tinplate business is still quiet. Tin is selling for the lowest price in years, and is another one of those metals burdened with heavy surplus stocks. Future tin is selling at same price as prompt.

Arrivals of tin in long tons: Aug. 9th, Hongkong, 75; 10th, Straits, 400; London, [illegible]; 11th, Rotterdam, 75; Straits, [illegible]; 15th, London, [illegible]; 16th, Straits, [illegible]; Liverpool, 75; Rotterdam, 75; 16th, Rotterdam, 25.

Gold

Gold in London: Aug. 11th, 112s. 5d.; 12th, 112s. 1d; 15th, 112s.; 16th, 112s. 4d.; 17th. 113s. 1d.

General stock of money in the United States, Aug. 1: Gold coin, $3,288,608,408; standard silver dollars, $291,869,326; subsidiary silver, $272,023,798; United States notes, $346,681,016; Federal Reserve notes, $2,920,595,060; Federal Reserve Bank notes, $136,200,400; National Bank notes, $732,419,179; total, $7,988,397,187. Money in circulation per capita, $53. The gold coin increased during July by $65,000,000, and the outstanding notes decreased by about $105,000,000.

Foreign Exchange

Sterling has been somewhat unsettled during the last week, and on Tuesday German marks touched a new low for the year, at slightly under 1.07c. at one time. The future of the mark is decidedly problematical. Paper money is still being printed in Germany in apparently unlimited quantities, and large amounts of it are held speculatively in foreign countries. Cable rates for sterling varied from 0.5 to 1c. above the demand rates quoted on the preceding page. On Tuesday, Aug. 16, francs were 7.725c.; lire, 4.345c.; and marks, 1.115c. New York funds in Montreal, 11⅜ per cent premium.

Silver

For the last week both the London and New York markets have firmed considerably—London rising from 37½ to 38½d. and New York from 60⅞ to 62c. Indian bazaars and China buying in London and China purchases here are responsible for the advance. The San Francisco market has broadened somewhat, and at the close is steady.

Mexican Dollars—Aug. 11th, 46⅞; 12th, 46⅞; 13th, 46⅞; 15th, 47; 16th, 47; 17th, 47⅝.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 19@20c. per lb.; 18½c. for imports, duty paid.

Rogers, Brown & Co., with offices in principal cities, have been appointed sole agents in the United States for the sale of virgin aluminum, of various grades, produced by the Norsk Aluminum Co. of Christiania, Norway. Stocks of aluminum will be carried at New York and Cleveland.

Antimony — Chinese and Japanese brands, 4.60@4.65c.; market dull. W.C.C. brand, 5⅜@5⅝c. per lb. Cookson's "C" grade, spot 9@9½c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500-lb. lots.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots Smaller quantities. $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb.; black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $160@$170 per oz.

[1]**Molybdenum Metal**—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70@$80 per troy oz. Nominal $70, Los Angeles, Cal.

Palladium—Nominally, $53@$55 per oz.

Platinum—Nominally, $72@$75 per oz.

Quicksilver—Nominally, $43.50@$45 per 75-lb. flask. San Francisco wires $45.75.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—22c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¼@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 13—Zinc blende, per ton, high, $24.10; basis 60 per cent zinc, premium, $21; Prime Western, $21@$20; fines and slimes, $19@$17; average settling price, all grades of blende, $21.78.

Lead, high, $52.30; basis 80 per cent lead, $50; average settling price, all grades of lead, $49.94 per ton.

Shipments for the week: Blende, 5,286; lead, 1,038 tons. Value, all ores the week, $167,000.

Purchases this week exceeded those of last week 2,000 tons of blende, aggregating 5,300 tons, but the larger demand in no manner affected prices. The demand and price of lead ore taxes the mines to supply the quantity sought, and the price, especially compared with zinc, is so enticing that miners are leasing lead ground from owners and operating on their own account. The Childress Leasing Company, composed of miners, has secured permits for operating several abandoned mines for lead.

Platteville, Wis., Aug. 13—No market for zinc or lead ore, and no shipments of ore for the week. The National Zinc Ore Separating Co., at Cuba City, has resumed operations at its roasting and acid plant after two months' shutdown for repairs and improvements.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,500@$2,000; No. 2, $850@$1,250; spinning fibers, $350@$850; magnesia and compressed sheet fibers, $225@$350; shingle stock, $95@$150; paper stock, $55@$70; cement stock, $16@$27.50; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Borax—Granulated, crystals, or powdered in bags, carloads, 5½c. per lb.; in bbls., 5⅝c.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

---

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

China Clay (Kaolin)—Crude, $6.50@$8.50; washed, $9@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

Feldspar—No. 1 soap grade, $7@$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, $6@$6.50; No. 2, $5@$5.50. Market dull. Large stocks are available and quotations are nominal. Producers report cancellations of orders. No. 1, Canadian, ground, $26 f.o.b. cars.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $13.50, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF$_2$, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, 2@2½c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined—Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $45@$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned—$33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quality); ground roofing mica, $[illegible]@$70, all f.o.b. New York.

[1]Monazite—Minimum of 6 per cent thorium oxide, $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $11.65; 75 per cent, $10.65; 75@74 per cent, $10.15; 70 per cent, $6.25; 68 per cent, $5.75; 68@66 per cent, $5.50.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 12c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica—Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $7.50@$11 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—6c. per lb.

Sodium Nitrate—$2.10@$2.30 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $15@$17 per ton, f.o.b. in bulk, Western mines, spot and six months' contract; $22@$25 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.25 per unit, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 14c. per lb. of chromium contained; 4 to 6 per cent carbon, 15c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $[illegible]@$67, f.o.b. furnace, resale [illegible]. English, $[illegible]@$70, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $[illegible]@$[illegible], f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $[illegible] per lb. of contained metal, f.o.b. works. Imported material, $1.70@$2.

Ferrosilicon—For 10 to 15 per cent per gross ton, f.o.b. works, $40; 50 per cent, $65; 75 per cent, $[illegible].

Ferrotungsten—Domestic, 70 to 80 per cent W, 50@55c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$4.25@$4.50 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 19¾@20c per lb.; wire, 13½@14c.

Lead Sheets—Full lead sheets, 7¾c.; cut lead sheets, 8c. in quantity, mill lots.

Nickel Silver—31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal—Dimension sheets 16¾c.; sheathing, 15¾c.; rods, ⅜ to 3 in., 13¾c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $50 per ton; 76 per cent, $90@$95 f.o.b. works.

Chrome Cement—40@45 per cent Cr$_2$O$_3$, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—$55 per net ton.

Fire Brick—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $70@$75 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Aug. 16, 1921

With the American Iron and Steel Institute's report of the production of thirty steel companies as a basis, it may be estimated that the industry produced steel ingots in July at the average of about 21 per cent of capacity, with a [illegible] per annum. Production now is at near[illegible]

[illegible]

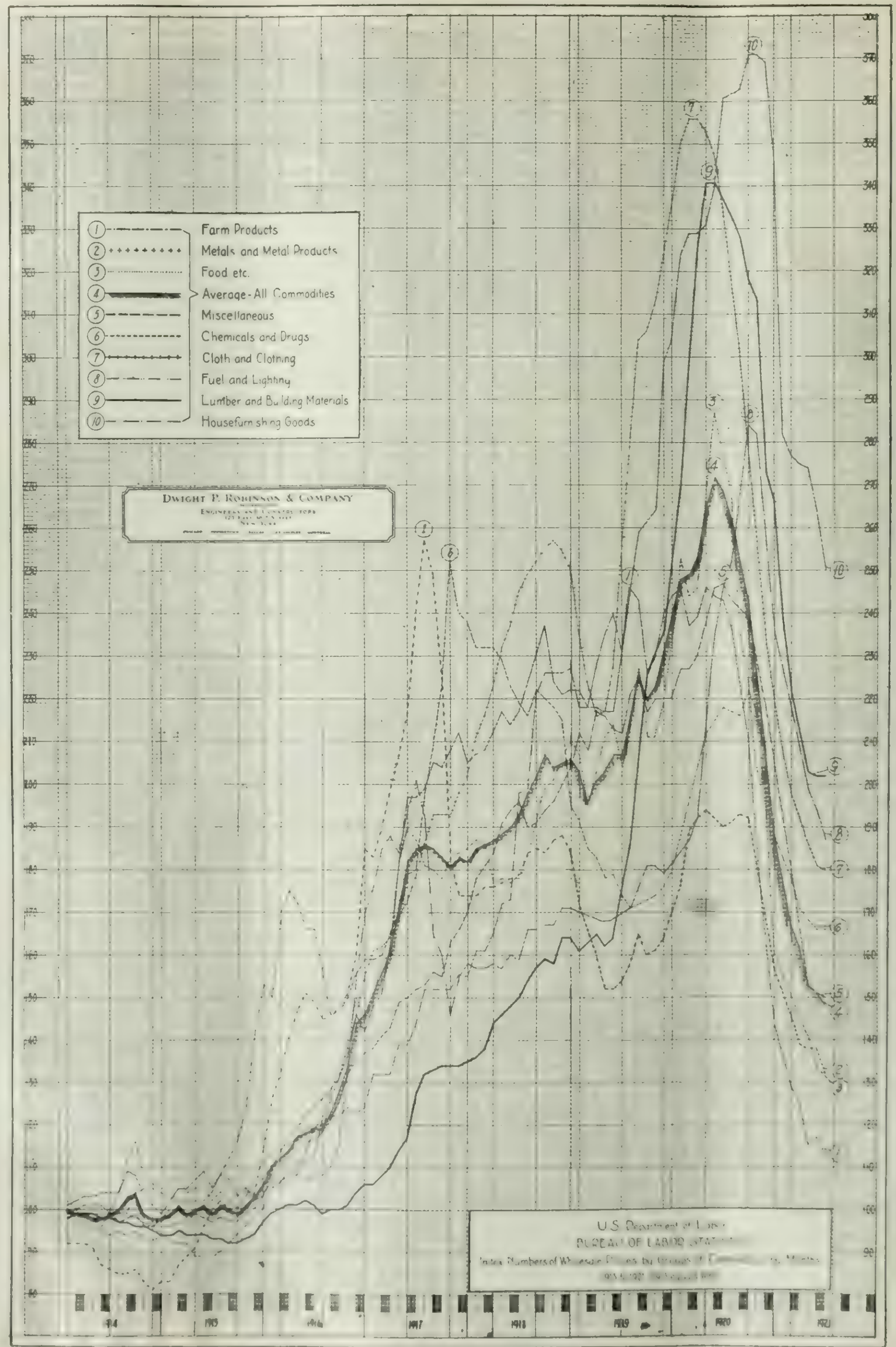
Pig Iron—[illegible]

Coke

Connellsville—Furnace, $2.75@$3; [illegible]

---

[1] Foote Mineral Co., Philadelphia, Pa.



NOTE IN THESE PRICE CURVES HOW RAW MATERIAL PRICES HAVE DECLINED MUCH FURTHER THAN THOSE OF MANUFACTURED PRODUCTS

COMPANY REPORTS

Round Mountain Mining Co.

Gold; Nevada

A report of operations of the Round Mountain Mining Co. for the year 1920 states that 64,665 cu.yd. of placer gravel was hydraulicked, yielding 4,292.26 oz. of bullion, having a value of $56,277.37. In addition, $818.78 was received as royalties from placer leases. The total operating costs were $44,6[illegible]1.11 and the net realization was $11,6[illegible]. A table showing the production and percentage of the clean-up from hydraulicking and bedrock cleaning is presented at the bottom of this page.

During the period beginning Jan. 1, 1920, and ending June 30, 1920, mining and milling operations at lode mines were carried on, in which time 4,513.1 tons of ore, having a gross value of $23,475.29, was mined and milled. The bullion produced yielded $21,377.96, representing an extraction of 91 per cent. The gross value per ton was $5.1992; tailings $0.4644; net value per ton $4.7348. The total development, stoping, milling, and marketing cost was $35,316.12, or $7.822 per ton; of which $17,006.50, or $3.767 per ton, was for development; $9,372.09, or $2.0076 per ton, for stoping; $8,556.58, or $1.895 per ton, for milling, and $380.24, or $0.084 per ton, for marketing.

In 1920, the lessees of the Round Mountain Mining Co. mined and milled 1,278.5 tons of ore, having a net value of $67,351.89, or $52.68 per ton. The company received in royalties from these operations $15,340.63, or $11.999 per ton. To this should be added the milling charge of $1 per ton, making the total revenue of the company from the lessees, $16,619.13.

The operating account, showing revenues, costs, and mine production, follows:

		[illegible]
[illegible]		
[illegible]	$56,277.37	$0.8703
[illegible]	818.78	
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	6,000.00	
[illegible]	[illegible]	
[illegible]	$[illegible].74	
[illegible]		
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	$[illegible]	
[illegible]	42,908.2[illegible]	
[illegible]		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	1,252.[illegible]	0.0503
[illegible]	4.45	0.0001
[illegible]	[illegible]	0.0002
[illegible]	[illegible]	[illegible]
[illegible]	$[illegible] 20	$[illegible]
[illegible]	[illegible] 18	$0.0474
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]		
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	

Shattuck Arizona Copper Co.

The results of operations of the Shattuck Arizona Copper Co. for the quarter ended June 30, 1921, were as follows: The total development work for the quarter was 3,265 ft. There was no regular production during the quarter. However, [illegible] of development ore was shipped and smelted which averaged about 7 per cent copper, 5 oz. in silver, and 40c. in gold per ton. The total production from this ore was as follows:

[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

About 500 tons of development ore was left in the mine bins on June 30, 1921. Only development work was done during the second quarter, as in the first three months of this year. The expense was as follows:

[illegible]		[illegible]
[illegible]		[illegible]
		[illegible]
[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]
[illegible]		[illegible]

The net development returns were obtained by inventorying recovered copper at 13c. per lb. and deducting all costs beyond the mine. Net development expense since Jan. 1 will be carried as a deferred charge and distributed over future production of copper.

Central Mining and Investment Corporation

Gold; South Africa

A report of operations of the Central Mining and Investment Corporation, Ltd., for the year 1920 shows the following results:

MINES UNDER CENTRAL MINING ADMINISTRATION

	1919	[illegible]	1920	[illegible]
[illegible]	[illegible]		[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Working profit (exclusive of [illegible])	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The accounts show a profit of [illegible], to which has to be added the net amount brought forward from Dec. 31, 1919, £145,259 [illegible], making a total of [illegible] 14s. 9d. This amount is appropriated to respective accounts as follows:

[illegible]	[illegible]	
[illegible]	[illegible]	
		[illegible]
		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
		[illegible] 14 9

The capital of the corporation remains [illegible] at [illegible], divided into [illegible] shares of [illegible] each. The reserve fund now stands at [illegible].

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	$2,696.19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

MINING STOCKS

Week Ended August 13, 1921

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Ahmeek	Boston	48	46	46	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*35	*32	*34	....	
Allouez	Boston	19	18	18	Mar. '19	1.00
Anaconda	New York	35⅜	34½	35	Nov. '20, Q	1.00
Arcadian Consol	Boston	2	1⅞	1½	....	
Ariz. Com'l	Boston	7¼	7¼	7¼	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*24	*22	*22	....	
Bingham Mines	Boston	†10	†9½	..	Sept. '19, Q	.25
Calumet & Arizona	Boston	47	45½	45½	June '21, Q	.50
Calumet & Hecla	Boston	222	219½	222	June '20, Q	5.00
Canada Copper	N. Y. Curb	*35	*28	28	....	
Centennial	Boston	†10½	†7½	7½	Dec. '18, SA	1.00
Cerro de Pasco	New York	25	24½	25	Mar. '21, Q	.50
Chile Copper	New York	10¼	9⅞	10	....	
Chino	New York	23	22	22½	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*27½	*27	27	....	
Con. Arizona	N. Y. Curb	....		*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1½	1	1	....	
Copper Range	Boston	31	30¼	30½	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*40	*37	*40	....	
Davis-Daly	Boston	6¼	5¾	6¼	Mar. '20, Q	.25
East Butte	Boston	8	7¾	7¼	Dec. '19, A	.50
First National	Boston Curb	*52	*50	*50	Feb. '19, SA	.15
Franklin	Boston	1¾	1⅝	1¾	....	
Gadsden Copper	N. Y. Curb	...		*25	....	
Granby Consol	New York	16½	16	16	May '19, Q	1.25
Greene-Cananea	New York	21¼	20¾	21	Nov. '20, Q	.50
Hancock	Boston	†3	†2¼	2½	....	
Howe Sound	N. Y. Curb	2¼	2⅛	2⅛	Jan. '21, Q	.05
Inspiration Consol	New York	32¼	31	31½	Oct. '20, Q	1.00
Iron Cap	Boston Curb			5½	Sept. '20, K	.25
Isle Royale	Boston	19	17	17	Sept. '19, SA	.50
Kennecott	New York	18½	17¾	18⅛	Dec. '20, Q	.50
Keweenaw	Boston	1½	1½	1⅛	....	
Lake Copper	Boston	†3	†2¼	2½	....	
La Salle	Boston	1¼	1⅛	1⅛	....	
Magma Chief	N. Y. Curb			*8	....	
Magma Copper	N. Y. Curb	18	17	17¼	Jan. '19, Q	.50
Majestic	Boston Curb	*6	*5	*5	....	
Mason Valley	Boston	1¼	1¼	1¼	....	
Mass Consolidated	Boston	1½	1⅜	1⅜	Nov. '17, Q	1.00
Miami Copper	New York	20¾	19¾	20	May '21, Q	.50
Michigan	Boston	†2	†1	1½	....	
Mohawk	Boston	48	46¼	47	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	4	3½	4	....	
Nevada Consol	New York	10	9¾	9⅞	Sept. '20, Q	.25
New Baltic	Boston Curb	...		3	....	
New Cornelia	Boston	13½	12½	12¾	Aug. '20, K	.25
North Butte	Boston	9⅛	7⅜	9	Oct. '18, Q	.25
North Lake	Boston	*15	*15	*15	....	
Ohio Copper	N. Y. Curb	...		*12	....	
Old Dominion	Boston	22	22	22	Dec. '18, Q	1.00
Osceola	Boston	22	21	22	June '20, Q	.50
Phelps Dodge	Open Mar.	†155	†145	..	July '21, Q	1.00
Quincy	Boston	35	34¼	34¼	Mar. '20, Q	1.00
Ray Consolidated	New York	12½	12	12	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*29	*21	21	....	
St. Mary's Min. Ld.	Boston	31	30	30	June '20, K	2.00
Seneca Copper	Boston	15¼	15	15½	....	
Shannon	Boston	*85	*80	*85	Nov. '17, Q	.25
Shattuck Arizona	New York	6¼	6½	6¼	Jan. '20, Q	.25
South Lake	Boston	*62	*62	*62	....	
Superior Copper	Boston	2¾	2	2½	Apr. '17,	1.00
Superior & Boston	Boston	1¼	1	1¼	....	
Tenn. C. & C. cfs.	New York	7½	7¼	7	May '18, I	1.00
Tuolumne	Boston	*46	*40	*44	May '13,	.10
United Verde Ex.	Boston Curb	23	22¼	22½	May '21, Q	.25
Utah Consol	Boston	†4	†3½	3½	Sept. '18,	.25
Utah Copper	New York	47	44½	44	June '21, Q	.50
Utah Metal & T.	Boston	1¼	1⅛	1⅛	Dec. '17,	.30
Victoria	Boston	1½	1⅛	1⅛	....	
Winona	Boston	†*50	†*45		....	
Wolverine	Boston	10½	10½	10½	....	
NICKEL-COPPER						
Internat. Nickel	New York	13½	13	13⅛	Mar. '19,	.50
Internat. Nickel, pf.	New York			84	Aug. '21, Q	1.50
LEAD						
National Lead	New York	75	72	72	June '21, Q	1.50
National Lead, pfd	New York			103	June '21, Q	1.75
St. Joseph Lead	New York	11	11	11	June '21, Q	.25
QUICKSILVER						
New Idria	Boston	†*50		*50	....	
ZINC						
Am. Z. L. & S.	New York	8	7½	7½	May '20	1.00
Am. Z. L. & S. pfd	New York			25	[illegible] '20, Q	1.50
Butte C. & Z.	New York	4½	4¼	4½	[illegible] '18	.50
Butte & Superior	New York	12⅛	11⅝	12	[illegible] '20	1.25
Callahan Zinc-Lead	New York	4½	4½	4½	Dec. '20, Q	.50
New Jersey Zinc	N. Y. Curb			116	Aug. '21, Q	2.00
Success	N. Y. Curb			*2	[illegible]	.03
Yellow Pine	Los Angeles	‡		55	[illegible] '20, Q	.03

*Cents per share. †Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Colorado Springs The Financial Press.

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	New York	½	½	½	....	
Alaska Juneau	New York	1¼	1¼	1¾	....	
Carson Hill	Boston	12½	12	12¼	....	
Cresson Consol. G.	N. Y. Curb	1⅝	1¼	1¾	June '20, Q	$0.10
Dome Extension	Toronto	†*65	†*64	*65	....	
Dome Mines	New York	17	16½	16⅛	July '21, Q	.25
Florence Goldfield	N.Y. Curb	*43	*39	*40	....	
Golden Cycle	Colo. Springs	*65	*64½	*64½	June '21, Q	.02
Goldfield Consol	N. Y. Curb	*7	*5	*6	Dec. '19,	.05
Hollinger Consol	Toronto	7.12	7.10	7.10	Aug. '21 4 wks.	.05
Homestake Mining	New York	58	57½	57¼	July '21, M	.25
Kirkland Lake	Toronto	†*40	†*37½	*37	....	
Lake Shore	Toronto	1.24	1.21	1.21	Aug. '21, K	.02
McIntyre-Porcupine	Toronto	1.99	1.94	1.95	May '21, K	.05
Porcupine Crown	Toronto	*14	14	*14	July '17,	.03
Portland	Colo. Springs	*43	*43	*43	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb			4	May '19,	.05
Silver Pick	N. Y. Curb	*12	*11	*12	....	
Teck Hughes	Toronto	15¼	15	*15¼	....	
Tom Reed	Los Angeles	‡		*71	Dec. '19,	.02
United Eastern	N. Y. Curb	2⅛	2 1/16	2 1/16	July '21, Q	.15
Vindicator Consol	Colo. Springs	*29	*27½	*27½	Jan. '20, Q	.01
West Dome Consol	Toronto	*7½	*7½	*7½	....	
White Caps Mining	N. Y. Curb	*6	*5	5	....	
Yukon Gold	N. Y. Curb	*90	*76	*80	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*22	*18	*21	Apr. '20, M	.03
Batopilas Mining	New York	½	½	½	Dec. '07, I	.12½
Beaver Consol	Toronto	*26	*26	*26	May '20, K	.03
Coniagas	Toronto	1.65	1.65	1.65	May '21, Q	.12½
Crown Reserve	Toronto	†*10	†*7	*9	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3⅜	3¼	3⅜	July '21, Q	.12½
La Rose	Toronto	*22	*18	*18½	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*15	*15	*15	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.25	1.15	1.25	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4⅜	4¼	4½	July '21, Q	.15
Ontario Silver	New York	..		3½	Jan. '19, Q	.50
Ophir Silver	San Francisco	....		*9	Jan. '12,	.10
Peterson Lake	Toronto	†*5	†4½	.	Jan. '17,	.01¼
Temiskaming	Toronto	....	†*22	.	Jan. '20, K	.04
Trethewey	Toronto	†*15	†*12	...	Jan. '19,	.05
GOLD AND SILVER						
Barnes-King	Butte	‡	..	60	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*74	*65	*70	....	
Cash Boy	N. Y. Curb	*7	*5	*6	....	
Consol. Virginia	San Francisco	..	..	*16	....	
Dolores Esperanza	N. Y. Curb	2	2	2	....	
El Salvador	N. Y. Curb	*21	*16	*17	....	
Jim Butler	N. Y. Curb	8	7	*7½	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*5	*4	*4	June '16,	.05
Louisiana Con.	N. Y. Curb			¼	....	
MacNamara M. & M.	N. Y. Curb	*18	16	16	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.			4	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1¼	1⅛	1 3/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*84	71	*75	....	
Tonopah-Extension	N. Y. Curb	1½	1¼	1½	July '21, Q	.05
Tonopah Mining	N. Y. Curb	1 5/16	1¼	1 5/16	Apr. '21, SA	.05
West End Consol	N. Y. Curb	*81	*65	*77	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*10	*8	*10	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	†1.20	†1.10	1.20	Dec. '21,	.15
Chief Consol	Boston Curb	2⅛	2⅛	2½	Aug. '21, Q	.05
Consol. M. & S.	Montreal	15	15	15	Oct. '20, Q	.62½
Daly Mining	Salt Lake	‡			Jan. '20, Q	.10
Daly West	Boston	†3	†2½	2½	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb			2	Apr. '21, K	.05
Electric Point	Spokane	‡....		5	May '20, SA	.03
Eureka Croesus	N. Y. Curb	*44	*32	*35	....	
Federal M. & S.	New York			7	Jan. '09,	1.50
Federal M. & S., pfd	New York	22	22	22	June '21, Q	1.00
Florence Silver	Spokane	‡		11	Apr. '19,	.01¼
Grand Central	Salt Lake	‡			June '20, K	.03
Hecla Mining	N. Y. Curb	4 1/16	3⅞	4	June '21, Q	.08
Iron Blossom Con.	N. Y. Curb	*17	*17	*17	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†3.50	†2.00		Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*3	*3	*3	Jan. '21, I	.02
Prince Consol	Salt Lake	†*21	†*20		Nov. '17,	.02½
Rambler-Cariboo	Spokane	‡		3½	Feb. '19,	.01
Rex Consol	N. Y. Curb	*9	*7	*8	....	
South Hecla	Salt Lake	*35	*20	*20½	Sept. '19, K	.15
Standard Silver-Ld	N. Y. Curb	*12	*10	*10	Oct. '17,	.05
Stewart Mining	N. Y. Curb	*4	*3	*3	Dec. '15,	.05
Tamarack-Custer	Spokane	‡		1.80	Jan. '21, K	.04
Tintic Standard	Salt Lake	2.40	2.22½	2.22½	July '21, Q	.05
Utah Apex	Boston	1¾	1⅝	1⅝	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*3	*2	*2	Nov. '17,	.01
VANADIUM						
Vanadium Corp.	New York	29½	27½	27¾	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	47	46	47	July '21, Q	1.50
Asbestos Corp., pfd	Montreal	73½	73½	73½	July '21, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	35⅞	33¾	34½	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	72	71½	71½	June '21, Q	1.75
Am. Sm. pf. A	New York			67½	July '21, Q	1.50
U. S. Sm. R. & M.	Boston	30	29	29	Jan. '21, Q	.50
U.S.Sm R.& M. pf.	Boston	38	37¼	37½	July '21, Q	.87½

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special Consulting Editors

Volume 112 New York, August 27, 1921 *Number* 9

The Great Communistic Experiment

RECENT FAMINE CONDITIONS in Russia have again produced extraordinarily disturbed events in that ill-fated domain. Those who are familiar with the country and the developments of the last few years assure us that the entire calamity signalized by the famine is not due solely to the drought, but is the natural, inevitable, and foreseen result of the Bolshevistic experiment, to which the drought happens to be the last straw—since it was inevitable that there had to be a last straw.

Recently we were privileged to hear of Russian conditions through a mining engineer who has lately returned. The communistic experiment put upon a stupid and unintelligent Russia by the bloody and iron hand of a few enthusiasts is like a fantastic story. Our informant reports that the country has actually been systematically governed under the régime (after the revolution had subsided), and that with a respectable show of order, discipline, and fairness. No one may make any profit for himself in the Bolshevist state: he gives his labor, in whatever field he may be most efficient (and this is determined not by himself but by the state), and in return he receives, through state dispensaries, the necessities and the ordinary luxuries of life. Every man—and woman—carries a little book in which are enumerated the national ration of clothes, of food, lodging, theater, newspaper, and all to the last item; and as he or she receives these articles at the state dispensaries they are checked off from his or her book, so that each receives his or her share and no more.

Failure to work or failure to work as directed by the mysterious and tyrannical Soviet tribunal which presides over Russia means trial and punishment by the authorities. Both men and women are obliged to work. Children are taken from their parents and the parents have no rights or influence over them; they are cared for and raised by the state in institutions. These children receive the best of care and the preference in food. Women, our informant says, are highly respected; and their standing is better than ever before in Russia. The white-slave trade, so characteristic of imperial Russia, he states, has disappeared with the removal of the possibilities of profit.

As no one can profit more than another, and as no one can do more than earn his daily bread, the result has been the elimination of efficient striving, and the swift disintegration of all industry and wealth. Factories, railroads, all installations and enterprises, have slowed down, stopped practically, dropped to pieces. That the country has existed as long as it has without an appalling disaster has been due to the fact that as the number of machines—of locomotives or automobiles, for example—became less and less, good parts of the old machines were used to patch up and repair those still running. But with the breakdown of transportation, the distribution of crops, of supplies, everything, has become impossible, and the country has reverted rapidly to the most primitive pre-civilization conditions. Our informant traveled from Omsk to Moscow on the Trans-Siberian railway without seeing a single freight car that was moving.

The greatest strain in the communistic system has been from the peasants or agriculturists, who have failed to cultivate the land as formerly. With nothing to gain beside their own daily bread, why should they sweat to deliver food gratis to the city dwellers? And so, when drought comes, there are no stores of food on hand, no transportation systems to move it. And thus the end of the gigantic and picturesque experiment is inevitable.

Communism is a pleasing and an ideal dream, which has been tried innumerable times before on all scales, though never on such a vast scale and with such ignorance of history, and with such ferocious and fanatical stupidity. Such an attempt shows ignorance of the laws of evolution, of human nature, of past and present events and their lessons. Mankind has progressed only by competitive striving for betterment, primarily for individual betterment—the betterment of one's self—which instinct in the strongest natures, when self-betterment is satisfied, translates itself into the strong instinct to work for the betterment of others.

Nature's laws are immutable; and he that opposes them will be crushed; and Nature has written that through strife, struggle, and hardship, by the desire to excel and the success in that struggle, and by that only, progress may be made, and higher and higher types of men and nations evolved.

Underground Mechanical Development Slow

ACCORDING to our Washington correspondent, Director Bain of the U. S. Bureau of Mines complains that improvements underground are not keeping pace with improvements above ground; that underground methods are not being bettered as much as they should, and that workings are often laid out in a way that will not permit efficient operation. He states that in many metal mines there would be ultimate saving if the workings were abandoned and a new mine was opened. He refers particularly to shoveling. In speaking of inefficient methods employed underground, he says that it is still done largely by hand labor, in the face of practical perfection of mechanical shovelling devices.

Mr. Bain is certainly in a position to know whereof he speaks. But many companies, notably in the Lake Superior district, are doing much in the way of developing new mechanical devices that will be adaptable to the method of mining employed. At Ishpeming, a so-called "sub-level slicing machine" is reported to have been invented by engineers in the employ of the Cleveland-Cliffs Iron Co., which machine is intended to load and transport ore in a single operation. This, we are informed, is to be given a trial underground by the Cleveland-Cliffs company. In the copper country, a combination shovel and picker has been devised for work in stopes and is now in use in the Champion mine. Other instances may be cited.

It is to be expected that the larger companies will lead the smaller in work of this sort. It is only comparatively recently that an efficient power shovel was developed, and one cannot expect that it will be universally adopted overnight, as it were. There are many places where power shovels cannot compete with hand shoveling, though perhaps by a modification of the method of mining and of the layout of the newer workings they can be used, even here, to advantage.

During the war, when common labor was especially scarce, more than one company gave power shovels a trial, only to abandon them when labor became more plentiful. But just as the horse has yielded to the automobile, it seems inevitable that eventually hand shoveling will be much less commonly used than it is today. Director Bain's advice that the mining industries should concentrate on means to improve underground methods is good. The Bureau of Mines is in a position to foster such a movement.

The Place of Jigs in Roughing Concentration

WE ARE PUBLISHING on pages 326-330 the first part of an article by E. H. Wiard which is to run in three successive issues. The author is well and favorably known through his "Theory and Practice of Ore Dressing," published six years ago. The present series of articles is on the subject of concentration by roughing, and more particularly jigging.

In the march of progress in ore dressing, jigs have possibly not received the attention to which their advantages entitle them, particularly in the case of copper ores, in the treatment of which jigs are almost extinct in this country. Roughing tables are generally considered to be preferable, for although they require that their feed be ground finer, they do not need so much water and their use makes the flow sheet simpler; a simple flow sheet has been a great desideration. To be sure, jigs are still popular in many districts, such as in Missouri, but there has been a general leaning to tables.

No doubt one reason for this (or is it a result?) is that roughing tables have received more attention at the hands of designers in the last few years than have jigs. Also, individual makes of tables are pushed by their sole manufacturers, whereas many satisfactory kinds of jigs may be made by anybody and therefore do not receive any particular attention from the salesman. How often does any one see a jig advertised? Some young copper metallurgists no doubt think that the jig is an obsolete machine.

Mr. Wiard points out the principles on which jigs operate and describes experiments indicative of possible improvements in construction. We trust metallurgists who have ores to handle in which a separation of concentrates, suitable for smelting, or tailings which may be allowed to go to waste, can be made in the coarse sizes, will give careful consideration to this article, even though it is of somewhat unusual length.

Why Mines Close Down

MINES blossom, occasionally flourish, and then decay. Their lives may be short and spectacular, like that of the Goldfield Consolidated, or they may lead a long and honorable existence as the mainstay of a community and a source of profit to their stockholders. Sometimes they are, in fact, exhausted and as bare of ore as old Mother Hubbard's cupboard. Again, an energetic ownership or management changes, and in its place an excessively conservative one may direct further operations, with the result that gradual and oftentimes speedy deterioration ensues, with the inevitable shutdown as the terminus. We know of one mine presided over by the attorneys for three estates. Drill steel is rusting, mine cars are strewn around, and hoisting ropes hang idle in the deserted plant. Poor management may dissipate capital in unwise equipment and wasteful expenditure, with the result that the project collapses without adequate return to the shareholders. Changing economic conditions, so familiar to the mining industry during the last few years, are responsible for many temporary and some permanent shutdowns.

Engineering judgment is not infrequently founded on too optimistic an estimate, and as a result the returns may be less than the costs, resulting in readjustment or shutting down. A management or the controlling ownership may become tired out or lose interest in the mine, owing to labor troubles or other mines of more direct interest. Profits may be distributed with too lavish a hand, leaving the mine bankrupt with respect to further prospecting, development, or plant betterment, with the result that when existing orebodies are exhausted the mine is shut down.

Anyone can run a rich mine, a gray-haired veteran in mining once cynically remarked in our hearing. This is partly true, but not wholly so, as the interval of richness is like the youthful period of life, gone before we realize it, and so the rich stopes become depleted and the mine passes into a period of its existence where only skilled management and supervision can prolong the operations.

Back of every long-continued mining project is some dominating personality. The successful mine represents the co-operative efforts of many, but leadership of the right kind is never conspicuously absent. In industry generally, dominating personalities are the sparking plugs that explode the mixture that keeps the engine going. Sparking plugs become worn out, covered with soot or crack under the stress of service. So do industrial leaders and mine managers.

The successful manager is interested in his mine and feels his responsibility critically. To succeed fully he must necessarily be a student and interested in the advances made in mining and metallurgy. His detailed interest should center in the property under his control, and this in all its phases should be repeatedly reviewed from time to time. The Bunker Hill & Sullivan mining property is an example of a long-continued successful mine. Granted that there are large orebodies, a conspicuously able management is nevertheless to be given a large share of credit in the result. The tenacity and good judgment of F. W. Bradley, the able management of Albert Burch and Stanly Easton, together with the co-operation of a wisely selected staff, are just as important factors as the orebodies in the mine.

These thoughts would border on triteness were it not for the fact that mining enterprises of more or less merit fail because of the absence of that dominating, well-informed, and capable personality so essential to success in enterprises which include technical as well as business fundamentals.

The failures in mining which are not decisively in the category of thoroughly and ably worked out districts are the opportunities in part at least of the well-trained experienced engineer of the present and the future. One of the tests to be applied is a review of the ability, practical and technical, of the men previously in charge, the facilities afforded them, and the financial resources at their disposal. Another, is the extent to which geological knowledge was used in understanding a given area, to the end that its ore-bearing possibilities were or were not realized. With information of this kind, an intelligent estimate of the probabilities of an apparently worked out area becomes possible. Thus does the lack of technical knowledge, of good management, and careful financing in the past furnish either crumbs or a whole loaf to the mining man who has conscientiously investigated the work of his predecessor.

Co-operative Experiments With "Gunite"

AN INTERESTING PLAN for co-operative experimental work in the use of "gunite" in metal mines has been worked out by B. O. Pickard, of the Berkeley Station of the U. S. Bureau of Mines. Three mines in California, the Plymouth, the North Star and the Empire, and one mining property in Nevada, the Gold Hill mine of the United Comstock Mines Co., have entered into an agreement with the Bureau to undertake the work, paying for labor and materials. A cement gun has been generously loaned by the manufacturers for the work.

The possibilities for the use of "gunite" have not been tried out in California or Nevada, so that the co-operative plan is pioneer work. The three mines offer a wide variety in underground conditions, and should yield experimental data of value. Obviously, many mines are neither equipped nor in a position to incur the expense for experimental work of this kind. Admitting the excellent results from the use of "gunite" under certain conditions, they would probably wait for a considerable period before making use of its advantages.

The experiments in question, if they definitely show advantages in the control of slabbing or in economical fireproofing, will encourage mine superintendents to use "gunite" where required. The co-operative plan is highly commendable, and we wish it success.

The Omnipotent Ford

HENRY FORD'S genius for advertising as well as for making cheap though satisfactory automobiles cannot be gainsaid. His name is continually before us in the pages of the press, often attaining first-page prominence. This free publicity seems particularly in evidence when general business is bad, and we suppose this is one reason why the Ford business is booming. The account of how Mr. Ford raised some eighty-odd millions of dollars without recourse to the wicked financial interests was an absorbing tale, well calculated to appeal to ordinary Americans. Then came the story of the rehabilitation of the Detroit, Toledo & Ironton Railroad. Ford's purchase of this road turned a consistent deficit into a six months' profit of over half a million dollars, but of course the chief reason for this is the fact that the road immediately got all the Ford business which could be deflected toward it. Decreases in announced freight rates have been so radical that the Interstate Commerce Commission will not allow them, but as most of the freight is Ford's the advertising value is no doubt worth what it costs.

Wages have been raised, but it is significant that more work is demanded. According to report, the brakeman dusts the seats, carries baggage, and generally acts as porter instead of dozing in an unoccupied seat; the conductor turns switches instead of waiting and watching a switchman do so. The engine crew takes care of the locomotive. All, no doubt, contrary to union rules, but the pay is better than the union scale. Ford's ideas are economically sound here. High wages are greatly to be desired, provided a man keeps busy and earns them. The trouble with most of the radical union-labor leaders is that they are equally as insistent for minimum work as for maximum wages.

Ford's latest is the development of an iron mine to productive capacity, thus giving him control of the chief raw material used in his automobiles. Hardly enough copper is used, we fancy, to make advisable the purchase of a copper mine, and as for tin, why "tin lizzies" probably do not contain even as much tin as do the so-called "tin" cans.

We welcome Mr. Ford to the mining fraternity, and trust he will be as successful in this as in his other ventures. He seems destined to become an American Hugo Stinnes.

Upside Down

THERE IS A LIGHT that darkens, and wherever it falls things seem gloomier than they were before. We have long felt that conditions in the mining industries were not as we should like them to be, but optimism forbade the pessimism that they could not be much worse. We feel privileged to think what we will and say what we will of our mining industries. They are our own, and in them and by them we live, move, and have our being. We shall say anything we like, even though we suffer for it. But we don't like to hear others speak ill of our own. So it is with dislike that we learn from the Federal Employment Service, in its report for July, that of all industries, the metal and metal products industries are at the bottom of the heap, as far as employment situation and business conditions are concerned. They make the "darker side of the picture." Outside of these industries conditions everywhere point to the certainty of an approaching business revival, says the bureau.

We are glad to know that somewhere the sun is shining, but things had not seemed quite so black to us in the mining industries before the Employment Service spoke. For one thing, there is silver, the producers of which might be far worse off than they are. Then again, conditions have so improved in the gold mining camps throughout the country that what chances the McFadden bill ever had seem vanishing. And if there be a lack of demand for the commoner metals, the approaching business revival, which the bureau forecasts, will remedy that. The consumer's business must revive before the demand on the producer will increase. We may be at the bottom of the heap, but we refuse to be disheartened. When things are right side up again we shall be in the lead.

WHAT OTHERS THINK

Foreign Manufacturers Offering Better Steel Than American?

In the *Engineering and Mining Journal* of Aug. 13, under the title of "Lower Costs the Way Out," the statement is made that "the chief reason why the United States is losing export trade is because of the higher prices charged by manufacturers compared with those of England, Germany, . . . " Do you think this is the only reason? If you do, please digest the following, which was received in a letter from the general manager of a large mining corporation in Mexico. This letter was in reply to a letter sent by me in which I deplored the present method of buying steel for mining work, particularly balls and liners for ball mills, and shoes and dies:

> I think there is a great deal in what you have to say about the lack of proper specifications on the part of the mining companies in the purchase of steel balls. So far as we are concerned down here, this has led in the past to the selection of a few reliable manufacturers, who deliver to us a standardized and satisfactory product.
>
> In this respect, it is notable that the English manufacturers have shown much better reliability in supplying, for example, shoes and dies of a regular high quality, and the same was true of one or two German manufacturers before the war. As a result of this fact, we find it very difficult to secure American competition for a product on which we can rely.
>
> The adoption of the ball mill on a large scale coincided more or less with the beginning of the World War, so that American manufacturers had to be looked to for forged-steel balls, with consequent unsatisfactory results, because, as you state, these balls, although put forth as special chrome or manganese steel, very rarely held up to specifications . . . ordinarily being made up of any steel scrap available.
>
> We believe that this condition is about to be corrected by the resumption of European competition.
>
> Meanwhile, as I wrote you recently, we have found it more economical to use ordinary high-carbon forged steel balls, or locally made cast balls, because we found that we had been paying for chrome and manganese contents which did not exist.
>
> Any effort on our part heretofore in trying to hold ball manufacturers to a given specification has only led to such a high quoted price that no business resulted.

In another letter he stated that high carbon forged balls costing considerably less than American so-called chrome steel balls had just as long a life. This would indicate that the American chrome steel balls were equal to, but no better than, the foreign high carbon balls.

What my correspondent says about his experience is common today in the United States. Some mining companies are paying high prices for inferior material. This is due to the fact that there apparently is no standard by which steel can be judged.

If the American steel manufacturers are going to secure the export business for this class of steel, they must prove that their steel is as reliable as that furnished by foreign competitors. The American steel manufacturers can and must produce a steel equivalent both in quality and price if they wish to control this business; and to insure a reputation for reliability they must adopt a standard and stick to it.

New York City. EDW. W. LAWLER.

Concerning Ignorance and Courage

Referring to the editorial in the July 30 issue of the *Engineering and Mining Journal* entitled "Against Engineer Licenses," I beg to state that your apparent ignorance of the case is so pitiable that it is ridiculous. You are not aware of the fact that the license law in Arizona was written and practically enacted through the efforts of real active practicing mining engineers of this state. You are also ignorant that nearly all businesses are licensed. In fact, to protect the public from dishonest and unscrupulous practitioners it has become necessary to license practically all businesses and professions.

Referring to your statement that the opinion of prominent mining engineers will have much weight, it is true, but you must remember that that statement has several interpretations. If you refer to the club or lounge-lizardly type of engineer, which is perhaps the case, it may surprise you to learn that the real active practicing mining engineers have learned to discount the opinion of such retainer men.

You will no doubt wake up to the fact, in the near future, that your stand in this matter is contrary to the opinion of the majority of the young active men, and you may well remember that the young engineers will soon be the men of the future.

I trust that you will have the courage to print this in your journal. FRANKIN B. SMITH.

Nogales, Ariz.

Personalities and Motives

I have read the communication from H. V. Winchell in *Engineering and Mining Journal* of July 30, apropos of an article written by me that appeared in the *Mining and Scientific Press* of June 11. His letter consists so largely of personal aspersions and the imputation of mean motives that I would not trespass upon your space except for the fact that I desire to correct an impression, which might be entertained by others, that the article in question was instigated or inspired by the editor of the *Mining and Scientific Press*. The fact is, the article is the amplified form of a letter that I intended to write for the Discussion column of the *Press*, because I demurred to some of the views taken by the editor with respect to the decision in the United Eastern-Tom Reed case. This difference of opinion will be manifest to anyone who has read the editorial comment in the *Press* when the decision was made public.

Mr. Rickard did not suggest the writing of the article; he did not know it was being written until it was complete, and he did not even edit it, for the reason that he happened to be leaving town at the time. He went through the manuscript hurriedly just before starting for Butte, and advised its publication because it seemed to him to be interesting.

I wonder if Mr. Winchell has read the autobiography of Benjamin Franklin. If he hasn't, he ought to; if he has, he ought to read it again. A. B. PARSONS.

San Francisco.

The Ideal Congressman

Referring to the editorial in the *Engineering and Mining Journal* of Aug. 6 regarding "Congress and the Tariff," where you make the extraordinary and surprising statement that "A special attorney should be appointed to represent the hundred millions" making up the American public, are not all the representatives in Congress special attorneys for the public? Have they not been elected to duly represent the general public? Do they not at all times seek to diligently safeguard the rights and interests of the public in all legislative matters? Of course they do. Are they not eternally on the job watching that the masses do not suffer any prejudice from the demands of the unscrupulous producers or manufacturers? Certainly they are. Have you not done an injustice to all the *worthy* members of Congress by indirectly charging them with a failure to properly function? Yes. Do you not consequently owe an apology to the said public representatives for this unwarranted charge? Most assuredly you do.

Will watch your next issue for an adequate apology.

Boston. J. A. A.

A British Opinion of America

In saying what I hope will be only a temporary farewell to the *Engineering and Mining Journal*, to which I have been an intermittent subscriber for over ten years, I suggest that you omit editorials of the nature of "The Republic of Canada" in a recent issue of your paper. You have created thereby a very hostile spirit among certain circles in consequence of this effusion, probably one which was quite innocent on your part. You should stick to strictly technical matters in your editorial policy; it would promote a better feeling between the United States and the British Empire, which is very one in feeling, as proved by the last war.

We resent the implication on your part that Canadians and Americans are almost indistinguishable. We Britishers can tell an American within a few seconds of viewing him, and generally we dislike your compatriots intensely, only liking those we know and appreciate. It is impossible for a good American to realize the intense contempt held for his country and citizens by outsiders generally, largely on account of the immense profits derived by the United States during the late war and the extraordinarily aggressive attitude of American diplomacy, especially in matters regarding resources of territory conquered by its former allies.

Vancouver, B. C. L. MAITLAND LEO.

A Mexican Market for Mexican Silver

As the silver market is "being dominated by speculators to a large extent," forcing the Mexican silver producer to sell his silver at a price fixed by New York and especially London brokers, and considering that the production of American silver has been removed from the world markets for a number of years to come, certain Mexican government officials are now studying the problem of silver and will shortly take steps to remove the Mexican silver from the world market. That is, they will take steps so that the silver produced in Mexico during the next ten years will not be obtainable at the present low prices and that if the world nations and consumers of silver want silver they pay for it at a fair price or do not get a chance to buy it. This taking care of the Mexican silver production for a number of years, say perhaps ten years, will result in making silver scarce and should have a good effect on the silver market.

As Mexico is now one of the few important producers of silver sold on the world markets, with the exception of silver sold from countries still having a supply at hand, a move is going to be made to shift the principal silver market to the City of Mexico, so that Mexico will sell its silver direct to the consumer without the intervention of the brokers in London and New York, who are now growing fat on profits secured from sales and resales of silver.

Mexicans producing silver should have something to say as to the price at which this silver is being sold to the consumer, and when this price falls below the actual cost of production, as happens at present, with a number of mines working either at a loss or barely covering expenses, the reduced production of silver should have the effect of boosting prices. X. Y. Z.

Mexico City.

Merits of Molybdenum Steel

I notice in the edition of your magazine dated June 18, 1921, an article with the heading "Molybdenum Mines in Norway," translated and abstracted from *Teknisk Ukeblad* after a lecture given by Dr. Falkenberg before the Norwegian Mining Industry Association. It appears that your translator, in dealing with the paragraph on molybdenum steel, has omitted some facts as to which there is substantial technical agreement.

When Mr. Falkenberg touches upon the field of molybdenum steel, he enters upon *terra incognita*, and his opinion on the matter should be valued accordingly. On the other hand, there seems to be no difference of opinion as to the great merits possessed by molybdenum steel, according to results obtained at different works and research laboratories this side of the Atlantic, which confirm the excellent results obtained in the States of late. Not only does molybdenum steel possess great properties for constructional purposes, but molybdenum introduced into steel castings will, provided it is added in the right quantity, and if such work is correctly heat treated, impart exceptional properties to the steel. OSCAR HAUGHOM,

Manager, Nordisk Bergselskab A G.

Stavanger, Norway.

Profit Sharing and Traveling Expenses

My first suggestion for a profit-sharing system for Mr. L. O. Kellogg's South American Development Co.'s mine in Ecuador (*Engineering and Mining Journal*, July 23, 1921) would be for that company to begin paying transportation charges of employees' families.

In the mining profession, where a man has to get away from the associations of relatives and friends, the burden of family is heavier than in most other professions, and the treatment of married employees is worth a little discussion and serious thought. Some of the most progressive mining companies today (Chile Copper for instance) help to meet this problem by standing the transportation expense of a man's family. Until a company does this much for its employees I don't think it is in a position to start talking about profit sharing. PAUL R. COOK.

Rolla, Mo.

Preliminary Roughing Concentration by Sorting, Jigging, and Tabling—Part I

Principles and Present Status of the Art — Hand Sorting, Its Limits, and How It May Be Improved — The Practical Application of Jigs and the Adaptability of Various Types

By Edward S. Wiard

Written for *Engineering and Mining Journal*

CONCENTRATION OF ORES by using the roughing principle, by which I mean subjecting them to a preliminary concentration in which a product is made which can be allowed to go to waste, can cover the whole range of mine sizes.[1] In rough concentrating by separative machinery the upper limit of size will be approximately three inches. Concentration by roughing may be defined as the immediate elimination of a part of an ore containing a metallic content greater than can be left in the tailings when using the most refined methods of treatment; greater to an amount which would be equal to the excess of cost of using the more refined methods; and the subjecting of the enriched portion to any refinements of finishing practice that may be desirable.

Where the capital or the amount of material to work on is limited, as in working dump material, the amount of metal left in the roughing tailings may be higher than indicated by the definition, and for obvious reasons. Some ores contain such a portion of material which cannot be unlocked by the finest grinding that roughing concentration is at once indicated as the preliminary operation.

In all thoroughgoing test work the possibility of roughing off a large portion of the ore, to be treated by cheaply operated large-capacity machines, should be given the most careful consideration. Even the preliminary division of the ore into a number of classes of middlings will often lead to greater recovery. The flow sheet will become more complex, but the mechanical arrangement of the mill may actually be simplified by such division of the ore. This aspect of preliminary concentration is not directly touched upon in the ensuing pages. As there is no sharp division line between middlings and tailings, much of the data and information given will by extension apply to middlings.

Present Status of the Art of Concentration

The old concentration adage that as early as possible in the scheme of concentration either concentrates or tailings or both should be made is as true today as it has always been. Some years ago when the advocates of flotation processes were at the high tide of their enthusiasm the situation to some seemed to be that flotation provided the long-sought-for successful means of treating the very fine material in which such heavy losses occurred with gravitational and other time-worn methods of concentration. It was further assumed that inasmuch as concentration formerly began as high up in the screen scale as possible, so as to avoid making any more fine material than was absolutely necessary, the flotation processes, affording such excellent means of treating the fine material, rendered unnecessary the equipment for coarse-size treatment and that grinding could be carried down at once to the range of size suitable to the flotation methods (20 to 50 mesh).

From our present-day knowledge of flotation certain constants of practice have arisen which should make us pause before agreeing to such sweeping generalizations. One and a half to three and a half pounds of metal per ton of ore ground are consumed in ball milling. A power consumption of approximately half a horsepower is also needed, and in the most commonly used flotation method from a third to a half a horsepower to the ton of daily tonnage treated is required. It is true that the immediate grinding of an ore to a size suitable for flotation makes a simpler flow sheet, but as to whether it makes a less costly mill to build than the old-fashioned jig mill is open to dispute. It may do so in some cases and on some ores. In the matter of operating expenses there is no doubt that the fine-grinding mill is more costly to run than one employing preliminary concentrations of the usual kind. Twenty years ago concentrating mills with operating expenses less than $0.50 per ton were not uncommon, and $1.25 must be substituted for this figure if today a similar statement concerning low-cost milling is to be made.

Efficiency Through Increasing Mechanical Equipment

Labor is of course more expensive now than twenty years ago; but the rise in milling costs has not been due so much to the lower value of the dollar spent for labor and the rise in price of milling supplies as to increasingly fine grinding and elaborations in slime treatment.

Attendance labor in mills can only be reduced by increasing the number of machines that a man tends until the limit of his capacity in that respect has been attained. The small mill employing jigs or other coarse concentrating machines may, by its greater number of kinds of units, operate at a disadvantage in comparing its attendance labor costs with those having simple fine-grinding flow sheets, for it might have units with but few machines in them and each unit ordinarily requires an attendant on each shift. Good designing will largely overcome high labor costs in small mills having complex flow sheets. Reduction in the per-ton operating costs of overhead labor such as for repairs, superintendence, and like charges is largely a matter of increasing the tonnage put through per man, and enters but little into labor-cost comparisons of different types of mills. Simplicity and the other advantages obtained by the fine-grinding mill are more than offset by the greater power and grinding-metal consumption.

---

[1] [NOTE—Roughing, in many branches of the art, is held to mean the separation of coarse concentrates for the smelter from tailings which must be retreated after further grinding. Throughout his paper, however, Mr. Wiard does not use the term in this sense.—EDITOR.]

If operating and plant cost comparisons be made between the true roughing mill and the fine-grinding mill they will all be in favor of the former, for in the roughing mill a large part of the ore will be eliminated by passage over machines of large capacity and small power consumption, only the remaining enriched portion being subjected to the expensive operations of fine grinding and refined slime treatment. The sole fly in the ointment of this statement is the mechanical imperfections under which roughing machines labor, as will appear in the sequel.

Ores which must be finely ground before they will yield a product which can be called tailings are rare. The sorts of ores going to many fine-grinding mills often show, when in place underground, large volumes of waste. Often there are poorly defined walls, the ore grading into rock in one or both walls. It is a burning question in some mills at some times whether the mine is sending in ore or waste, particularly in the plants of those properties where there is insistence on the maintenance of a certain daily tonnage.

Had the flotation process, used as a primary, single, and finishing process, recovered 100 per cent of the metals in simple ores, little argument against its sole employment in simple mineral separations would be offered. It would be a sad sort of ore which could not stand the grinding charges if 100 per cent of its metallic content could be recovered.

ADVANTAGE OF COMBINING FLOTATION WITH OTHER METHODS

Unfortunately, as experience has revealed in many cases, the recovery is no greater when used alone than is obtainable by the old methods. As a primary method in the treatment of complex ores the flotation processes are at a disadvantage, and flotation is used best as an adjunct to old methods. It is a canon of concentration that if one method of separation is used, and all possible commercial recovery has been made by it, some method employing an entirely different principle must be employed if an additional saving is to be effected. Gravitational and other old methods gave a recovery ranging ordinarily between 60 and 80 per cent on simple ores. The grafting of flotation on these old methods may be expected to yield an additional recovery of 50 to 70 per cent of the remaining 20 to 40 per cent, raising the total recovery to 80 to 90 per cent. It would be idle to deny this as being a great and distinct advance in the art of concentration. On many high-ratio-of-concentration problems such as with low-grade silver ores, where there is little of value except the silver, or in the separation of rare minerals, the flotation processes are a sine qua non of success, as gravitational methods will not yield products clean enough to ship. High ratios of concentration are no longer the bugbear that they used to be.

DIFFICULTY OF EVALUATING EFFICIENCY OF FLOTATION MACHINES

Before leaving the introductory portion of this paper one more point will be cited against the flotation processes (particularly the frothing processes). That is, the inability to tell whether the flotation machine is doing the best work that it is capable of doing on the particular ore, and the inability to determine what to do if it is suspected that the machine is not doing its best work. One of the criticisms frequently shot at jigs and jigging is that it is difficult to see what is going on. Having operated jigs myself in the old days of twelve-hour shifts, I am prepared to admit that things go on in jigs that are not always spotted as quickly as they might be, particularly in the small hours of the night. However, troubles in a jig can be quickly found by an active experienced attendant, and quickly remedied if they are capable of being remedied. This cannot be said of frothing cells; they may go wrong and stay wrong until they take the notion of pursuing again the straight and narrow path, and in this interval all the curatives between gasolene and paraffin seem often to make matters worse.

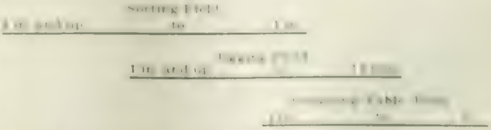
This disadvantage would be classed as a retrogression were it not that the art prefers not to proceed by perfecting and improving its old machines. General improvement in mill recoveries has come about by grafting entirely new machines, machines with new principles, onto the practice along with the old. In other mechanical arts, improvements in old machines (or entirely new devices) displace older ones, even when they are more complex mechanically, provided they increase the certainty and ease of control of their operations. The milling fraternity would certainly be receptive to any process which will give better results as a finishing method than flotation. At present, because it offers possibilities in reducing operating expenses, preliminary concentration should receive serious attention.

That roughing is correct in principle will be evident on reflecting that any milling operation considered as a whole is but a roughing one. It is only a step toward the finishing operations in the smelter and the refinery, and just how this roughing operation in this bigger sense is to be applied to the individual ore will depend on the character of that ore and the money problems connected with it. How to get the most net dollars out of individual ores is the metallurgists' real problem, and a 50 per cent extraction may be more profitable than a 90 per cent one.

That the concentrating devices available for roughing purposes present mechanical deficiencies when so used will be evident from the ensuing pages. It is largely in the hope of stimulating improvement in roughing practices that this paper is written.

RANGE OF THE ROUGHING FIELD

The roughing field can cover the whole range of size, from the maximum made in ordinary underground operations down to slime sizes. The field can be illustrated diagrammatically as follows:



The availability of roughing grows less going from the upper or left-hand side of the diagram to the lower or right-hand side. In the sand size to zero portion it will rarely be possible to make tailings by a single, or roughing, operation.

HAND SORTING

The best range of size for hand sorting is between one and three inches. With any ore, the ability to sort out concentrates, conveying the remainder of the material to the waste pile, or to do the reverse operation of sorting out waste, does not prove that roughing operations in the smaller sizes may be undertaken. Conversely, the ability to rough the jig sizes does not prove that hand sorting may be successful. Each operation should be carefully tested.

Sorting for roughing differs from the usual sorting operations in the mills where either first-class ore or waste, or both, is thrown out, in that the principal aim in roughing by sorting is to obtain a second-class ore or enriched mill feed. Sorting out of waste will accomplish this in some cases if thoroughly done, but if the ore will admit of high ratios of concentration in the sorting sizes, higher than 3:1, direct sorting out of the second-class ore will be preferable. Unless grading up can be done in this way I am of the opinion that roughing by sorting will not be feasible. The mere sorting out of waste has always in my experience degenerated into a farce, and the reason for this seems to be that it is difficult to check up the work the sorter is doing.[3] If he is making a good tonnage removal rate he may be throwing away ore. If he appears to be idling he may actually be removing all the true waste there is. But it is very easy for the sorter to keep up a semblance of doing something. On the other hand, once a sorter is instructed to pick out of the stream of fragments passing before him, everything that is ore or has any semblance of ore, he can be checked by visits to the waste pile or in more exact ways. Once the rate at which he must handle tonnage is fixed, he must either remove all the ore or give way to somebody who will.

ROUGHING SORTING SIZES SUCCESSFUL

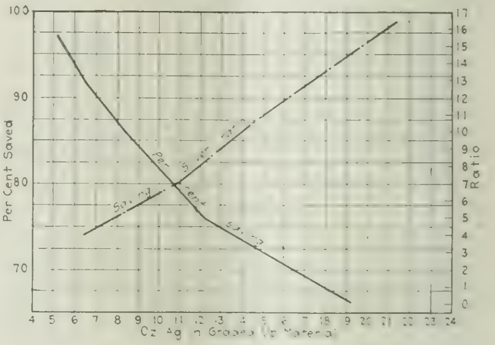
Two examples of the successful application of roughing to the sorting sizes will be given; first, in the working of a two-dollar waste dump. The valuable content of the ore was gold in the form of tellurides. Sorting for first-class ore only, on this material, the best result obtainable was about \$6 concentrates and tailings averaging about \$1.20. The ratio of concentration was about 6:1, and the recovery in the concentrates was about 50 per cent. An experienced ore sorter was employed in the test work. His difficulty lay in discriminating between ore and waste. Slightly mineralized pieces sometimes went into the waste, sometimes into the ore. Then, on being directed to do so, he made first-class ore which averaged about \$16; a mill grade running about \$4; and a waste averaging \$0.80. The ratio of concentration was about 3.5 : 1, and the recovery about 70 per cent, including both classes of ore made.

The ore sorter was instructed to put everything into the second class which contained the slightest evidence of mineralization, and also every piece about which there was the slightest doubt of its being first class. This relieved him almost entirely of mental effort, and with these instructions his capacity increased noticeably. A successful plant was founded on the discovery that two classes of ore could be sorted out to greater advantage than a single one.

The second example is a low-grade silver ore, the value of the metallic contents being about \$3. The total metallic content was about 0.5 per cent. Silver existed in the various forms of antimonial sulphide. Evidences of mineralization contrasted so well with the pale gray of the washed rock that an unskilled man of ordinary intelligence could be taught to do first-class work with a half hour of instruction. Tests on this ore extended over many months, and the results are incorporated in the accompanying curves. By carrying a vertical line from the figures of graded-up material at the bottom, the ratios and savings curves will be cut, and horizontal lines carried to the right and left respectively will give the ratio and saving corresponding to the second-class ore figure from which the vertical line arises. The excellent saving made with even comparatively high ratios will be noted.

CRITERIA OF THE AVAILABILITY OF ROUGHING BY CONCENTRATING MACHINES

The ability to make a tailing is the criterion as to whether or not a roughing operation is possible. If the ore will sort successfully the balance from the sorting test sample may be screened to various sizes, and different ranges of size can be tried on concentrating machines. If the ore will not sort, it can be crushed, and the various ranges of sizes so made can be tested to see if the tailings will fall below the economic limit of metallic content fixed by the metallurgist. What can be left in the rougher tailings can be determined only after completing tests which will show what is the best technical saving possible on the particular ore.



PLOTTED RESULTS OF SORTING TESTS

If concentrates can also be made, the refinements that may be effected in treating the large sizes are at once indicated. An ore out of which concentrates can be made in the large sizes is not a simon-pure example of an ore suitable for roughing. But it is more favorable to successful treatment to have the roughing type of ore lean to this type rather than to the other extreme of one requiring fine grinding to unlock the metallic portion. If middlings of more than one class may be made, as well as tailings, a great gain in mechanical simplicity may often be effected.

JIGS AND JIGGING

Twenty years ago the upper limit of Harz jigging was in the neighborhood of 3 in. Today the upper limit has been lowered to an inch, keeping pace with the improvements in slime treatment. The average upper limit is nearer a half inch than one inch.

COMPRESSED AIR AS A PULSION MEDIUM

The Richards pulsating jig and the Plumb air jig have rotating valves for water and air respectively. It is possible that this mode of pulsion could be employed to actuate a water jig by compressed air. This mode of

---

[NOTE—Our experience in this matter is not in accord with Mr. Wiard's, and we know of several instances where the sorting out of waste is a profitable operation. The work of the sorters can be checked by inspecting the dump or more accurately by having a sample taken and assayed.—EDITOR.]

actuating a jig has not been thoroughly tried out on Harz jigs. Whether it could be applied so as to give a sharp stroke on what would be the plunger side of a Harz jig, and without too great consumption of air, has not been demonstrated by exhaustive trial. What is in mind is a multi-compartment jig pulsated by a rotating member having a number of ports corresponding to the number of compartments which it supplies with compressed air, the ports to open progressively so as to simulate the wave of pulsion obtained in plunger jigs by the proper arrangement of eccentrics around the circle of the driving shaft. Means might also be provided for regulating the exhaust so that all effects, from a very free fall back from the tops of the pulsion wave, to a decided suctive effect, might be secured. Possibly it might be necessary, to obtain suctive effect with complete control, to provide each compartment with a rotating valve. The Baum coal jig was accuated by air, but the strokes were too few in number to give capacity.

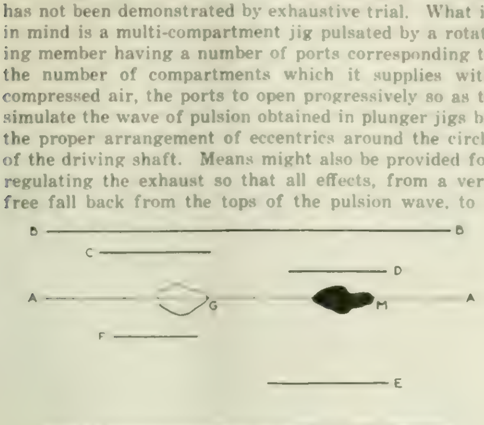


FIG. 2. DIAGRAM TO SHOW THE ACTION IN A JIG

LOSS OF CAPACITY FROM SUCTION

If the plungers be too tight the suctive effect on sized feeds will be too great. If they are too loose, they will not lift the bed sharply and with good effect. There is always more or less suction with plunger jigs, particularly if the plunger is placed so as to give the maximum suctive effect, a position where, at some point of the stroke, it emerges from the water. The reason jigs lose capacity will be evident by reference to Fig. 2. *G* is a gangue grain; *M* a grain of higher specific gravity than *G*, and of such a size that it has a greater settling rate than *G*. On the down stroke of the plunger *G* will rise to the diagrammatic position *C*, but *M*, owing to its superior rate of fall, will only ascend to some such position as *D*. If now the fragments *G* and *M*, representatives of a bed of material in a jig, are allowed to settle from the positions last given, the action of the plunger being removed, *G* will arrive at some such diagrammatic position as *F*, and *M*, owing to its superior settling rate, will arrive at some such position as *E*. By a number of such cycles *M* would finally rise at the screen while *G* would still be at some position above. The rapidity with which a separation of this kind can be made determines the separative capacity of the jig, and, other factors being equal, the greater the specific gravity difference, the more rapid the separation.

On the upward movement of the plunger the tendency is to carry the water away from the fragments, causing them to come together and pack, and go back to the screen without sufficient looseness to allow of a settlement of the heavy grains to diagrammatic positions such as *E*. The heavy grains will descend little or no more than the gangue grains. Or, in other words, the tendency of suction will be to reduce capacity to a degree proportional to only half of the complete stroke. Numerous mechanical devices for giving an accelerated motion to the down stroke of the plunger with a retarded return have been invented, but none of these have been received with favor by millmen. Various mechanical devices have been tried in the endeavor to reduce the suction. Most of them consist of various forms of valves placed in the jig plunger.

With compressed air as a pulsion medium suction could be prevented to any desired amount by letting the air exhaust with any desired degree of rapidity, either freely or into the next plunger compartment.

OVER-USE OF WATER IN HARZ JIGGING

One of the principal reasons why I have suggested doing away with the loose plunger of American Harz jig practice is to save water. The enormous quantities of water used in Harz jigging are not only often highly disadvantageous for other reasons, but interfere materially with the separative capacity of the jigs. As will be shown later, the use of large quantities of water increases the transportive capacity of the jig. (Transportive and separative capacity are frequently confused in the millman's mind.) The water increases progressively in ordinary Harz jigging from the first to the last compartment. On screened sizes, water is often abundantly used in jigging to overcome the effects of suction.

Neglecting leakage and assuming that the strokes in the different compartments of a jig are of the same length, it might be thought that no more fresh additions of water to the other compartments of the jig beyond the first would be required, and only enough added there to make up for what is lost at each stroke by displacement. In actual practice, to soften suction and increase the rate of flow through the jig, fresh water is introduced in most or all of the compartments, so that by the time the fragments passing through the jig reach the lowermost compartment they are subjected to floods of water, and in close separations where the separative forces are feeble, the forward movement of the water has far more influence than gravity. The grains are carried forward and out of the jig before they have had time to settle and separate. Referring to Fig. 2, if *M* is the middling grain, which it is desired to recover, then if there be too strong a current through the jig, the direction or movement of the grain, instead of being ideally toward the screen with vertical movements, will be more nearly horizontal and with a consequent tendency to carry the grain into lower compartments and eventually to waste.

THE RICHARDS JIG

In the Richards pulsating jig, fresh accessions of water must be made to each compartment, for pulsion is effected by allowing water under a head to act through a valve which opens periodically. As is well known, the compartments of this jig are very small. To make them larger would require an increase of water which would be prohibitive. For jigs using the pulsating principle of concentration the chief requirement is area, and, as must be evident, this is the true essential factor in capacity in any Harz jigging problem. Area gives good transportive as well as separative capacity.

On the score of small area the Richards jig, from its inferior settling power, would seem best adapted to problems where comparatively great difference in specific gravity exists between the gangue and concentrate. It is excellently suited for separations of nearly pure gangue or pure sulphide or other heavy material

The small compartment provides for rapid movement of the lower layers of the bed toward the discharges.

HIGH DROP PREFERABLE TO A LARGE USE OF WATER

If large quantities of water, used to secure transportive effect, are objectionable in the Harz jig, a greater effect of this kind can be secured by a large drop between the compartments. In the test jig described later is the extraordinary drop from screen to screen of three inches. In Richard's work, "Ore Dressing," the average drop from screen to screen (determined by averaging results obtained from the various mills) is one inch. In my book on ore dressing it is stated that the drop should not be less than two and one-half inches. High drop seems preferable to a large use of water; an equal transportive effect is obtained without so much of the evil effect of the material entering a compartment being carried along in the strong water current which exists above the bed of material in jig compartments and for some distance down below the upper surface of the bed. With high drop and a moderate use of water the general rate of progress of the material remains practically unchanged while the velocity of the upper layers is diminished. Material overflowing from one compartment to the next below will do so in a thicker layer than would be the case if more water were used, and such thicker layer consists more nearly of the top grains, provided there is active withdrawal of the lower layer either through the discharges or in some other manner.

G. Caetani, who was an early advocate of large drop between screens, maintained that the boiling and eddying effect to be observed at the entry point of a compartment in a jig having a large drop, and due to the rapid rush of ore and water down the relatively highly inclined division board between compartments, permitted the heavy grains, on entering a compartment, to at once reach positions at or near the screen. Here they would, as is evident, be beyond the influence of the transportive current in the jig and there would be no danger of their being carried away in the overflow.

INFLUENCE OF AREA ON CAPACITY

The separative capacity of the jig depends almost entirely on its area. If a plurality of products of varying grades and composition are desired, particularly if concentrates can be made, a multi-compartment jig must be employed. If the jig is to be employed on the roughing principle, then, regardless of whether or not concentrate products are made, a multi-compartment jig is desirable. Also, as will be shown at a later point, area in roughing work is more desirable in the form of a large number of compartments of moderate size than in a few compartments of large size. Except for practical considerations, an infinitely large number would be desirable.

Area is required in middlings removal to give the slowly subsiding grain time to reach the screen before it is carried so far forward in the compartment that it goes on to the next, where it does not properly belong, or to waste. Area can be secured by having wide compartments or long compartments. With loose-fitting plungers and wide compartments there is difficulty in getting an even distribution of the water pulsing through the screen. The effect of the pulsion is greatest on the side nearest the plunger. The dimensions of the passages in the jig have much to do with its proper operation. I agree with Richards' dictum that the plunger dimensions should be the same as the screen, and that the line of the pulsion from the plunger to the screen should at all points pass through cross-sections, equal as nearly as possible, to the area of the screen and plunger. The following out of this requirement has the sole objection that it requires a comparatively deep jig, if there be a large drop, to get the proper dimensions for passages in the last compartment.

With the ordinary Harz jig having a square cross-section it is only necessary, in securing proper dimensioning, to make the depth from the center partition down to the point of discharge equal to the width of the plunger or screen. By mounting the hutch discharges of all the other compartments at an equal distance below the center boards of the jigs, a good pulsion effect can be obtained. The pulsion of the plunger always keeps the hutches flattened out to a horizontal sand surface. In the upper compartments, following this mode of placing the discharge of the hutches, the sand will fill up to the discharge orifice, leaving a dead sand-filled space below. The action of the jig is not so good with too great depth of compartment as it is when properly dimensioned, and by allowing a space at the bottom of the jig to fill up with sand to the proper point the best effect can be secured.

COST AND POWER REQUIREMENTS LIMIT SIZE OF JIG

A limit to the size of the ordinary Harz jig is reached when the plunger and its supports and means of actuation become so massive that large size is prohibitive on the score of cost and power. On large jigs with a single plunger rod, breakage of this part is a common occurrence. An air-actuated jig would, if feasible, overcome this objection and would make possible the handling of large tonnages without occupying the floor space that would be required by an equivalent number of plunger jigs with comparatively small compartments. Instead of a large number of jigs of the ordinary size and kind, the equipment might be reduced to large single jigs, one for each of the sizes jigged. If the jigs have to be skimmed at regular intervals, large jigs are preferable to a number of jigs of equal total area of screen surface. Experimental work to the end of obtaining a simple close-sizing device of large capacity will be described in a following part of this paper.

CLEAN TAILING MIXED WITH MIDDLING OFTEN A NECESSARY CONDITION

In using the Harz jig on the roughing principle the heavy mineralized middlings grains are removed with considerable ease. In order to draw off as much of the lightly mineralized grains as possible, it will be necessary also to draw off a proportion of clean waste. This cannot be avoided in theory, and, as will be shown later, the withdrawing of the lightest middling by top discharges is impossible. To the uninitiated the spectacle of the top middling discharges of a Harz jig pouring out great quantities of clean tailing with the true middlings grains indicates either inattention on the part of the jig men, trouble with the jig, or poor design. Very little of the criticism for this condition should be directed at the jig man, however. In jigging under the roughing principle the aim should be to take out as middling as little waste and as much true middling as possible. It will be the endeavor in the next two papers to indicate how this can be done to the best advantage, or to suggest something fruitful.

Inaccurate Assay Reports

Whether Originating in Carelessness or Dishonesty, the Results Are Generally Costly—Careful Checking Always Advisable

BY G. L. SHELDON

Written for Engineering and Mining Journal

FALSE ASSAY returns have often been responsible for serious trouble and great expense. Sometimes they are caused by carelessness. The assayer may employ cheap help in the crushing, bucking, or quartering of the sample, which results in the sample becoming salted with gold from a previous rich sample. An instance of this nature in which I was personally interested occurred at Cripple Creek many years ago. A vein was found near the surface by trenching, sampled carefully, and given to a competent, honest assayer, who returned $660 gold per ton. I immediately resampled for a check, and my return showed only $12 per ton.

One time in Mexico, samples from various veins averaged 76 oz. silver and $11 gold per ton. The vein was 6 to 8 ft. wide and looked good, so I denounced it. In correspondence with a Chicago friend, I mentioned the matter. In a short time I received a wire offering me one thousand pesos for an interest in the claim. This I accepted and did 40 to 50 ft. of development work on it. During the work, I sent this friend samples of the ore. The returns came back showing $6 to $9 gold, 15 to 20 oz. silver, and some lead. I then took new general samples and sent to a reliable assayer of my acquaintance in the United States. These checked with the Chicago assayer. I lost a friend, as I was never able to convince him that it was the assayer's fault, not mine. It was a pretty fair prospect, at that?

Another time in Mexico, in the vicinity of a property that I owned, I found a small mountain of eruptive rock, probably three-quarters of a mile in diameter, surrounded on one side by limestone, on the other by granite, with a large river near. This mountain was of highly siliceous rhyolite, iron stained, a kindly appearance for mineral. My first samples gave $4 to $5 in gold and silver, about equal values of each. I took out a *zona*, good for ninety days, for the exclusive prospecting of the area. The surface in many places was bare rock exposure. With my *mozo* we spent twelve or fifteen days sampling the claim carefully and thoroughly over large surface areas, breaking and quartering each sample. These samples, assayed by a Mexican assayer in the employ of an American ore buyer, ran $2.50 to $5 in gold and silver. I retained part of ten of the principal samples. I went to the States soon thereafter, and had these tested by two reputable assayers, obtaining an average of thirty cents.

Not many years ago over $300,000 was spent on a large low-grade gold orebody in Montana, a promoter with little mining experience being placed as the manager. A large mill was erected. A competent assayer was employed at the mine during all the development period and mill construction. This assayer gave returns continuously of from $3 to $6 gold, an average of $4 per ton. After running the mill a time, he reported about $4 for the feed, with the tailings less than 50 cents per ton; but the actual recovery was less than $1 per ton. To a friend of mine, who was employed on the property as general mechanic, the promoter one day mentioned the peculiar results, asking him his opinion of them. This assayer was the only one who had been on the job; no other assays had been secured but his. My friend suggested that he take some general samples himself, unknown to the assayer, and send half of each to different reputable assayers. These results showed that he had no commercial ore, as they gave around $1.50 per ton. The mill has been idle ever since. It was found that this assayer had deliberately given the higher values with the intention of breaking the manager (which he did) on account of some fancied wrong.

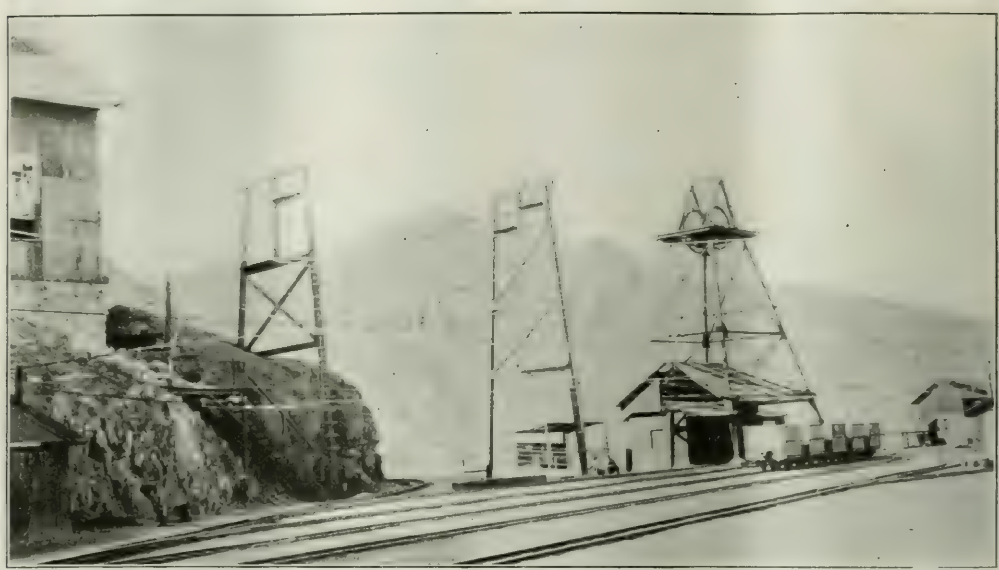
The Tonopah mine was found by Jim Butler. His first samples were thrown out the back door of a former Klondike assayer (near there), who reported to Butler that they were no good. Later samples taken by Butler, given to the present Senator Oddie, of Nevada, and sent by him to a reputable assayer at Austin, Nev., gave over $600 in gold. The Klondike assayer, hearing of this, dug up the glassy, white quartz samples he threw away, and checked with the Austin man. He then attempted to find and locate the ground, but failed. The Austin assayer, for making the test, received what is believed to be the record price for a single assay, $32,000, which was promised him if the samples were any good.

In 1890, a Cornishman, whom I knew well, prospecting at Cripple Creek (this being about one year prior to Bob Womack's discovery of ore on Womack Hill, at Cripple Creek), discovered what has ever since been known as the Gold King mine, up Poverty Gulch (near the Kathelin). He located it and did the discovery work, taking about 30 lb. of a general sample with him to Leadville, where he worked winters to secure a grub stake on which to prospect during the summer. He delivered the sample to an assayer, cautioning him to be very careful, as it was a new discovery. Three days later the assayer gave him a certificate of $3 gold per ton. It is quite certain that the assayer never tested it, for after Womack's discovery, this claim was located by others, and the Cornishman's dump from his 10-ft. hole, shipped to the Pueblo smelters, returned $200 per ton. The mine was still producing when I last heard of it.

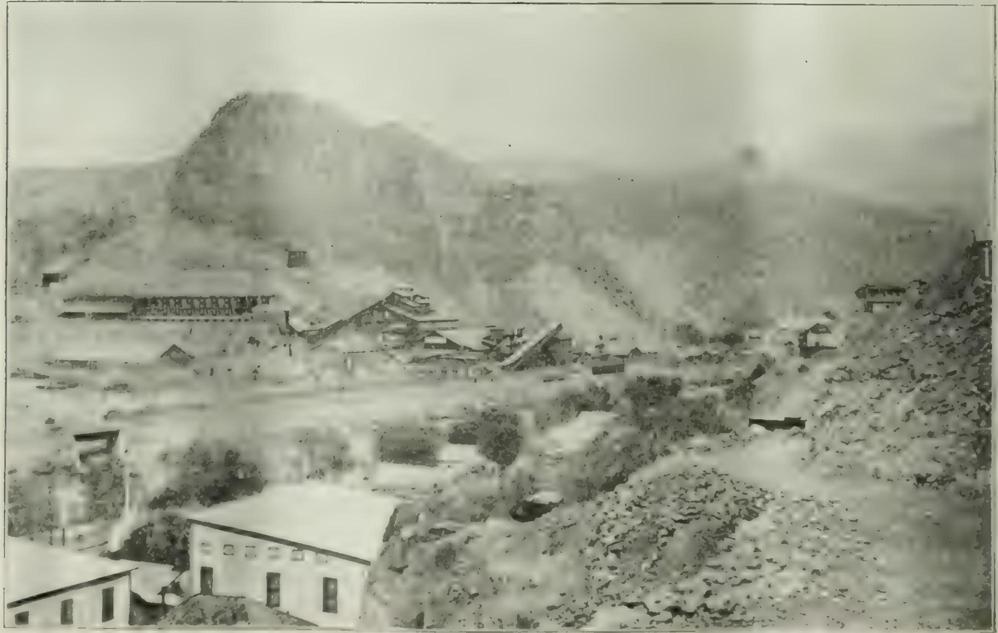
Prospectors have been known to work for years on a property because of the encouraging returns given them by dishonest assayers. For many years I have pursued the plan of frequently checking up any and all assayers, using part of the same samples. Mistakes often occur, and one cannot afford to take chances; one must know, as near as it is possible to ascertain, just what the valuable mineral content of the deposit is.

A sample should be carefully taken, broken in the field to walnut size (depending upon the size of the sample), well mixed and quartered, again broken to hickory-nut size, mixed and quartered, broken again to hazelnut size, well mixed and quartered, and one-quarter each sent to two assayers. If they do not check, then by retaining the half, one will still be able to get a correct idea by sending the remainder to other assayers. There are plenty of honest, careful men in the business. In other words try to be sure you are right, and eliminate all possible chances of errors.

Arizona Copper Co., Clifton-Morenci District



HEAD OF LONGFELLOW INCLINE, MORENCI, ARIZ.



EXPERIMENTAL LEACHING PLANT, ARIZONA COPPER CO., CLIFTON, ARIZ.

LOOKING UP CHASE CREEK, AT CLIFTON. ARIZONA COPPER CO. OFFICE AT LEFT.
SAN FRANCISCO RIVER IN FOREGROUND

STEEL TRESTLE ON LONGFELLOW INCLINE OF ARIZONA COPPER CO.

Field Work in the Philippines

Observations of Conditions Under Which Geological Exploration Is Carried On —Local Supplies Adequate, Transportation Generally Poor, Labor Plentiful— Usual Precautions Should Be Taken To Guard One's Health in the Tropics

BY ERNEST F. BURCHARD
Written for *Engineering and Mining Journal*

GEOLOGIC WORK in the Philippines, as in other parts of the Oriental tropics, requires that due consideration be given to conditions not encountered in temperate zones, but if this is done field work may be made fully as interesting and productive as in more favored regions. It was my privilege to engage in field examinations from February to September, inclusive, 1920, in different parts of the islands of Luzon, Cebu, Leyte, and Mindanao, and I found that only near the larger towns can field work be done advantageously with the party "living on the country," and if work is contemplated in the interior of sparsely settled islands like Mindoro or Mindanao, or even in the Bondoc Peninsula of Luzon, the only practicable plan is to maintain a camp.

OUTFITS MAY BE OBTAINED LOCALLY

In outfitting, if one goes from the United States, it is not necessary to take special clothing or camp equipment half way around the world. Practically all necessary articles of this sort may be obtained in Manila. The folding army cot is sold in almost all good-sized towns, and specially designed mosquito nets may be purchased to hang over it. In camp this net may easily be fastened in place by means of bamboo poles driven into the ground, or by cords tied across the tent, but it is convenient to carry two wooden rods, folding to the same length as the folded cot, which could be quickly clamped at each end when the cot was set up in a native hut or on the deck of a boat.

Staple canned foods, such as meats, fish, soups, milk, butter, vegetables, fruit, hard bread, and flour, are much more common in Manila than fresh foods, for the Filipino has found it easier to earn the money to buy canned food than to produce it from the soil. About the only foods one can obtain in bulk for use in camp are potatoes, rice, flour, sugar, and salt. For native help, rice and canned and dried fish are carried.

Instruments should all be taken from the States, and there should be extra aneroids and other easily broken apparatus. Medical and surgical supplies are obtainable in Manila, and should be selected with care, as one who is three or four days' foot journey from any settlement, without a physician in the party, may be unexpectedly called upon to play doctor himself, and he should, in addition to being able to render aid in injuries, know how to guard against and to treat, if necessary, some of the common tropical disorders.

It is said that the American population in the Philippines has diminished during the last eight or nine years, and that newly arrived Americans are therefore especially welcomed by those who permanently reside there. Be that as it may, our party met a cordial welcome from all officials, American and Filipino, from the Governor General to the village presidentes, and we were rendered valuable assistance by the Civil Government, including the office of the Governor General, the Treasury Department, the Bureau of Science, the Bureau of Forestry, the Bureau of Lands, the Bureau of Navigation, the Weather Bureau, and the Philippine Constabulary, and by the officers of the Philippine Scouts of the U. S. Army, particularly at Pettit Barracks, Zamboanga.

THE PHILIPPINES ALSO HAVE EXCHANGE DIFFICULTIES

If one uses a letter of credit with which to obtain funds, it is just as well to draw only the amounts needed from time to time in local currency, rather than deposit a large sum in local banks subject to check, on account of possible depreciation of exchange. United States funds deposited at the time of my arrival in Manila brought no premium if deposited in banks, but upon my departure it was necessary to pay 8 per cent premium to get American money, and about 10 per cent is now demanded. To pay native labor in the field I had to carry the necessary fractional currency from Manila, as the branch banks and provincial treasuries were able to keep little silver coin on hand. This condition may have improved later, on account of the output of the new mint of the Philippines at Manila, but there is a tendency among the natives and Chinese to hoard metal currency.

TRANSPORTATION STILL POOR

There are narrow-gage railroads on the islands of Luzon, Panay, and Cebu, but water transportation is, of course, the main method of travel in the Philippines, for there are about 3,000 islands in the archipelago. To get about among the islands one depends on all sorts of boats —the comfortable Japanese liners plying between Australia and Japan and making two stops in the Philippines, the native inter-island steamers and third-class junks employed mostly for picking up cattle and copra, and the local river steamers, gasoline launches, sail boats and even "vintas," hollowed out of long logs and paddled swifty by Malay oarsmen.

A GOOD ROAD IN THE FOOTHILLS NEAR MANILA

The irregularity of the inter-island traffic is, perhaps, what most vexes an American, but one finally accepts philosophically the enforced pastime of waiting, and readily agrees with whoever said that the slowest man in the Philippines was one who missed an inter-island boat. Many amusing incidents might be related of delays in progress of these inter-island steamers, which illustrate their trivial nature, but a few will suffice.

MOVING CAMP IN MINDANAO, P. I. MOUNT KITUBUD IN DISTANCE

A trip on a small steamer from Manila to a point in southern Luzon, about 175 miles, consumed four days, the nights mostly being spent in unloading cargo. One morning, four hours after leaving a small port, the mate suddenly discovered in checking over his lists that he had unloaded fifty bags of rice too many. Notwithstanding our protest, the boat was put back, and the rest of the day was devoted to recovering the extra rice, which a covetous Chinese merchant had secreted.

The next forenoon, as we lazily steamed through an indigo-blue sea under a cloudless sky, an awful din arose on the bottom deck; whistles of distress were sounded, and a boat was lowered. Hastily preparing, as I thought, to leave a sinking ship, I gathered up my precious instruments, notes and maps, and looked over the rail. What I beheld was three nearly naked Filipinos rowing frantically to overtake a small white pig which had escaped from its crate and jumped overboard, and had started on a five-mile swim for shore. The pig swam nearly as fast as the sailors could row their clumsy boat, but after three futile attempts had been made to grab him, he was finally landed with a loud squeal, and after a delay of one hour we were once more serenely on our way. It is a wonder that a shark did not get the pig, for a short time before I had seen a dorsal fin cutting the surface of the water.

On another occasion when the largest of the inter-island steamers had been scheduled to leave port at 5 p.m., it took her stevedores all the following night to get a horse on board and an automobile off. Delays are not always due to human frailties, however, as bad weather often takes a hand in the game. In July, 1919, a geologist set out from Manila in a gasoline launch, intending to run down to southern Luzon. A typhoon arose as he reached the mouth of Manila Bay, and he was obliged to take shelter in a small cove on the mainland and to remain there three weeks before the storm abated.

Methods of travel by land in the Philippines may be quite as diverse as those employed in traveling by water. There are short narrow-gage railway lines in the islands of Luzon, Cebu, and Panay, but travel on them is to be avoided if one can reach the same places by automobile. Many fairly good automobile highways have been built in the larger islands, but it is claimed that they have not been as well kept up under native local government as before Americans relinquished most of the control. Among the roads well known to tourists is that leading to Baguio, the mountain resort in northern Luzon; those across and lengthwise of the island of Cebu, and the one from the coast up to Lake Lanao, in the north of Mindanao.

HORSES AND CARIBAO AS TRANSPORT ANIMALS

Field work is usually remote from good roads, however, and travel must be on horseback, on caribao, or on foot, and transportation must be by means of native cargadores or by caribao. Horses are small and weak, besides being scarce or difficult to obtain, and only in a few places have the caribao been trained to carry white men or packs. The availability of the caribao is limited to regions where the distances from streams or wallows can be traveled in two or three hours, for the caribao is a water buffalo and must spend a good part of his time wallowing in the water—the muddier the more he enjoys it. Where this beast is available, however, he is exceedingly useful, for he will carry at least as much as three cargadores and will live on coarse grass that would kill a horse.

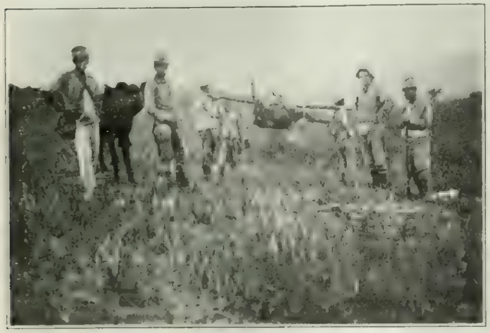
Where cargadores are the sole means of transporting equipment and supplies, the average burden that can be carried is fifty pounds, and the really serious problem is to get cargadores enough to carry the bulky food, rice, canned salmon, and dried fish, that will be needed by themselves. On one expedition only thirty-five cargadores could be obtained, not enough to carry all the outfit into the interior, a four-day hike from river transportation. Part of the supplies were therefore left in a safe place, and on making the first field camp fifteen cargadores were sent for [illegible] of a [illegible] supplies. On their return, a week later, there were fewer supplies to be moved to the next camp, and when this move was accomplished in two relays it was possible to discharge a few cargadores. Others were discharged each week, and at the end of six weeks the party returned back to the river with just fifteen cargadores packing everything including mess provisions. The advantage of caribao vs cargadores is readily apparent when it is con-

NATIVE CONSTABULARY AND CARGADORES AT A MINDANAO CAMP sidered that no food need be carried for the animal, and that his rental is about the same as the pay of a cargadore.

While we were in the Philippines a reconnaissance for a railroad was being made in northern Luzon by airplane. Whenever this method can be used for topographic and geologic reconnaissances it will give a wonderful advantage to whoever can employ it in Mindanao.

COUNTRY HAS VARIABLE CLIMATE

Except in the hilly and mountainous regions of the islands, warm temperatures prevail, ranging generally between 75 deg. F. just before daybreak to 95 deg. in mid-afternoon. The cities of Manila and Cebu are among the hottest places in the islands, but rural regions are mostly cooler. The southern islands are cooler than the northern, although nearer the equator. Close to the open sea the trade winds fan away the tropical heat, and at altitudes of 1,000 to 3,000 ft. conditions are often pleasant, and one must sleep under a blanket at night.


CONSTABULARY BRINGING IN FRESH MEAT

The dry and rainy seasons exercise the most important influence on field work. These seasons do not occur at the same time in all parts of the islands, but in certain instances are influenced by the direction of the monsoons, or trade winds, and the typhoons, or cyclonic storms, and the distribution of the mountain ranges. For instance, in western Luzon, including the vicinity of Manila, the wet season comprises the months of June to November, whereas in central Mindanao it begins about September and lasts until later. The eastern regions have longer wet seasons. Some parts of the islands have rains well distributed through the year. When the rainy season occurs in full force, geologic mapping may be impossible for days or weeks at a time, and on account of the high winds, which reach frequently the proportions of a typhoon, life in a tent at such times is almost impossible. Fortunately, the great island of Mindanao, at the south, is outside of the belt of frequent typhoons. Good data may be obtained for most parts of the islands from the Weather Bureau at Manila.

PRECAUTIONS NECESSARY TO GUARD HEALTH

It was found advantageous to carry practically all food supplies, mostly canned, based on standard army rations, rather than to depend on the country for anything; then, whatever might be available locally, such as chickens, eggs, bananas, camotes (sweet potatoes), fish, and game, could be used to offset an equivalent of canned goods. To carry supplies involved a problem in transportation, but in most of the country under investigation there were few inhabitants and these so poor that they have little or nothing to sell.

Deer and wild pig are plentiful in Mindanao, and our constabulary guards frequently brought us fresh meat, but in islands where we were not accompanied by constabulary no one had time to do any hunting. Possession of firearms and ammunition is not permitted to the inhabitants except under extraordinary circumstances—one reason for the abundance of game.

The two most essential precautions to be observed to maintain health were (1) to take no food or drink that had not been thoroughly cooked, and (2) to avoid being bitten by malaria- or dengue-fever infected mosquitos. A third essential precaution was to disinfect thoroughly as soon as possible any wound, however slight. An exception to cooking food may be made with fruit picked from trees, but the general prevalence in the soil of dysentery-producing amœba, and the abundance near settlements of bacilli which cause dysentery and other intestinal diseases, make it obligatory that all water taken into the mouth in any form shall be boiled at least twenty minutes, and that no green vegetables or salads be eaten; and these rules apply equally well to all of the Oriental tropics. The new-style army canteen with aluminum cup and folding handle makes it possible for a thirsty geologist—delayed perhaps beyond the duration of his sterilized water supply—to boil a quart of water gleaned from any source, provided dry fuel and matches are available.

Skin diseases of many suspicious sorts are common among natives of remote provinces, especially among the Moros, and one must therefore exercise particular care to avoid contact with them or their possessions. One party of cargadores in our employ was put under an unusually intelligent and capable capitaz, who understood sufficient English to render him of great value, but he was handicapped by a scaly eruption which formed a scroll-like design over his visible anatomy. It was said to be a non-contagious malady due to eating fish without salt, but this seemed dubious.

The first-aid equipment, mentioned above, contained iodine in small sealed glass tubes, which upon breaking the end formed convenient emergency swabs, of great value in preventing the development of tropical sores. Our natives, who were barefooted, frequently asked for treatment from the medicine chest, both for wounds and for fevers, although they are more immune to all kinds of infection than white men.

Wherever our work led us the mosquito was present, although not at all abundant in the high, sparsely settled foot-hill country in Mindanao. Ants, from those microscopic in size to half an inch long, literally teem everywhere, and more than once I was forced to vacate my cot and even my tent in the middle of a rainy night because of being overrun and nearly devoured by millions of tiny ants which had sought a dry spot and thus repaid our hospitality. Reptilian life is sparse except for small lizards, most of the large snakes having been killed and eaten by the natives.

Laborers for our purpose (we required about fifty at the maximum) appeared to be abundant, but unwilling to work, and had to be forced to it by village presidentes in Luzon and by the Moro dattos in Mindanao. In Mindanao it is also essential that the Moro datto shall approve of the project, for he can easily prevent any labor being secured if he does not fancy the proposition, and so it is well to cultivate his friendship.

Those who proved to be the best cargadores were municipal prisoners, assigned to us from a constabulary jail in Mindanao, and who, therefore, did not receive any wages until their term of sentence was served. Wages in 1920 ranged from 80 centavos (40c.) in Mindanao to one and one-half pesos (75c.) per day in Luzon, besides subsistence. Two cargadores deserted one night en route into the interior, but this practice was speedily discouraged by announcing that, if any one deserted, his friends would have to carry his pack for the rest of the journey.

Gambling is a great vice among the Moros, and to deter them from it while any remained idle in camp they were kept busy under constabulary supervision clearing ground, building shelters, furniture and baskets. Given a bolo knife and a supply of bamboo and rattan from which he can cut thin strips of "bohuka," the native will make almost anything needed for temporary comfort. Nails are not needed by him—everything is tied together with bohuka. For a cook we found it best to take with us a Filipino—a Visayan or a Tagalog. Filipino men are accustomed to do cooking and general housework, even at home, and they make good cooks with a little "Americano" coaching.

For mining or drilling operations most skilled labor would have to be brought to the Philippines. The Filipino is adaptable and is naturally a fairly skilled mechanic, and in time could be taught to do much of the necessary work, but on account of his propensity for holidays and cock fighting, a large excess of labor must be kept on the rolls. The problem of gathering and transferring laborers from one district to another in the Philippines should not involve so many difficulties as considered probable in China, by Bain,[1] but it presents greater difficulty than that of mobilizing a similar force in the United States.

Filipinos are attached to their homes and families, or at least offer that admirable virtue as an excuse when their services are sought elsewhere. In the Visayan group of islands the population is dense in places, and the natives have to work comparatively hard to support themselves, and so recruiting among these inhabitants and also among the Ilocanos, of the north, is said to produce the best results.

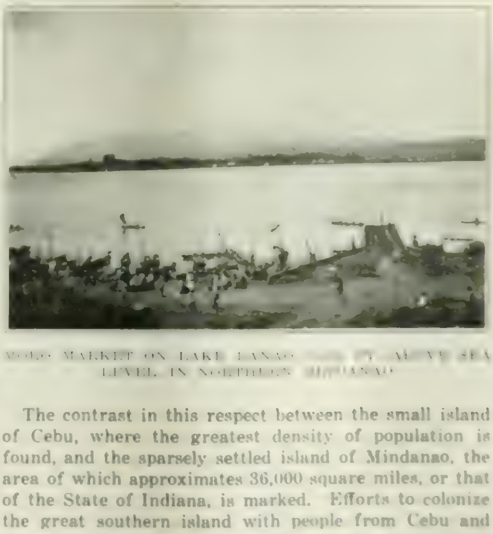
It must be remembered that in the Philippine Islands there are many tribes, each speaking a different language; in fact, it is credibly reported that at least seventy-five different tongues are spoken in a population of about 11,000,000 and within an area of approximately 115,000 square miles. Despite the efforts of Americans during twenty years to teach the natives the English language and otherwise to educate them, these efforts have not been as gratifying as might be wished, and comparatively few have any knowledge of English.

The Moro, in the south, for whom some Americans in the Philippines have expressed considerable admiration, has yet a long way to go in learning industry and cleanliness before he will become of much value to himself or to his country. Accustomed for centuries to roam the mountains and valleys of Mindanao as far as possible from the beaten trails, raising a few crops of vegetables on a hillside clearing, then migrating to a more remote place, it has been difficult to bring him close to civilization and a settled life.

Philippine laws have long excluded Chinese coolie labor, but have permitted the entrance into the islands of Chinese merchants and clerks. The Chinese are shrewd traders, industrious, thrifty, and progressive, and the result is that by far the greater part of the retail trade of the islands is in the hands of the Chinese. Recently there has been agitation on the part of Filipino planters for the admission of Chinese coolie labor.

MUCH UNDEVELOPED TERRITORY

One thing that impresses the observer is the unequal distribution of population and development in the Philippine Islands. This is due in part, of course, to physical conditions, for much of the country is so rugged as to offer almost insurmountable obstacles to settlement. On the other hand, Oriental inertia and hostility among tribes have had much to do with retarding migration from one island to another and even from one locality to another. Ordinarily one would not expect an island as wild and mountainous as Mindoro to be inhabited anywhere except on the fringe of coastal lowland, but when the wonderful cultivation of rice on the terraced mountain sides in north-central Luzon is borne in mind, it seems strange that in past centuries the mountainous regions in other islands have not become similarly inhabited and developed.



MORO MARKET ON LAKE LANAO, [illegible] FT. ABOVE SEA LEVEL, IN NORTHERN MINDANAO

The contrast in this respect between the small island of Cebu, where the greatest density of population is found, and the sparsely settled island of Mindanao, the area of which approximates 36,000 square miles, or that of the State of Indiana, is marked. Efforts to colonize the great southern island with people from Cebu and other crowded areas are proceeding slowly, chiefly along the coasts, in the valleys, and on the plateau north of Lake Lanao, but Japanese are reported to be coming in rapidly, and may in time find themselves in "peaceful possession," as they already are said to be in Hawaii.

The Island of Mindanao may be likened to a miniature continent, for it possesses the principal topographic features of the major land divisions, such as mountain chains, highlands, lowlands, lakes, river systems, alluvial valleys, and coastal plains. The valley of the Cotabato River, one of the most fertile regions of the world, and capable of supporting several million people, is relatively sparsely settled. It contains a few coconut groves and rice plantations, but the greater part is overgrown with tall coarse grass. Up some of the northern tributaries are virgin forests of valuable timber, and still farther north are great areas of grassy highlands inhabited here and there by a few poverty-stricken Moros. Two or three farm schools have been established in the interior, with Filipino teachers, and their plans to teach the Moro boys the rudiments of farming are worthy of encouragement, but they have little or no funds with which to work, and the conditions which I saw were so miserable and discouraging as to leave no room for doubt that it is America's duty not to desert the Philippines now, but to assist materially in agricultural education and colonization in Mindanao. Until the interior is better settled and plowing becomes more general, the grasshopper invasions, which at present seriously handicap the cultivation of rice and corn, cannot be checked. Depredations by wild pigs and monkeys are serious, because the natives have no guns with which to slay these pests.

---

[1] Bain, H. F., Mining and Metallurgy, New York, February, 1921.

Hostility between the Mohammedan Moro and the Christian Filipino will long retard Filipino immigration into Mindanao. Filipino domination is detested by the Moro, and to most Filipinos the only good Moro is a dead Moro. The Moro wishes in the event of ultimate Philippine independence to have the United States retain Mindanao and the Sulu archipelago; yet he resists one important American measure; namely, the education of females, for he fears that with enlightenment his women may rebel and try to overthrow polygamy.

Instances of friendly relations between Filipinos and Moros are not rare where acquaintance and mutual understanding have developed, and it is my belief that, if these conditions are fostered, tribal and religious differences will become less significant and the really important thing—the settling of Mindanao by natives of the more crowded Philippine Islands—may progress more rapidly under American guidance.

The Recovery of Zinc From Lead Blast-Furnace Slags

In the *Proceedings* of the Australasian Institute of Mining and Metallurgy, No. 38, a summary is given of the tests conducted by the Sulphide Corporation at Cockle Creek on zinc recovery from lead slags. Most of the experimental work was done in a small electric furnace holding about 500 lb. of slag. Earlier experiments, conducted with a reverberatory furnace, were found to be not promising, owing to a prohibitive cost of working. Tests were also carried on in a small blast furnace with a 5-ft. charge column and air at a pressure of 8 to 10 oz. Slag briquets, slag nodules, and ordinary dump slag were charged at different times. The fume was cooled and collected in a baghouse. The work with briquets and nodules did not offer much promise.

In the blast-furnace tests using slag direct from the dump, a certain proportion of limestone was added to form a slag containing about 25 per cent CaO. The charge contained about 100 parts of 1-in. slag, 17 parts of 1-in. limestone, and 34 parts of 3-in. coke. It carried 2.3 per cent lead and 9.8 per cent zinc. The tapped slag assayed 1 per cent lead and 5.4 per cent zinc, the recovery being about 60 per cent of the lead and 41 per cent of the zinc. These results are low, but from data obtained while using a small quantity of slag rich in zinc it was found possible to obtain a recovery of about 75 per cent, and it was also found to be a simple matter to reduce the zinc to about 5 per cent, whether the original contents was 9 or 15 per cent. In running on a slag containing 15 or 20 per cent of zinc a fair profit would be indicated.

In the electric furnace work, it was found that a large proportion of the zinc is fumed during the process of melting, and nothing is gained by charging molten slag into the furnace. From slag in the molten stage, no fume comes off until the temperature reaches about 1,600 deg. C. Fume can be driven off at a lower temperature, around 1,200 deg. C., only if a state of constant agitation is maintained.

California Talc Production Declining

Deposits of high-grade talc in California have been known for some years, but little interest was shown in them until 1911 and 1912, when considerable activity was evident. Then interest died down again until the war curtailed imports from overseas in 1917, which caused a remarkable increase in production from 630 tons in 1916 to 4,152 tons in 1917. In 1918, according to the U. S. Bureau of Mines, California stood third in the list of talc-producing states, with eight going mines and a total production of 10,364 tons, valued at $170,775. This great stimulus to production in California led to the development of several deposits of exceptionally high-grade material and the erection of modern and efficient mills. Prospecting for talc in other western states was also encouraged, and deposits of high-grade talc were discovered at several localities in Washington, and in Montana, Wyoming, Arizona, New Mexico, and other states.

Complete statistics of production for 1919 and 1920 are not yet available, but production in California was maintained at a high level until the latter part of 1920. During 1920, however, imports of talc from Italy and France greatly increased and those from Canada were the largest in history. The total imports of talc in 1920 were 21,729 tons, valued at $442,732, a greater total than in any preceding year. Meanwhile the ocean freight rates have decreased and the transcontinental railroad freight rates have greatly increased. Thus at the present time California producers are faced with high costs of production, high freight rates, and increased foreign competition encouraged by the lower labor and freight costs abroad and by a favorable condition of foreign exchange.

Ontario's Silver Output Handicapped

Considering the combined disadvantages of power shortage, a decline in the price of silver, and the fact that several properties are closed down, the silver output of Ontario for the first quarter of 1921 is creditable, according to the Ontario Department of Mines. The average New York price of silver was 60.5c. per fine oz. for the period, as compared with $1.30 for the first quarter of 1920. The following ten mines made shipments: Nipissing, Mining Corporation, Coniagas, O'Brien, La Rose, Miller Lake-O'Brien, McKinley-Darragh-Savage, Beaver, Trethewey (Castle), and Bailey. In addition to 2,083,989 oz. shipped by the silver mines, there was a recovery of 19,103 oz. by gold mines and 2,953 from nickel-copper refining operations. The mines also received payment of $4,809 for 32,531 lb. of cobalt.

During the period southern Ontario refineries situated at Thorold, Deloro, and Welland recovered 1,073,202 oz. of silver in addition to arsenic, nickel, and cobalt in various forms. The market for all these products was poor, and in consequence stocks have accumulated.

Metallurgists of Note

Frederick G. Cottrell

THE NAME COTTRELL is well known to all metallurgists through the fume precipitation process to which the inventor's name was given. Not so many, however, even among those who use Cottrell equipment, know much of the frank and attractive personality, or the work, of the man who developed the process to a commercial success. Frederick G. Cottrell, chemist, metallurgist, and inventor, was born in Oakland, Cal., on Jan. 10, 1877. He attended school in Oakland and matriculated at the University of California in 1893. After being graduated in 1896, with the degree of Bachelor of Science, he was a Le Conte fellow at the university in 1896-1897, and taught chemistry at the Oakland high school in 1897-1900. Then he went to Europe, where he studied at the University of Berlin and the University of Leipzig, receiving from the latter the degrees of Master of Arts and Doctor of Philosophy in 1902. On his return to this country in 1902 he was appointed instructor in physical chemistry at the University of California, and in 1906 was appointed assistant professor, holding this position until 1911. While at the university, Dr. Cottrell's chief contributions to science were researches relating to the electrical precipitation of fume and fine particles suspended in the gases from smelters and cement works, and he finally evolved what is known as the Cottrell process for this purpose. This invention was first utilized at the Selby smelter in California for removing fume from the waste gases of a sulphuric-acid plant at the smelter, thereby abating a nuisance that threatened to necessitate shutting down the works. Subsequently, this electrical precipitation process was installed at other smelters to remove fume and solid particles contained in the escaping gases, and it was also successfully used at cement plants, notably near Riverside, Cal., to prevent the dust from the calcining kilns from damaging nearby orange groves and vegetation. Today, the Cottrell process of fume and dust removal is in world-wide use, and is recovering materials heretofore wasted to the value of many thousands of dollars. One of the latest installations is at a large smelting plant in Japan. The largest installation is at the Anaconda smelter, Anaconda, Mont. Dr. Cottrell, in a desire to encourage scientific research, turned over his extensive patent rights to a non-dividend-paying company, known as the Research Corporation, a body formed for that purpose. A fundamental requirement in the incorporation is that all net profits shall be devoted to the interests of scientific research. In 1911, Dr. Cottrell was appointed chief physical chemist of the U. S. Bureau of Mines, being successively promoted to director in June, 1920. He resigned on Dec. 31, 1920, to accept the position of chairman of the Division of Chemistry and Chemical Technology of the National Resources Council. Aside from his work on smelter smoke Dr. Cottrell has been deeply interested in and intimately connected with work on the separation and purification of gases by liquefaction and fractional distillation. During the World War, and subsequently, the development of the Norton or Bureau of Mines process for the recovery of helium from natural gas has been his special care, and it was chiefly through his efforts that a plant for recovering helium (a rare non-inflammable gas) on a large scale for military aeronautics has been erected near Petrolia, Tex.

FREDERICK G. COTTRELL

Dr. Cottrell is greatly interested in some plan to encourage Government employees to patent inventions, whereby the Government will develop the patents.

Dr. Cottrell is a member of the American Chemical Society, the Mining and Metallurgical Society of America, the American Electrochemical Society and American Institute of Mining and Metallurgical Engineers. He was awarded the Perkin medal by the New York Section of the Society of Chemical Industry in 1919 in recognition of his work on electrical precipitation, and was presented with the Willard Gibbs medal for eminent work in and original contributions to pure and applied chemistry on May 21, 1921. This medal is awarded annually by the Chicago section of the American Chemical Society. Dr. Cottrell is also an enthusiastic student and advocate of Esperanto.

HANDY KNOWLEDGE

A Review of Drilling—Part I

BY GEORGE J. YOUNG
Western Editor *Engineering and Mining Journal*

The rock type affords indication of the ease or difficulty of drilling. The structure of the rock is also of importance. If it is granular, it usually drills well, although some fine-grained rocks of granular texture give low rates of drilling, though the equivalent rock in coarser structure drills readily. Compact, dense rocks, as a rule, drill with greater difficulty than those of more open structure.

A simple test with the hammer will indicate whether the rock is tough or brittle. Brittle rocks drill more easily than tough ones. The test for hardness is useful, but to be so must be considered along with the other physical properties. Altered rocks are usually more readily drilled than unaltered. Silicified rocks may be exceedingly hard and tough and give low drilling rates. Quartz may be so shattered by movement as to be drilled at a rate comparable with that obtained in very soft rocks. Some varieties of vein quartz are very tough and hard. The following table gives a rough division into hard, intermediate and soft rocks:

Hard	Intermediate	Soft
Granite	Rhyolite	Altered rocks
Aplite	Andesite	Serpentine
Syenite	Dacite	Gypsum
Diorite	Trachyte	Shales
Basalt	Phonolite	Rock salt
Dolerite	Glassy volcanics	Anhydrite
Silicified rocks	Tuffs	Iron ores
Flint	Sandstones	Sandstones
Quartz	Slates	Coal
Quartzite	Limestones	
Siliceous hematite	Marble	
Magnetite	Altered rocks	
Pyrrhotite	Iron ore	
Diabase	Dolomite	

A homogeneous rock mass will drill with less difficulty than one which is characterized by frequent changes in the rock or one containing slips, joints, gouges, bedding planes, vugs, and holes. The latter interfere with regular drilling and often cause drill holes to fitcher. With hammer drills less difficulty is experienced with such irregularities than with the piston drill. Rocks belonging to the hard and intermediate divisions are best drilled by percussion. Soft rocks yield more readily to rotary drilling.

SELECTION OF THE DRILL

Modern rock-drilling appliances of the hammer type fall into three well-marked groups, namely, the drifter, or mounted drill, which can be used for drilling holes in all directions, but which is preferably used for horizontal and holes not exceeding 35 deg. above or below the horizontal; the plugger, which is most suitable for down holes or holes not exceeding 35 deg. from the vertical (for all other holes if the plugger is used a light support is desirable); and the stoper, for all holes above 30 deg. from the horizontal, although with special supports this type of drill can be used for holes in all directions.

In each of the three types heavy to light drills are provided, and the selection from each group is determined by the kind of rock to be drilled. For hard, tough rocks, the heaviest and most rugged drills are required, to secure the highest drilling rates obtainable in the rock. In softer and intermediate rocks, lighter and small drills will give sufficiently high rates of drilling; the heavier drills are not suitable, as the force of the blow is often such as to cause the drill to stick badly and necessitate throttling down the air supply to secure a lighter blow. For the very soft rocks, hammer drills which have the rotating element specially developed are more suitable than those which are provided with a rotating mechanism of ordinary capacity. For seamy and more or less fractured rock, hammer drills of the "Turbro" type appear to give excellent results.

In securing the best results with the rock drills selected it is essential that the mechanical condition of the drill be maintained at the highest point. In order to do this it is desirable to test the drill against hard rock after it has been overhauled in the shop. This can be done by having a testing gallery or drift convenient to the repair shop and connected thereto by a track so that drills can be readily transported to the testing stand and tried out. In some mines a "drill doctor" is provided, who goes from working place to working place and examines each drill in operation. Drills not in proper mechanical condition are sent to an underground shop and repaired and tested in the shop against the roof and walls of the shop, which is usually situated in an unused crosscut.

Another effective method is to remove each drill after two or three shifts' work and completely overhaul it in a surface shop. This is probably the most effective way to maintain mechanical condition. The use of shop testers such as the Paynter rock drill testing machine[1] is to be recommended, but the best test is to determine the drilling speed by actual use against rock of the same nature or harder than that encountered in the mine workings. W. L. Saunders states that "the maximum foot-pound energy (as determined for a given drill by use of the Paynter or similar testing machine) does not always mean maximum drilling capacity."

The standardization of the different types of drills used in a given mine by the determination of the rate of drilling a hole of a given diameter and with the same air pressure in use at the drills, and the comparison of the results obtained from a repaired drill with these standards, are more illuminating in showing the mechanical condition of the drill than any of the crude shop tests in ordinary use.

The lubrication of the drill regularly during operation by means of a suitable lubricant is fully as important as proper mechanical condition. To a considerable extent drill manufacturers have provided their drills with automatic lubricating appliances which need only to be filled at intervals with the proper lubricant to keep the drill in efficient operation. It is important that the grade of lubricant most suitable for each type of drill be provided and used. Drill manufacturers have conducted careful investigation of the proper lubrications of their drills, and supply the necessary information to users. Instruction of drill runners by foremen, shift bosses, or by a special drill boss upon the details of lubrication of each drill is desirable, and systematic inspection of drills under operation with the objective of attaining careful attention to lubrication will repay itself in increased efficiency and decreased repair cost.

---

[1] *Engineering and Mining Journal*, Vol. 96, p. 829. *Transactions* A. I. M. E., Vol. 49, p. 318.

THE DRILL RUNNER

Upon the knowledge, skill, and care of the drill runner much depends. The drill manufacturer has done his part in turning out an excellent machine. Although it is made to be almost "fool-proof," and to stand rough usage, it is not necessary that it be either subjected to unnecessarily rough handling nor that it be expected to give efficient results in the hands of unskilled drill runners. With new types of drills, drill runners should be carefully instructed by operators familiar with the handling of such machines.

The drill runner's prejudice in favor of certain drills and against new drills arises frequently from his knowledge of the one and his ignorance of the other. It is money well spent for a mine management to provide a well-trained and intelligent drill operator to check up drill runners and instruct them in the proper use of the type of drill used in a given mine. A tactful man is essential, as some drill runners resent obviously needed instruction. Probably more can be gained, or at least as much, in increasing drill efficiency by selection and adequate instruction of drill runners as by care in the selection of drills and their mechanical maintenance.

AIR PRESSURE

Modern hammer drills operate best at air pressures ranging from 85 to 95 lb. per sq.in. This condition requires from 90 to 100 lb. at the air compressor and a well-designed pipe-distributing system. A poorly designed pipe system, improperly maintained, will result in low air pressures at drills and negative all the other factors. Periodic inspection for leaks and the testing of air pressures at the drill are essential factors in drilling efficiency. Excessive lengths of drill hose, poor drill hose or hose of too small diameter will result in low drilling pressures. The best drill will be inefficient if supplied with low-pressure air, and the drill runner will operate under a handicap that he cannot overcome. It should be kept in mind that a single drilling unit represents a capital investment of from $1,200 to $[illegible],000 and the labor cost per shift from $4 to $5. To make proper returns upon this capital investment and to secure an adequate return for the labor cost requires air under proper pressure at the throttle of the drill. Power cost is one of the lesser factors in drilling cost, but insufficient compressor capacity and excessive leakage may result in low drilling footage per shift and disproportionate cost of power and labor.

DRILL STEEL

The sizes and weights per foot of drill steel upon the market are given in the accompanying tables.

The lightest section is the cruciform; the heaviest the quarter octagon. The round steel is next to the cruciform section in weights per foot. In addition to those given in the table, twisted hexagon, twisted cruciform, spiral steel, and hollow spiral steel are manufactured for "rotators."

For drifters, 1¼-in. hollow round is used to a large extent; for stopers, ⅞- and 1-in. solid cruciform and hexagon and hollow hexagon; for pluggers, hollow hexagon ⅞, 1, and 1⅛ in. Solid octagon is used for piston drills, but is not used for hammer drills. B. F. Tillson states that the quarter-octagon section is fast becoming popular. This is probably true of Eastern districts, but in Western districts of the United States the round, hexagon, and cruciform sections prevail. I am informed that the North Star mine has experimented with this section, as have mines in the Lake Superior copper district. Mr. Tillson states that the quarter-octagon section has the advantages of a longer life of drill-chuck bushings, of scraping the cuttings free for ejection from the drill holes, and of ease of forming cross bits, and that it has shown superior strength in resisting strains of service. He states that in many instances this section would give better service than much larger sections of cruciform steel. It is of interest to note that of the different sections, quarter octagon contains the greatest steel area for a given size. Hence where excessive breakage is encountered, a heavier section is called for and may be obtained by substituting the same size steel in quarter-octagon section. The larger diameters and heavy section in the case of the cruciform are used for the larger drills and the lighter section and smaller diameters for the smaller drills. Usually the drill manufacturers specify the section and size of steel most suitable for the different types and sizes of drills which they make. Light steel has the advantage of portability and ease of getting into difficult places, but where the section is too light increased breakage results.

WEIGHT OF SOLID DRILL STEEL IN POUNDS PER FOOT

Size, In.	Cruciform	Cruciform Rocky Mountain	Hex.	Round	Octagon	Quarter Octagon	[illegible]
[illegible]		1.70		2.[illegible]4	[illegible]	[illegible]	[illegible]
[illegible]	2.17	2.20	2.4[illegible]	2.67	2.8[illegible]	[illegible]	[illegible]
[illegible]	2.7[illegible]	2.80	3.10	3.[illegible]8	3.[illegible]7	[illegible]	[illegible]
[illegible]	3.[illegible]	3.35	3.61	4.17	4.40	4.[illegible]	[illegible]

WEIGHT OF HOLLOW DRILL STEEL IN POUNDS PER FOOT

Size, In.	Size of Hole, In.	Round	Hexagon	Quarter Octagon
[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	2.[illegible]0	[illegible]	[illegible]
[illegible]	[illegible]	3.14	[illegible]	[illegible]
[illegible]	[illegible]	3.[illegible]	4.[illegible]	4.[illegible]4

[illegible] Rock Drill Steel [illegible] 0.283 lb. per [illegible]

B. F. Tillson states that [illegible] per cent carbon steel is the most favored steel. The analysis given by Mr. Tillson is as follows: Carbon, [illegible] to 1 per cent; manganese, 0.10 to 0.40; silicon, [illegible] to 0.30; sulphur, 0.02 to 0.04; and phosphorus, 0.005 to 0.09.

G. H. Gilman specifies straight carbon steel for hollow drill steel conforming to the following percentage limits: Carbon, 0.85 to 0.95 per cent; manganese, 0.30 to 0.40; phosphorus, under 0.03; sulphur, under 0.03; silicon, 0.10 to 0.20.

Chrome-vanadium, and chrome and nickel steels, as well as other alloy steels, are upon the market, but experimentation is necessary to show whether their increased cost will return a commensurate service.

(To be continued)

THE PETROLEUM INDUSTRY

Unjust Taxation of California Oil Properties[*]

By Carl H. Beal and Robert B. Moran

THE OIL INDUSTRY, as well as any other industry, should contribute to the commonwealth its just proportion of county and state taxes. It should not be compelled, however, to pay more than its prorata of such taxes, which are based on the "full cash value" of the properties. Section 3627, Political Code of California, provides that "all taxable property must be assessed at its full cash value." The determination of the "full cash value" is left to the county assessors, who employ various rules and methods in determining the basis of the tax. Any rule that is unequal in effect or discriminatory in character should not be employed, though it is admitted that some method not too complex must be devised to enable the assessor to assign the "full cash value" to the various classes of properties under his jurisdiction.

Recently, the rule used by the assessor of Orange County, Cal., in computing the "full cash value" of oil properties in that county for purposes of taxation, was analyzed. The conclusion reached is that the rule is inequitable; it is unsound and fallacious in every detail, and it is a marvel that an industry that has always fostered progress in all its branches has submitted to it. If the procedure were equitable it could not be so objectionable, even though it were not based on sound principles.

It has been said that market value fairly represents the full cash value. There are many decisions in the California courts to this effect; for instance, one decision states that "market value" is the criterion of "actual value." Market value of a property means the fair value as between one who wants to purchase and one who wants to sell; the present value at a sale which a prudent owner would make if he could elect as to time and terms; the value in view of all the purposes to which the property is adapted; the amount for which it would actually sell at the time; such a sum as it is fairly worth in the market.

The assessor's method of valuing oil lands may be explained briefly as follows: The gross production of oil from the operator's land for the year immediately next preceding the first Monday in March is ascertained. He then estimates the average selling price of such oil for the year and deducts therefrom a sum which in his judgment represents the cost of production of a barrel of oil. If he is unable to obtain statistics on the cost of production, or the sale price of oil, he arbitrarily assigns his own estimates. This gives him a result which he terms the net income or revenue from each barrel of oil produced, which, multiplied by the production for the year, is presumed to give the net income of the operator for the year next preceding the first Monday in March. At various times when the assessor has been asked to testify as to the next step he states that he "capitalizes this net income on the basis of 10 per cent." His method of capitalizing is to multiply by 10. Here lies the fundamental error in the assessor's method.

"Present value" means the value of an article or an annuity at the present time. In other words, how much can one afford to pay for it, and one can afford to pay for a commodity or an annuity that sum which will be returned to him with interest at the proper rate, at the time when the profit is to be realized.

It has long been accepted that money invested in a mineral property should earn a higher rate of interest than the average run of investment where the risk is less. Money so invested should earn the prevailing rate of commercial interest plus a premium for the hazard of the business.

The assessor of Orange County has stated on the witness stand that he figures that the money invested in the oil business should earn 10 per cent. In the application of his rule he figures the previous year's net income, which he treats as a yearly income or an annuity; he then multiplies this amount by 10 to ascertain the capital sum. On cross-examination he stated that he did not figure the life of a property to any stated term of years. He states that this is automatically taken care of by the fact that the following year and each succeeding year the value would be recomputed and raised or lowered according as the income from the property goes up or down.

This argument is absolutely fallacious, and the method of capitalization is fundamentally wrong. It is evident that every oil property will reach a condition when all the locations have been drilled and all the producing sands have been penetrated, after which the production will decline until the wells no longer pay to pump.

Suppose the production on a property for the year next preceding the first Monday in March, 1921, is 100,000 bbl., and that the average selling price of the oil is $1.60 per bbl. The assessor estimates the cost of production at 50c. per bbl., leaving $1.10 as the net profit. This, multiplied by the production, gives a so-called net revenue of $110,000, which capitalized on the basis of 10 per cent, gives an assumed full cash value of the property at $1,100,000. The assessed valuation is a percentage of this, as it is in the assessment of any other land in the county. The full cash value arrived at, however, represents the total net operating profits to be realized from the property in the year, if the assessor's opinion of the productivity of the property is assumed as correct; consequently, he has not determined the present value of the annual net income of $110,000 for ten years. In other words, his method of capitalizing on a basis of 10 per cent is fundamentally erroneous, for instead of giving the full cash value of the property he has given the total net operating profits, which should include the money invested and interest on same at 10 per cent. He treats each property the same, regardless of its productivity, degree of development, or age. He assumes no decline in the production of oil or else that the rise in price will offset the decline so as to keep the income uniform. He has not actually made those assumptions, but his method of calculation results in such absurdities.

---

[*] Abstracted from an article appearing in *California Oil World*, Los Angeles, Cal.

If the income from a property should remain uniform for ten years beyond the date of assessment, the assessor figures the total net operating profits for that period, instead of the present value of these profits; consequently, if a purchaser should buy a property on that basis he would either realize on his investment only the return of his capital, or interest at 10 per cent and no return of capital.

Would anyone pay a million dollars for ten one-hundred-thousand dollar United States Government bonds maturing in one to ten years successively, if the coupons had been already removed from the bonds? Is the average oil property in Orange County as sure of producing its last year's income for ten years in the future as the redemption of Government bonds at date of maturity? If so, the assessor allows the industry an unnecessarily high rate of interest on the money invested.

In addition to the assessor's rule being unsound from a methematical and business standpoint, the assumptions that necessarily follow the use of such a rule are likewise fallacious. The usual oil property will not maintain its production, and the only possibility of net annual operating profits remaining the same for ten years on a fully developed property is that the price of oil will increase rapidly enough to offset the decline in the production of the property. Another point of importance in connection with the rule is that if the assessor maintains that the sum of $110,000 represents the present value of another figure representing net operating profits, he must assume that the operating profits are increasing, for the amounts that one can afford to pay for equal annual payments of $110,000 gradually decrease from $100,000 the first year, to $42,400 the last year, so that if $110,000 represents the present value for each year of the net operating profits for that year, the actual net operating profits must increase. This postulates an increase in the production of oil, and the assumption must necessarily follow that the production of oil for the last year of the property's life, as assumed by the assessor, is greater than it has been in any of the previous ten years. This might be true in the case of a property with large undeveloped reserves.

We have been informed that the county assessor insists that his method is absolutely fair in the long run, for the reason that the assessment varies as the production from the property changes; that is to say, if the production increases the assessment automatically increases, and if the production decreases the assessment in like manner decreases. He insists that this is absolutely fair to the taxpayer, because he pays his taxes to the county as he takes the oil from the ground. The fact, however, that the assessor must necessarily assume a ten year life and does not allow for interest, makes overvaluation of properties almost a universal rule. If some of the properties are overvalued and some undervalued, the net result might be the same so far as the entire industry is concerned, if there are sufficient undeveloped properties to offset the decline of the properties which have passed the peak of production, but one company would be forced to pay exorbitant taxes under such an arrangement, whereas another would be undertaxed.

The assessor contends that, even though a property should be exhausted in five years, his method is equitable, because the following years the assessment will be reduced, and there will be no assessment for the sixth year. This argument has a ring of plausibility that appeals to the layman as being absolutely sound and equitable, and the members of the Board of Equalization probably take the view that the result obtained by this system of assessment is fair both to the taxpayer and to the county. It might be fair as regards the whole of the oil industry and the rest of the county taxpayers is concerned, so long as there is enough undeveloped oil property in the county to balance exactly the decline of the developed properties, but if it is followed to its ultimate conclusion it will inevitably overtax the oil industry, because the oil is a wasting asset, and a time must come when there are no reserves to offset declining production.

This rule utterly disregards the law which has been enacted for the guidance of the assessor in computing the value of property for assessment purposes, because it does not produce a result which corresponds to the present cash value of the property.

Considering that valuation methods are now fairly well known, it should not be an unsurmountable difficulty to find an engineer capable of doing all of the oil-land valuation work of the county at a moderate cost, and an industry that furnishes such a large proportion of the taxes of the county should demand that it be taxed justly and on the same basis as property of other industries. With an engineer added to the staff, the county assessor would find no difficulty in obtaining co-operation with the oil companies; all would have a common interest in determining a fair valuation of the properties.

The matter of county and state taxation is so important, and the injustice done the oil industry so great, that the oil companies of California can well afford to combat the practice that is now firmly intrenched in only one county. The substitution of some other method that will operate more equitably should be arranged for, or a deputy assessor with engineering training should be appointed to determine valuations which will be equitable to the oil operators. These steps should, by all means, be taken before the Orange County practice has become so firmly intrenched that it can be changed only by recourse to the courts.

Another possible evil effect of such a rule in ascertaining the full cash value for county taxes is that if the oil operators of the state tacitly approve such an arbitrary method of determining a valuation, other methods as arbitrary, and possibly as unjust and harmful, may be advocated by other taxing bodies, which fact leads to the conclusion that the matter is of double importance.

Correct methods of valuation should be adopted not only to insure greater justice to taxpayers, but to promote greater harmony in values assessed by the Federal Government for Federal taxes and by the counties for county taxes.

Technical Papers

Chromite — Bulletin 725-A, of the U. S. Geological Survey, Washington, D. C., of eighty-four pages, obtainable on request, is entitled "Deposits of Chromite in California, Oregon, Washington and Montana." The papers included in this bulletin cover the investigations which were made during the World War into the chromite resources of the states mentioned. The United States has reserve deposits adequate to supply a war demand for several years, but these are now being conserved by the use of higher-grade and cheaper ore that is being obtained from foreign countries.

Rill Stoping—*Compressed Air Magazine* for July, 1921 (New York, N. Y.; price, 35c.) includes an article by H. L. Bicknell, "Rill Stoping in the Butte District," which is a valuable addition to the literature already covering mining methods. The advantages of the rill stoping method are as follows: Timber required only for raises and center ore chutes; reduction in mucking and handling of ore; little handling of filling; efficient ventilation; low development and up-keep costs, and low fire risk. Section diagrams are given, and the explanatory text is so prepared as to be easily understandable.

A supplementary article in the August number of the same magazine is entitled "Advantages of Using Timbered Rill Stopes."

Guide to Mohave Desert, California.—In the *Engineering and Mining Journal* of Dec. 4, 1920, we mentioned the first of this series of guidebooks to desert regions of the Southwest. The second number is a guide to the desert part of San Bernardino County, Cal., and adjoining parts of Los Angeles and Kern counties. Brief statements are given in regard to points where supplies can be obtained, choice of routes, character of roads, and the quality of water in the wells and springs. A few suggestions in regard to desert travel are given for the benefit of those entering the region for the first time. Excellent maps in keeping with U. S. Geological Survey standards are included. Copies may be obtained on request to the Survey for "Water-Supply Paper 490-B."

Lake Superior Iron Ores—The Lake Superior Iron Ore Association, Kirby Building, Cleveland, Ohio, has issued a forty-nine page pamphlet containing the average cargo analyses of Lake Superior iron ores for the season of 1920. These include figures from the Cuyuna, Gogebic, Marquette, Menominee, Baraboo, Marysville, Mesabi, Vermilion, Michipicoten, and Sudbury districts.

British Columbia Ore Deposits—The *Bulletin of the Canadian Institute of Mining and Metallurgy* for August, 1921, (503 Drummond Building, Montreal), contains a twelve-page article, entitled "The Ore Deposits of British Columbia."

Canadian Mineral Deposits—Summary Report, 1920, Part A, of the Canadian Geological Survey (free from the Survey at Ottawa), is a 106-page bulletin containing the following papers: "Silver-Lead Deposits of the Keno Hill Area, Mayo, Yukon"; "Salmon River District, B. C."; "West Coast of Vancouver Island Between Barkley and Quatsino Sounds"; "Coquihalla Area, B. C."; "The Limonite Deposits in Taseko Valley, B. C."; "A Reconnaissance Between Taseko Lake and Fraser River, B. C."; "Eutsuk Lake District, B. C.," and "Larder Map-Area, B. C." Part C, thirty-two pages, contains papers on "Ospwagan Lake-Burntwood River Area, Northern Manitoba"; "Rat River Route From Threepoint Lake to Southern Indian Lake, Man."; "The Terminal Moraine of the Seal-Churchill Divide," and "The Maskwa River Copper-Nickel Deposit, Southeastern Manitoba."

Exploration in Labrador—Memoir 124 (sixty-eight pages with maps) of the Canadian Geological Survey may be obtained free by addressing the Survey at Ottawa. This bulletin describes work done by A. P. Coleman during two trips to this interesting region, so little known because of its rigorous climate. The author believes that the interior of Labrador includes not alone barren granite gneisses, but probably equal areas of other Pre-Cambrian rocks of much greater economic promise. The country is largely barren, and so would be easy to prospect from this standpoint. Very little such work has been done, and that usually near the coast by persons who are unfamiliar with the general conditions existing there.

Fluorspar — The University of Arizona, Tucson, Ariz., has just published Bulletin No. 114, 19 pages, on "Fluorspar." The paper describes the different varieties of the mineral, their geological occurrence, and Arizona deposits. Information as to demand, value, production, imports, exports and uses is followed by a description of methods of separating flourspar from its associated minerals and preparing it for market. A list of producers and purchasers is also given, together with a selected bibliography.

Tungsten—The Imperial Mineral Resources Bureau has issued a report on tungsten in its series on the mineral industries of the British Empire and foreign countries. The bulletin is of forty-four pages, and consists of statistical and technical information covering recent years. An excellent list of references to technical literature on the subject is appended. The bulletin may be obtained for 1s. 1½d. from H. M. Stationery Office, Imperial House, Kingsway, London, W. C. 2.

Platinum — "The Present Status of the World's Platinum" is the title of a five-page article in the *Compressed Air Magazine* for August, 1921 (11 Broadway, New York; price 35c.). Present production, marketing and uses of this "one of the two noblest of metals" are briefly reviewed, accompanied by photographs and curves.

Tungsten Deposits — The contact metamorphic tungsten deposits of the United States are described in Bulletin 725-D of the U. S. Geological Survey, Washington, D. C., obtainable on request. The bulletin, which consists of sixty-four pages, is entirely devoted to a description of the various deposits, most of which are in the Great Basin region in California, Nevada and northwestern Utah, the tungsten mineral being scheelite in every case. Most of the world's tungsten comes from the wolframite of the Chinese placers. Scheelite is difficult to detect, and prospectors would do well to familiarize themselves with its known occurrences.

Business Survey—One of the departures in the Department of Commerce which has been instituted by Herbert Hoover is the monthly publication of a "Survey of Current Business." This is to be issued as soon after the 20th of each month as possible, the figures to cover the preceding month. The July issue is now available from the Secretary of the Department of Commerce, Washington, D. C., on request, and contains numerical data and index numbers for the principal American industrial activities.

Petroleum Resources—Bulletin 721, of the U. S. Geological Survey, outlines the "Geology and Petroleum Resources of Northwestern Kern County, California." The area treated in this report comprises about 200 square miles of hilly and mountainous country, and about 350 square miles of the alluvium-covered San Joaquin Valley, in which the Lost Hills, or Manel Minor, and Belridge oil field are situated. The report has been prepared by Walter A. English, and is obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10c. per copy.

Flotation Research — The Aug. 13 number of the *Mining and Scientific Press* (San Francisco; price 15c.) contains an eight-page article by A. W. Fahrenwald on "Surface-Energy and Adsorption in Flotation." A description of a new instrument for measuring surface tension is included.

Canadian Oil Fields—The July 29 issue of the *Canadian Mining Journal* (Gardenvale, P. Q., price 15c.) has a twelve-page illustrated article by Alexander Gray entitled "What Canada's New Oil Fields Have Disclosed." The Dominion is being carefully prospected at great expense and the current year's work should go a long way toward a better understanding of conditions.

Antimony—*Metall und Erz* for July 22, 1921, (Königgrätzer Str. 106, Berlin SW 11, Germany), contains a nine-page article on antimony in Hunan (China)—occurrences, treatment, production and marketing being covered.

Mineral Resources — Recent publications of the U. S. Geological Survey in the "Mineral Resources" series include "Phosphate Rock in 1920" (eight pages), and "Feldspar in 1919" (two pages). They are obtainable on request to the Survey.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Copper and Brass Research Association Formed

Society Includes Principal American Producers and Manufacturers —Will Help Stimulate Consumption

The formation of the Copper and Brass Research Association, an unincorporated, voluntary organization of the copper, brass, and copper-alloy interests, has been announced by its president, R. L. Agassiz, president of the Calumet & Hecla Mining Co. The purpose of the association, as stated in its by-laws, is to stimulate, by co-operative effort, the use of copper, brass, and copper-alloy products.

Membership in the association is open to producers of copper sold here or selling agents of copper in the United States; to fabricators of copper, brass, and copper products generally in the United States and in the Dominion of Canada, and to others directly engaged in or connected with the copper and brass industries.

Eligibility for membership in the association is determined by the board of directors, which is composed of the following: Walter Douglas, Phelps Dodge Corporation; C. F. Kelley, Anaconda Copper Mining Co.; H. C. Bellinger, Chile Exploration Co.; Stephen Birch, Braden Copper Co. and Kennecott Copper Corporation; F. H. Brownell, American Smelting & Refining Co.; R. L. Agassiz, Calumet & Hecla Mining Co.; Charles Hayden, Utah Copper Co. and Chino Copper Co.; C. V. Jenkins, Ray Consolidated Copper Co. and Nevada Consolidated Copper Co.; H. B. Paull, Calumet & Arizona Mining Co. and New Cornelia Copper Co.; W. Parsons Tod, Copper Range Co. and Quincy Mining Co.; Robert H. Gross, East Butte Copper Mining Co.; J. Parke Channing, Miami Copper Co.; Fred S. Chase, Chase Rolling Mills Co. and Chase Metal Works; Henry F. Bassett, Taunton-New Bedford Copper Co.; Edward H. Binns, C. G. Hussey & Co.; H. J. Rowland, Rome Brass & Copper Co.; U. T. Hungerford, U. T. Hungerford Brass & Copper Co.

The officers of the association are R. L. Agassiz, president; Fred S. Chase and C. F. Kelley, vice-presidents; Stephen Birch, treasurer, and W. S. Eckert, secretary. William A. Willis has been appointed manager of the association, which has offices at No. [illegible] Broadway. Membership in the association now includes the following:

American Smelting & Refining Co., Anaconda Copper Mining Co., Braden Copper Co., Calumet & Hecla Mining Co., Calumet-Arizona Mining Co., Chile Exploration Co., Chino Copper Co., Chase Metal Works, Chase Rolling Mills Co., Copper Range Co., East Butte Copper Mining Co., U. T. Hungerford Brass & Copper Co., C. G. Hussey & Co., Kennecott Copper Corporation, Lake Copper Co., Michigan Copper & Brass Co., Miami Copper Co., Mother Lode Coalition Mines Co., the National Brass & Copper Co., Nevada Consolidated Copper Co., North Butte Mining Co., New Cornelia Copper Co., Phelps Dodge Corporation, Quincy Mining Co., Ray Consolidated Copper Co., Rome Brass & Copper Co., Scoville Manufacturing Co., Shattuck Arizona Copper Co., Taunton-New Bedford Copper Co., Utah Copper Co.

Welfare Work in the Mining Industries

Survey of Educational and Recreational Activities Shows Favorable Progress at Mines

An analysis has recently been made by the International Labor Office at Washington showing the extent to which several American industries have carried on various kinds of welfare work for the benefit of their employees. The study was made by means of questionnaires, the answers to which, as we all know, are usually incomplete, and dependent entirely upon the co-operation given by the companies to whom the inquiries are sent. Nevertheless, the information has a certain comparative value and offers an index of the various industries represented. Under the different heads are covered the following: Educational work; recreational facilities, and old age pensions.

The number of mining employees represented in the replies to the questionnaire is 35,716, the other industries making the total 453,069. Under educational facilities it is stated that two of the mining establishments, employing a total of [illegible], have done educational work. The remaining eleven plants, with a total of [illegible] employees, have established various forms of general educational work, vocational training, safety lectures and libraries that benefit [illegible] per cent of the employees. Recreational facilities consisting of clubhouses, clubrooms, baseball diamonds, tennis courts, bowling alleys, golf courses, swimming pools and gymnasiums are provided at some plants, representing [illegible] employees and benefiting [illegible] per cent. Under "old age pensions," it is shown that eleven establishments have made provision for sick or death benefits, one provides for employees during the slack season and three have established old-age pensions.

Industrial Conditions in Mexico Steadily Improving

Mexican Exhibit To Be Feature of the Exposition of American Mining Congress To Be Held at Chicago, Oct. 17-22

Mexico—a land of almost limitless mineral wealth—will be officially represented at the National Exposition of Mines and Mining Equipment, which will be held in Chicago, Oct. 17-22, with a remarkable exhibit thoroughly representative of the great mineral and mining opportunities which are presented in Mexico.

Louis Rubalcalba, Assistant Secretary of Commerce and Industry of Mexico, who has complete charge of the arrangements for this exhibit, made a special trip to Chicago to confer with the representatives of the American Mining Congress relative to the final arrangements for the Mexican exhibit.

Plans were completed which will make it possible for the Mexican exhibit to present a picture of the possibilities for mining development in each of the important states in Mexico. Sixty cases of ore samples, illustrative of the production of gold, silver, lead, copper, and other minerals, will be shown in Chicago.

In addition to these interesting specimens of ore, there will be a series of specially prepared graphic illustrations which will furnish the visitor with a picture of Mexico's mineral resources, of the development which has taken place, and of the reserve supplies which are ready for production.

Mr. Rubalcalba was enthusiastic over the National Exposition of Mines and Mining Equipment and believes that this meeting here in Chicago will do much to foster the development of a more cordial sentiment between the people of the United States and Mexico.

The American Mining Congress has been making a careful study of the Mexican situation, and throughout the Western States a friendly feeling toward the present Mexican government is found and the majority of American mining men are strong believers in the sincerity and good faith of President Obregon, and hope that under his administration and wise leadership Mexico will soon be in a position where it will be possible to [illegible].

There is a growing feeling among our Western mining men that the recognition of the present Mexican government would do much, not only to assist in the reconstruction of Mexico, but in assisting American mining interests to enter the Mexican field and to operate and develop [illegible].

MEN YOU SHOULD KNOW ABOUT

Isaac Guggenheim, of New York, is in San Francisco.

F. S. Norcross, Jr., of Goodrich, Lockhart & Co., Valley Ranch, N. M., is in New York.

Jesse T. Boyd is manager of the Silver Mines Co. of America, operating at Aspen, Col.

L. H. Goodwin has returned to New York from South Dakota, where he has been examining mining properties.

Leon Dominion sails for Naples on Sept. 7. His address will be, care of American Consulate General, Rome.

Milnor Roberts has returned to Seattle after spending some time in Montana, where he made several mine examinations.

John T. Reid, who has been in New York since February, recently left for his office in Lovelock, Nev. He expects to return to New York in January next.

A. W. Ambrose, chief petroleum technologist for the U. S. Bureau of Mines, is to make an extended trip in the West, visiting oil wells on the public lands.

J. F. Sleeper, recently manager of Ricketts & Co., and research analyst for the Testing Laboratories of New York, Inc., has resigned from the latter position.

H. G. Ferguson, of the U. S. Geological Survey, has been designated to act as chief of the division of geology and of the section of metalliferous deposits in the absence of F. L. Ransome.

George F. Zoffmann, assistant general manager of the Cuico Minas Mining Co., of Magdalena, Jalisco, Mexico, is returning to Mexico after a short vacation in Los Angeles and San Francisco.

Charles E. Stearns, of Eveleth, Minn., sailed on Aug. 23 for the Belgian Congo, where he has accepted a position as metallurgical engineer for the Union Minière de Haut Katanga.

J. Edwin Hawley, of Kingston, Ont., has returned from Ecuador, in which country he has been investigating oil lands, and is leaving for India, where he will make geological investigations.

B. K. Cham, mining engineer and a representative of the China Industrial and Trading Corporation, has arrived in New York from London, and, after a brief professional visit here, will proceed to Hongkong.

A. C. Oberg, of St. Paul, consulting mining engineer for the State Securities Commission of Minnesota, is in the Cœur d'Alene district, Idaho, for the purpose of investigating mining companies doing business in Minnesota.

Alex. Richardson, principal of the Camborne, Cornwall, School of Mines, has concluded a visit to the Lake Superior copper district. He is touring the mining districts of the United States and Canada, and will sail for England Sept. 3.

Earl B. Young, of the geological department of the Anaconda Copper Mining Co., has been appointed professor of geology at the Montana State School of Mines, succeeding **C. H. Clapp**, who has been appointed president of the University of Montana at Missoula. Mr. Young formerly was an assistant professor at the School of Mines, and is well known in connection with his activities in the Montana Section of the A. I. M. E. and in Montana Society of Engineers. For the past five years he has been directly supervising the development work for the Anaconda at its Mountain Con., Mountain View, High Ore, West Gray Rock, and Poulin mines. Since February, 1917, he has been secretary of the Montana Section of the Institute and since April, 1921, has held a similar position in the Montana Society of Engineers.

EARL B. YOUNG

F. W. Bradley, of San Francisco, president of the Bunker Hill & Sullivan Mining & Concentrating Co., after spending several weeks inspecting the mining and smelting operations of the company at Kellogg, Idaho, has returned to his home.

Jose Zakany and **Enrique Hecht**, capitalists of Mexico City, are in California studying the gold-dredging methods employed in that state as a preliminary to the development of their properties on the Bacubirito River in Sinaloa, and have purchased machinery for that purpose.

Dr. T. L. Walker, director of the Royal Ontario Museum, and **Prof. A. L. Parsons**, of the mineralogy department of the University of Toronto, have been in northern Ontario, collecting mineral specimens. They have been out since June and have been as far east as Nova Scotia.

Bradley Stoughton has resumed practice as a consulting engineer, and will specialize on financial investigations and reports on industrial plants, engineering enterprises, and iron and steel plants. His office until Oct. 1 will be Engineering Societies Building, 29 West 39th St., New York City.

Sir Archibald Mitchelson, of London, is leaving for Canada, where he will visit the Porcupine gold camp in company with **John Hambly**. Sir Archibald was associated with the late Lord Rhondda in the Peace River district, and it is reported that he has taken over a large interest in the Davidson Consolidated, in Porcupine.

H. C. Morris, formerly of the engineering staff of the Bureau of Mines, and a member of the Interdepartmental Economic Liaison Commiteee, has been selected to head the new petroleum division of the Bureau of Foreign and Domestic Commerce of the Department of Commerce. The original idea was to group coal and oil together, but Secretary Hoover has decided that the needs of each of those industries are such as to require separate commodity chiefs for those subjects.

George S. Rice, chief mining engineer of the U. S. Bureau of Mines, landed at Seattle on Aug. 19 after an extended trip through the mining regions of Alaska. In order that there be sufficient tonnage to allow of the profitable operation of the railroad which the Government is building in Alaska, it is necessary to increase mining activities in the territory. Mr. Rice has been studying the problem at first hand and will make an exhaustive report on the matter to the Secretary of the Interior.

SOCIETY MEETINGS ANNOUNCED

At the joint meeting of the **Society of Economic Geologists** with the **American Institute of Mining and Metallurgical Engineers**, which is to be held on Wednesday, Sept. 14, the following papers will be presented:

"Ore Deposits of Braden Copper Company, South America," by Waldemar Lindgren and Edson S. Bastin; "Review of Lead and Zinc Mining in Pennsylvania," by Benjamin L. Miller; "Some Unique Bolivian Tungsten Deposits," by Frank L. Hess; "General Geology of Catorce Mining District," by C. L. Baker; "The Material Which Should Be Offered in Petroleum and Gas in a Course in Economic Geology," by Roswell H. Johnson; "Stratigraphy of the Anthracite Region," discussion led by James F. Kemp; "Geology of the Namma Coal Field," by Edel Moldenke; "Review of Deep-Seated Oil and Gas in the Appalachians," by George H. Ashley; "Coning of Water in Mexican Gulf Coast Wells," by E. De Golyer, and "Petroliferous Rocks in the Sierra da Baliza," by E. P. de Oliveira. Professor Kemp will preside at the morning session, and D. H. M. Chance at the afternoon session.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

WEEKLY RESUMÉ

Activity in Tombstone district increasing. Capt. McDougall loses patent suit. [illegible] Salt Co. [illegible] Phelps Dodge [illegible] Copper [illegible] in [illegible] [illegible] consummation of [illegible] deal. American Zinc Institute urges equitable treatment for zinc [illegible]. Judge [illegible] [illegible] to determine standard of comparison.

Canada [illegible] wants protection. McIntyre to erect custom mill. Copper depression affects Arizona's finances. [illegible] strike attracts Alaskan prospectors. Liberty Bell mine shuts down. Many Mexican mining properties declared forfeited. [illegible] to consolidate [illegible]. Platinum discovered in [illegible], Oregon.

Captain McDougall Loses Suit Against Oliver Iron Mining Co.

A decision has been rendered by Federal Judge Wilbur Booth for the defendant in the trial of Capt. Alexander McDougall against the Oliver Iron Mining Co. The suit was for the recovery of royalties amounting to more than $19,000,000 on a claim that the engineers of the defendant were guilty of infringement on a patented ore washer invented by the plaintiff.

The royalty stipulated was $2 per ton. Judge Booth absolves the defendant from all liability, on the ground that no device can be held to infringe a combination such as the one in question unless it employs all the elements of such a claim. The contention of the plaintiff that the devices used in the manufacture of the mining company's machines were mere mechanical equivalents was not held valid, but the few differences existing between the two machines distinguished one from the other, and is was held that there was no infringement.

The machine or log washer of the Oliver Iron Mining Co. was granted a patent owing to the fact that essential elements were lacking, and under the patent law the absence of these elements freed them of the charge of infringement. The trial was bitterly contested, with abundant legal talent on both sides, and startling charges were brought forth. It is expected that the plaintiff, Captain McDougall, will appeal the case at once to the Circuit Court of Appeals or direct to the U. S. Supreme Court.

Tombstone Takes a New Lease on Life

Operations in Old Camp Confined Exclusively to Lessees and Local Operators—Old Workings Deepened With Good Results—Large Tonnage of Dump and Mine Ore Awaiting Milling Facilities

By HARRY E. SCOTT

Written for Engineering and Mining Journal

Much confidence is shown in the mining district around Tombstone, Ariz., at present. There is no occasion to get wildly enthusiastic and it cannot be compared to the early day excitements, but there is every reason to be confident in the outcome. Many prospects that have been scratched over in the district in the past years are now being worked a little deeper with encouraging results. More improved machinery is being taken into the district and new veins of silver and lead ore are being uncovered.

The closing down of the Douglas smelters, to which plants the ore from the Tombstone district had been shipped, was not as great a blow as at first anticipated, as suitable contracts were made with the El Paso smelter by some of the leasers, who have a very high grade silver-lead ore. Many of the leasers with the lower grade ore cannot ship to this smelter, however, owing to the expense. This fact has caused the building of several small mills in the district, which are now in operation. As experiments these will undoubtedly be the opening wedge for building a large custom concentrator and cyanide plant, which will be able to treat the many hundred thousand tons of silver ore, which was put over the dump in the days when milling had not progressed as far as now, as well as the ore being mined now.

A mill recently completed on the Emerald dump had its beginning about two years ago when Bert Holland, a Tombstone man, put in an old table driven by a gasoline engine and began treating the fine ore in the dump. His success attracted the attention of Frank Cavanah, and the two are now treating about seventy-five tons of ore per shift, the concentrates running $75 per ton. Gasoline engines are used for power and the milling equipment consists of crusher, rolls and tables. The cost of operating is small and it is estimated that there is enough ore in the dump to last three years under present working conditions.

The Co-operative Milling Co., com-

[illegible] MILL, TOMBSTONE, ARIZ.

posed of leasers on eight different properties of the camp, has recently erected a mill near town for the treatment of the ore from their leases. This is a concentrating and cyanide plant of fifty-tons' capacity. A test run has been made with satisfactory results, except as to power. The engine installed was too small to give the required horsepower. It has been sold, however, and as soon as the new one is in place operations will start, first, on the ore of the leasers interested, who have a large amount of low-grade ore on their different dumps; later, custom ores will be handled. H. C. Hurst is manager and has direct charge of all work.

George Kitt Co. have a cyanide plant on the State of Maine property, treating fifty tons of ore per day with good results. Nothing but ore from the dump, which contains thousand of tons of low-grade silver ore, is being treated at this time, but the company will start working the mine soon. This property has produced a large amount of high-grade silver-lead ore in the past, but, like all of the other producers, was forced to close many years ago, not because it was worked out but because the low price of silver forbade operation.

HEADFRAME OF SOLSTICE MINE, TOMBSTONE, ARIZ., WHERE IMPORTANT STRIKE HAS RECENTLY BEEN MADE

The Old Guard mill, which is situated approximately in the center of the mining district, has been remodeled and leased by J. D. Stockham, formerly of the Shattuck mill, at Bisbee. This mill is to be run as a custom plant and will treat ore from all parts of the camp. Because of its central location, the haul from the mines to the mill by trucks will not be prohibitive in cost.

The center of interest at this time, however, is the Solstice mine, which is situated in an undeveloped part of the State of Maine mining district, and on which a strike was made a few weeks ago. The four claims in the Solstice group were bought by local business men about two years ago, machinery was purchased and installed and sinking commenced. The shaft was sunk three hundred feet with little or no encouragement. A crosscut was run from the shaft about one hundred feet, at which point a vein of high-grade ore was cut. Here the vein is from two to three feet wide and assays have run as high as 1,000 oz. in silver. The Solstice has the marks of a real mine. W. T. Boyd is manager.

The leasers of the camp are so numerous that space will not permit the naming of all of them and the work being done, but the following list taken at random from widely separated parts of the district will give an idea of the size of the orebodies and how far the work has progressed:

Springer and Hilton, leasing on the North Bonanza, are down 175 ft. At this point drifting was started and they now have a 2-ft. vein running 60 oz. in silver.

Vaughn and Hurst, on the Free Coinage, are stoping on the 100 level. The vein is 4 ft. wide and runs 25 oz. in silver.

Gorney & Co., on the South Bonanza, are down 220 ft. The shaft shows 2 ft. of ore running 100 oz.

McAndrews, Esser & Co. leasing on the Dry Hill claim of the Bunker Hill Mining Co., have 4 ft. of $45 ore at 20 ft. in their new shaft.

Critchley and Ivy have installed a three-drill compressor and a 30-hp. Western hoist on the Emma B. This shaft is down 100 ft. and shows 4 ft. of silver ore running 18 oz.

Conservative estimates place the number of leasers operating in the camp at seventy-five, all of whom have ore. It is not to be understood that all of them have large paying veins. Some of them are small and undeveloped, but as work progresses the "pay rock" increases.

A number of the leasers are men who have come in from the near-by copper camps with very little money to equip and develop a mine, and as a result some very unique ideas have been worked out. Cox and Bland have put the well-known "Lizzie" to work as a hoist in a novel way. A drum was made out of 8 x 8-in. timber, built up and rounded with 2 x 4-in. stuff. On the end of this drum a smaller one was made for the cable. In the morning the miners jump into "Lizzie" and go to the mine. On arrival the car is backed up to the larger drum and on to it, the front wheels are fastened and the back wheels set on top of the drum, making a friction hoist. A bucket holding from 800 to 1,000 lb. is handled with satisfactory results.

Hurst and Vaughn have connected a Buick automobile to an old compressor, which they fell heir to, and are getting fine results. It furnishes air to the drills for stoping and at a much smaller cost than the regulation type of gasoline engine used to drive compressors.

One noticeable feature of Tombstone at this time is that there are no stock companies operating. All work is being done by leasers and local men, who have never lost confidence in the camp, even in its darkest days, when the price of silver forebade mining the white metal. The mining stock promoter, the "shoot-mouth" mining man and the dead beat companies have not appeared on the scene as yet, and it is to be hoped that Tombstone will be kept clean of this class, so well known in almost every mining camp of the West.

Jefferson Island Salt Co. Begins Shipments

Large Reserves Indicated in Gulf-Coast Salt-Dome Deposit of Company

The Jefferson Island Salt Mining Co. has started making shipments. This mine is situated on Côte Carline, or Jefferson's Island, Louisiana, the old winter home of Joseph Jefferson, which lies on the line between Vermilion and Iberia parishes, and nine miles west of New Iberia. A circular, concrete-lined shaft has been sunk to the deposit, and mining by the room-and-pillar method begun. The initial production is 125 tons daily. This will be increased later when the shaft is deepened to the 900 level. Railroad connection has been made with the Abbeville branch of the S. P. Railroad.

This formation is one of the Gulf-Coast salt domes. Salt was discovered in 1905 by A. F. Lucas while prospecting for oil. The salt was struck at a depth of 330 ft. and the well was drilled in salt to 2,090 ft., where it was abandoned. The area of the dome is about 300 acres, and the tonnage commercially available runs into the tens if not hundreds of millions. The work of developing and equipping the mine began last year. A warehouse will be built in Houston, Tex., which will be the distributing center.

Talisman Consolidated, Ltd., Is in Liquidation

A cable dispatch has been received from New Zealand at the London office of Talisman Consolidated, Ltd., advising that the resolution for the voluntary liquidation of the company has been duly confirmed as a special resolution and that F. A. Crew, of 20 Copthall Avenue, London, E. C. 2, has been appointed liquidator.

Injunction by Minority Interests Prevents Consummation of Hecla-Bunker Hill Deal

Action Postponed to Sept. 14—Stockholders Accept Searles' Report Approving Management of Hecla's Operations

At a special meeting of the stockholders of Hecla Mining Co. held at Spckane, Wash., Aug. 18, to ratify an agreement for acquiring a joint interest with the Bunker Hill & Sullivan Mining Co. in the property of the Star Mining Co., adjoining the Morning Mine, it was decided to postpone action and adjourn to Sept. 14, because of an injunction obtained by the Day-Smith minority interests which prevents the Hecla company from making the deal, pending a court hearing on Sept. 2. Other business transacted at the meeting was the approval of the Marsh-Federal settlement and the acceptance of a report made by Fred Searles, Jr., mining engineer, of San Francisco, who, at the request of a special committee of directors, visited the Coeur d'Alene silver-lead mine and made an exhaustive examination of the property.

Formation of a committee of investigation was made at the request of President McCarthy, of the Hecla Co., some weeks ago, following allegations of minority stockholders that the Hecla mine workings were not in good physical condition. Mr. Searles' report indicated clearly that little cause for alarm existed as to the condition of the mine, and that every precaution was observed with a view to prevention of undue loss through stope caving.

"Speaking generally," the Searles' report states, "the mine is neither in as good a condition as it ought to be, nor in a condition so bad as to be properly a cause for alarm, or even for serious concern to your directors, or to the stockholders whom they represent.

"That the condition of some of the stopes and workings is not as good as you or your management could wish is due almost entirely to the fact that the successive discovery and development of new orebodies to the east of the old Hecla stopes has led to the opening up, and blocking out for stoping, of an area of ground far in excess of the requirements of your present production."

Maps accompanying the report showed considerable caving in a block of ground between the 1,200 and 1,400 levels, and between the 1,400 and 1,600, with some evidences of caving at two or three other points. The most serious break represented a pile of approximately 6,000 tons, and the other about 3,800 tons. This, it was pointed out, did not entail really serious additional mining costs, an estimate being $10,000 involved for the ultimate cost of extracting the ore over and above what the cost would have been if caving had not occurred.

The report further stated that:

". . . The stopes in the old Hecla orebody have not been worked fast enough to keep them from getting heavy. This, in a nutshell, is the real difficulty in the mine today. You have enough stopes started to produce 2,000 tons of ore a day, and you are producing only 700. Your difficulties are, in a measure, the result of the good fortune that has attended your development work."

Other "sloughs" are classed as "unimportant." The substituting of a trial area of square timbering for the method at present in use was suggested, and recommendations were made as to mining of certain areas with higher-grade silver content during the life of the Pittman Act as being desirable from the standpoint of company revenue. In conclusion the report states:

"To pursue the subject farther probably lies beyond the proper scope of this report. The writer feels justified in having discussed it thus far, because it has a considerable bearing on the condition of the mine. It is his opinion that your property is in competent hands, that you need not be unduly concerned about the practical details of the extraction of the ore, and that there are larger problems of interest to you and your stockholders, concerning which the management is entitled to your advice and co-operation."

Phelps Dodge and Arizona Copper Still Negotiating

Plans Almost Complete for the Absorption of Arizona Copper Co.'s Property

It is held beyond question that the Phelps Dodge Corporation will take over the property of the Arizona Copper Co., a British corporation. The deal is considered closed except for the compilation of the final audit and minor details of supplies on hand. Auditors from the New York office of Phelps Dodge are busy with the auditing of accounts. In the event of the transfer, the Arizona and New Mexico R.R., which is over 100 miles long from Clifton to Hachita, via Lordsburg, would become part of the El Paso and Southwestern system.

The lighting and power service of the entire district has been transferred from the Arizona power house, at the smelter below Clifton, to the Phelps Dodge power house at Morenci, where Diesel engines are more economical. It is reported that Mr. Hodgson, formerly manager of the Detroit Copper Co. at Morenci, is to take Norman Carmichael's place as general manager of the Arizona Copper plant.

Rio Tinto Miners Increase Output

[illegible]

Madrid, Aug 15—The mine workers in the Rio Tinto district are working an hour extra daily, without increase in pay, to accelerate the output and to avoid dismissals.

Minerals Separation vs. Butte & Superior Suit in Final Stage

Judge Bourquin Grants Motion To Determine Standard of Comparison in Settlement of Claims

Decision was rendered on Friday, Aug. 12, by Judge George M. Bourquin, in the Montana U. S. district court, on the motion of plaintiffs that the court determine a standard of comparison for the guidance of the master in the settlement to be made by the Butte & Superior Mining Co. to the Minerals Separation, Ltd., et al., for infringement upon patents.

Judge Bourquin's decision follows:

"Plaintiffs' patent valid and defendant having infringed it (250 U. S. 336), the suit is in the final stage and has been referred to a master to take and state an account.

"Therein, plaintiffs move the court to determine a standard of comparison for the guidance of the master. The standard they contend for is processes known (1) at the date of patent, or (2) at the date infringement begun.

"Defendant resists specific and particular instructions to the master as calculated to embarrass the proceedings by vague determinations in respect to evidence before tendered, and maintains the proper standard is processes known at any time so far as subsequent infringement is concerned. The issue of relativity in time of standard and infringement has been exhaustively argued and briefed, and some time to be decided, better be decided now. There is no controlling decision in this circuit, the issue not having been expressly raised and determined in either Supreme Court or Circuit Court of Appeals. In several cases the Supreme Court's language is that the infringer accounts for the fruits of the advantage which he derived from the use of that invention, over what he would have had in using other means then open to the public and adequate to enable him to obtain an equally beneficial result. See Coupe vs. Royer, 155 U. S. 583.

"In McCreary vs. Canal Co. 141 U. S. 466, it cites without approval or disapproval Mr. Justice Harlan's ruling in Turrill's case, 20 Fed. 912, that the standard is only that known at date of invention infringed. Likewise does the Circuit Court of Appeals in respect to a like statement in Walker on patents. Fullerton, etc., Assoc. vs. Mfg. Co 166 Fed. [illegible]. To review these and other cases would interest more than enlighten, for in the end the motion is decided by principle.

"The rule of comparison is settled law, and contemplates that the infringer had a choice of processes, chose that of the patent, and gained an advantage over what would have been his had he chosen otherwise. Obviously, the choice is made from processes existing at the time of choice, that is, at the time of infringement from day to day and as alternative presents itself. He is not limited in fact to the process of the patent and processes existing only at the date of the patent, and the principle of standards does not require nor warrant that he be so limited in theory. For the advantage he actually gains and which as profits or savings he must render to the patentee is only that of the invention over other processes he might have chosen in lieu of the invention and did not.

"What the infringer thus gains is also what the patentee is presumed to thus lose, so far as accounting for profits is concerned, and equity is done when all such gains are taken from the infringer and given to the patentee; for thus the former loses nothing, he is not penalized, the latter is made whole, and he is not given gratuities nor rewarded beyond his present deserts, as otherwise would be the case. And it seems fairly clear that this is the import of the quoted language of the Supreme Court.

"The event to which the court refers is the infringement, and the time to which it refers is 'then,' at that time, the time of the antecedent event.

"The Circuit Court of Appeals of the eighth circuit has likewise determined in Columbia, etc., Co. vs. Company 194 Fed. 108, and Judge Relstab of the second circuit likewise in American, etc., Co. vs. Snyder 241 Fed. 274. To their collation of cases, and to their comment, little can be added.

"In so far as the motion seeks a general and not a particular determination, it is granted. The standard of comparison that will govern the master is any standard (having in mind the distinction between processes and standard) that is duly made to appear, in respect to subsequent infringement."

Austrian Magnesite Exports Increase

Vienna, Aug. 8—A Government report, just issued, shows that the exports of magnesite from Austria during the first quarter of 1921 totaled 47,712,000 lb., compared with 29,120,000 lb. in the corresponding period of 1920. Germany is now the chief purchaser of Austrian magnesite and some has come to the United States.

Burma Corporation's Advisory Committee Appointed

E. P. Mathewson To Visit Property as Consultant Engineer to Determine Future Policy

On the invitation of the board of directors of the Burma Corporation, Ltd. (incorporated in India), the following gentlemen, meeting in Rangoon, and representing large interests in the corporation, have agreed to act as an advisory committee: Sir Henry Strakosch, Sir John Mann, John A. Agnew, A. Chester Beatty, F. A. Govett, Herbert Guedalla, James C. Prinsep.

On the recommendation of this committee, P. E. Marmion, lately manager of the Swansea Vale Spelter Co., Ltd., has been appointed by the board as general manager in Burma to succeed R. G. Hall, whose agreement is expiring shortly. E. P. Mathewson, an engineer and metallurgist of great reputation, has also been engaged to visit the mine and consult with Mr. Marmion as to the general lines of policy to be adopted.

South African Miners Not To Strike

According to a cable dispatch received by the Department of Commerce on Aug. 17, South African miners will accept a reduction of 1s. 6d. per shift, and a strike has been averted. This arrangment will be in force until Oct. 1, when wages will be adjusted by quarters, the basis for wages in one quarter being the cost of living in the quarter second preceding. The demand for the reduction of the wages followed the decrease in the selling prices of gold.

Bradley Interests Enter Keno Hill District

It is reported from Dawson that Livingston Wernecke, geologist for the Alaska Treadwell Gold Mining Co. and the Bunker Hill & Sullivan Mining & Concentrating Co., has secured options on three large groups of mining claims in the Keno Hill district, Yukon Territory. About fifty claims are included under the options. The Treadwell and Bunker Hill companies are controlled by the same interests, F. W. Bradley, of San Francisco, being president of both companies. This is the second group of mining interests to enter the Keno Hill district, the first being the Yukon Gold Co.

Chillagoe Smelters Resume

The copper and lead furnaces of the state smelting works at Chillagoe, Queensland, have resumed operations. The officials are satisfied that at the existing price of lead, and with the recent development in the Mungana mine, the working of the lead furnace will be on a profitable basis. As for copper, the government will not sell its metal at the price now ruling, but will wait for a rise in values. The Mount Morgan Co. is taking the same course. The Chillagoe are the only smelting works operating in Australia.

New Radium Company Organized In Czecho-Slovakia

Special Cable by Reuters to "Engineering and Mining Journal"

Prague, Aug. 9—A company with a capital of 10,000,000 crowns has been organized here for the purpose of producing radium and other metals. The company has acquired a number of mines in northern Bohemia.

NEWS FROM WASHINGTON

By **PAUL WOOTON**
Special Correspondent

American Zinc Institute Urges Change in Tariff on Zinc Oxide

Requests Equitable Treatment for Lead and Zinc Pigments — Stephen H. Tuthill Presents Schedules

A change in classification of zinc oxide from the chemical to the metals schedule and the application to zinc of the same rules adopted in the tariff bill for lead were urged upon the Committee on Finance of the Senate by Stephen S. Tuthill, representing the American Zinc Institute. Mr. Tuthill testified that the institute is representative of more than 95 per cent of the domestic zinc production. In the course of his testimony, Mr. Tuthill said:

"I wish to call your attention to two points: First, that in the brief submitted to the Committee on Ways and Means of the House of Representatives by the institute, to which brief reference is hereby made, E. H. Wolff, the president of the institute, in recommending a duty of 2¾c. per lb. on 'zinc, oxide of, and white pigment containing zinc, but not containing lead, dry,' stated that this entirely zinc product had been previously classified under Schedule A, but that it appropriately belonged under Schedule C. That suggestion, however, was not accepted by the Ways and Means Committee; zinc oxide appearing in the present bill under Schedule 1—Chemicals, Oils, and Paints.

"Therefore we wish at this time to renew our request for such reclassification.

"Second. We wish also to invite your attention to the inequitable treatment of zinc oxide in the bill as it now stands.

"The duties on lead and zinc as proposed in the bill before you are as follows: Lead ore, 1½c.; zinc ore, 1½c.; pig lead, 2⅛c.; slab zinc, 1⅝c., although for two years it was 2c.; white lead, 2⅞c.; zinc oxide, 1⅛c.; zinc chloride, 1 3/10c.; zinc sulphate, ¾c.; zinc sulphide, 1⅛c.; lithopone, 1⅛c.

"The above has been prepared with a view to showing, first, the singular provisions for import duties on the products manufactured from zinc ore, and second, the rational and entirely different theory pursued in providing duties for the manufactured products of lead ore.

"The lead schedule recognizes the propriety of a higher duty on the manufactured products of ore than on the ore itself. The zinc schedule, as a whole, completely ignores that principle. Slab zinc and zinc oxide, for example, are two of the chief products of zinc ore. They are produced by similar process, namely, smelting the ore in furnaces. Slab zinc is reduced or condensed in the process in the absence of oxygen. Zinc oxide is reduced or condensed in the furnace in the presence of oxygen. This is the essential difference in the two methods of manufacture. On general principles the two products should be regarded alike in framing a protective tariff.

"The analogy between these two products on the one hand and pig lead and white lead on the other hand is close. Pig lead is lead metal in its simplest form. Slab zinc is zinc metal in its simplest form. White lead and zinc oxide are white powders which are similarly used as competitive constituents in the composition of paint, besides having other uses of their own.

"We, therefore, request that whatever rate of duty, whether high or low, the Committee on Finance shall see fit to impose on lead-bearing ore or zinc-bearing ore, the products of such ores shall be favored with appropriate duties somewhat higher than the duties imposed on the ores from which such products are manufactured. This seems elemental, and it has been observed in framing the lead schedule. In framing the zinc schedule the principle was granted by the Ways and Means Committee, as will be observed [illegible].

"May we ask that the principle be observed by the Committee on Finance in respect to zinc oxide, slab zinc, and other products manufactured from zinc ore?"

Pittman Act Purchases Now 69,053,430 Oz.

Purchases of silver under the Pittman Act during the week ended Aug. 20 amounted to 2,318,000 fine ounces. This brings the total purchases under the act to 69,053,430 fine ounces.

Cyanide Manufacturer Wants Protection for Industry

Asserts Domestic Producers Can Now Meet All Requirements and That Raw Materials for Production Carry Duty

The Committee on Finance of the Senate granted considerably more than the usual time allowed witnesses to P. S. Rigney, of the Roessler and Hasslacher Chemical Co., of New York, in his effort to urge that cyanide be taken from the free list and made dutiable, either at 33⅓ per cent ad valorem or at 6c. per lb. Mr. Rigney pointed out that this is a clear-cut case of encouraging an American industry. He declared that his company has no monopoly in the manufacture of cyanide in that the patents covering the Castner process, which his company uses, have expired.

Mr. Rigney declared that the rates he is asking will not prohibit imports, and that they are intended only to equalize the present difference in labor costs in Germany and in the United States and to allow for the depreciation of the mark. Under the Payne-Aldrich law, his company, he said, prior to 1914, built up the manufacture of sodium cyanide to the point, where it was producing 10,000,000 tons per annum.

When importations ceased, at the beginning of the war, the production was expanded to 17,000,000 tons per year, thus meeting all the requirements of the United States. If the industry were properly protected, he asserted, it would be possible for his company to meet all domestic demands. He said that for the last year and a half the country has been flooded with German cyanide and with a low grade of cyanide manufactured in Canada. German and Czecho-Slovakian manufacturers are offering cyanide at this time in the United States at from 6 to 8c. per lb. [illegible]

Mr. Rigney stated that cyanide guaranteed [illegible] per cent sodium cyanide is sold at a price ranging from 21½c. to 23c. per lb., when in carload lots. During the course of his testimony, Mr. Rigney presented the following table showing the quantities of sodium cyanide used by the Homestake Mining Co. from 1914 to 1920, with the average costs:

[illegible]	[illegible]	[illegible]	[illegible]
1914	[illegible]	[illegible]	[illegible]
1915	322,322	[illegible]	20.18
1916	[illegible]	[illegible]	[illegible]
1917	[illegible]	87,500.00	[illegible]
1917	[illegible]	4,000.00	[illegible]
1918	[illegible]	33,000.00	[illegible]
1918	[illegible]	[illegible]	[illegible].00
1919	[illegible]	63,750.00	[illegible]
1920	[illegible]	[illegible]	[illegible]

The committee evidently was impressed by Mr. Rigney's presentation. He laid stress on the fact that cyanide is a finished product which requires two separate processes in manufacturing. A large percentage of the costs is for labor and an equally large percentage for power. It has been put on the free list in the House, though the principal two raw materials used in its production are made dutiable at a comparatively high rate. The raw materials to which Mr. Rigney refers are caustic soda and anhydrous ammonia, which the House made dutiable.

NEWS BY MINING DISTRICTS

London Letter

Report of Chemical & Metallurgical Corporation Shows Strong Financial and Technical Support—Burma Corporation's Troubles Being Eliminated

By W. A. Doman

London, Aug. 8.—The first report of the directors of the Chemical & Metallurgical Corporation is a rather interesting document, both from a technical and financial point of view. If a strong board of directors could ensure the success of the undertaking, shareholders would have nothing better to wish for. The managing director is A. Stanley Elmore; F. W. Baker and Herbert Guedalla, the chairman, represent in the main, finance, and the technical lights are Hugh F. Marriott, Walter McDermott, John A. Agnew and M. Atkinson Adam. The technical adviser is Frank E. Elmore, the original owner of the patents. In their various spheres the directors mentioned see many possibilities of business, and their reputation is sufficient guarantee that they will not play ducks and drakes with shareholders' money.

Out of an authorized issued capital of £1,200,000, the public has subscribed £200,000 in cumulative preference shares of £1 each. The balance is ordinary shares, the whole of which figures in the balance sheet as purchase consideration to F. E. Elmore for the various patents and rights. Unless the patents and rights were regarded as valuable, such a body of business men as the directors would never have paid so heavy a purchase price. It is at all events some indication of what their value is expected to be. Another indication may perhaps be found in the alteration that has been made in the rate of interest on the preference shares. Originally they bore a fixed cumulative dividend at the rate of [illegible] per cent per annum. This has been reduced to [illegible] per cent, holders being given the right to convert into ordinary shares at any time on or before June 1, [illegible], by paying 10s. per share in respect of each preference share to be converted. This is optional on the part of the shareholders, but the company after June 1 next may give general notice requiring all preference shareholders to convert if the selling price of the ordinary shares on the stock exchange shall not have fallen below [illegible] per share during the thirty days preceding. This would seem to mean that the holders of the preference shares—who presumably would be to a great extent technical people—are certain in their own opinion of the prospects that they are not keen on having their dividend limited to [illegible] per cent. Judging by the results, however, they may have to wait some time before getting a higher rate. Incidentally, the arrangement for conversion of the preference shares into ordinary will benefit the corporation financially, seeing that a wholesale conversion will provide an [illegible]. It is quite a good scheme from the standpoint of the corporation.

From the constitution of such an undertaking [illegible] enters largely into the operations, particularly in regard to the disposal of patent rights. In this connection the directors have not been idle. They have formed the American Chemical & Metallurgical Corporation, with a capital of £400,000 in £1 shares, of which 200,000 shares constitute the purchase consideration for patents and rights for the Dominion of Canada and British Columbia. The Mexican Chemical & Metallurgical Corporation, formed to operate in Mexico and the states of Central America, has a capital of £200,000 in £1 shares, of which the Chemical & Metallurgical Corporation received £115,000 for the rights. In a company to exploit the processes in France, whose capital is 5,250,000 fr., of which 2,500,000 fr. is in preference shares, the Chemical & Metallurgical has received ordinary shares to the nominal value of 2,500,000 fr. The Chemical & Metallurgical Corporation is assisting to finance the Francois Cementation Company, and for its advances has received 176,100 ordinary shares in that company. The parent company therefore has large share interests, the value of which depends upon the manner in which the patents are worked in the respective countries. Slow though the start has been, it appears to be on a solid foundation.

Presumably the troubles in connection with the Burma Corporation, to which I referred some weeks ago, are now smoothed over, for a strong advisory committee has been formed on the invitation of the board in Rangoon. This committee consists of Sir Henry Strakosch, Sir John Mann, J. A. Agnew, A. Chester Beatty. F. A. Govett, Herbert Guedalla and James C. Pinsep. The last mentioned represents the Consolidated Gold Field interests.

CANADA

British Columbia

Rambler-Cariboo To Shut Down—Lucky Jim Zinc Mines To Be Reorganized

Three Forks—Work at the Rambler-Cariboo Mines will stop at the end of August. This is due to the desire of the management to conserve cash resources. Since the One Big Union strike of last year, operation has been conducted in a half-hearted way, with no attempt at production, and only a few men on development. Results of development of Jennie ground, acquired two years ago, are reported an unpromising. The mine has some reserve of milling ore.

Ainsworth—Sixteen leasers continue to take out ore at the Florence. This is being stocked.

Kaslo—Senator McMeans, of Winnipeg, who with associates now own the Lucky Jim zinc mine, at Bear Lake, by mortgage foreclosure, visited the property early in July. He was accompanied by A. G. Larson, who was appointed receiver for the Lucky Jim Zinc Mines, Ltd., when the affairs of that corporation became badly tangled about four years ago. The company will be reorganized if possible. If so and if sufficient funds are raised for additional development, the recommendation of the former receiver is that the No. 4 level be extended further into the mountain with a view to developing a series of lead-zinc orebodies outcropping south of the present workings.

Ontario

McIntyre To Erect 500-Ton Mill—Hollinger's Profits Increase

Porcupine — The McIntyre has decided to go ahead with the immediate construction of a 500-ton crushing and cyanide plant on the north side of Pearl Lake and adjoining the main shaft, and is now placing the largest machinery orders recorded from northern Ontario since the Hollinger added to its equipment in 1916. The main mill will be left where it is for the present, on the south side of the lake, but eventually, after the new mill starts operating, the whole milling plant will be transferred north of the lake.

The new unit will be first used to treat carbonaceous ores, of which the company has about 150,000 tons developed. This ore has given a great deal of trouble, due to reprecipitation of the gold, but after a year's experimental work it was found that by the addition of half a gallon of crude oil or petroleum per ton of ore, an extraction of 97 per cent could be obtained in a 48-hour treatment, and that the danger of reprecipitation was absolutely eliminated. The oil is added to the ore in the ball mill.

H. H. Sutherland, general manager of the Davidson Consolidated, has returned from England, where he has been negotiating for the sale of the mine to a British syndicate, and announces that an agreement has been entered into, which will be submitted to a meeting of the shareholders on Aug. 24 for ratification.

The Hollinger Consolidated has issued an interim report covering the first seven months of the year, showing net profits of $2,339,921, as compared with $2,074,023 for the corresponding months of 1921.

The Keora has cut its working force from two shifts to one.

S. T. McKinney, of Gold Hill, N. C., is cleaning up the old silver smelters at Orillia and Trout Mills, Ontario.

At the property of the Union Mining Co. in Whitesides Township, twenty-seven miles southwest from Timmins, the shaft is down 240 ft. In crosscutting at the 150 level an 8-ft. vein has been encountered which is stated to carry high gold content. The construction of a 150-ton mill is under consideration. Ample power is available from a fall on the Kamiscotia River, about one mile distant.

Tunneling operations are in progress at the Big Dyke, in Deloro Township. The work has proceeded for about 70 ft., and the orebody is expected to be reached in a few days.

Diamond drilling has been started at the Gold Island property of Night Hawk Lake, with A. R. Globe, formerly assistant manager of the Hollinger Consolidated, in charge.

Tenders are being called for by the Ontario government for the construction of a road to connected the towns in the Porcupine district, including Timmins, Schumacher, South Porcupine and Porcupine, with Porquis Junction, on the main line of the T. & N. O. Ry.

Matheson—The work of dewatering the Hattie mine, preparatory to resuming development, is under way.

Kirkland Lake—Concrete work for the mill of the Ontario Kirkland has been completed and the framing of the building started. It is hoped to have the mill running by the end of the year.

The mill of the Wright-Hargreaves is treating 125 tons a day.

Surface exploration is being carried on at the Level Lode. The plan pursued is the crosscutting of the fractured area at intervals of every 100 ft. or so and connecting the cross trenches by following up the vein fractures, so as to ascertain the zone of the greatest mineralization. Assays taken from the most promising part of the fractured area show gold in important quantities.

Cobalt — A general shareholders' meeting of the old Bailey Cobalt Co., which went into liquidation in 1914, will be held in Toronto on Sept. 23. An attempt will be made to have the company taken out of the hands of the liquidators and restored to its former standing. The assets of the company were sold to the Bailey Silver Mines, Ltd., a new company which also took over the mill of the Northern Customs Concentrators, Ltd. For this the Bailey Cobalt received 425,000 shares of the new stock, which is held by the courts, and has never been distributed to the old shareholders.

Following the burning down of part of the power plant of the Castle property, in Gowganda, the property has been closed, pending a financial reorganization.

Toronto—A seemingly important iron prospect has been located by Col. J. A. Currie and Archibald M. Campbell, geologist, 62 miles north of Spragge and 100 miles from Sault Ste. Marie, Ont. According to Mr. Campbell, the mineralized ground is 2¼ miles long and about half a mile wide and the ore is steel blue specular hematite of bessemer grade, low in phosphorus and without a trace of magnetite. The first discovery in this region was made by the Herrick Survey expedition in 1859. The iron deposits were marked by Herrick, but were forgotten for years. The marks of the Helen mine and the Magpie mine were afterward discovered. Col. Currie was told of the deposits just rediscovered, by one of the men who had been on the Herrick Survey, but encountered considerable difficulty in locating the old Herrick line. Claims have been recorded and development work will shortly be started.

ALASKA

Girwood Gold Strike Attracts Prospectors—Salt Chuck Mining Co. in Litigation—Yukon Celebrates Birthday

Anchorage—The recent gold strike near Girwood on the Government Railway continues to draw prospectors into the district. Residences in Anchorage have been opened to accommodate transients unable to find lodging in the crowded hotels. Prospectors are returning from the Eagle River watershed in the Girwood belt with samples of showy gold ore.

Via Seattle, Wash.—J. E. Chilberg, former president of the defunct Scandinavian American Bank of Seattle, and the Salt Chuck Mining Co. and the Platinum-Palladium Products Corporation of Alaska have been made defendants in a suit recently brought by J. M. Davidson, a stockholder in the Goodroe Mining Co. Mr. Davidson is seeking to recover 2,000 shares of Goodroe Mining Co. stock by attempting to set aside a judgment awarded J. E. Chilberg in the U. S. District Court of Alaska. Davidson alleges that by this decision Chilberg was enabled to transfer stock in the Goodroe Mining Co., in which he was a former trustee, to the Salt Chuck Mining Co., and the Platinum Palladium Products Corporation, of which Chilberg is the principal stockholder. He claims that, although the judgment was rendered in the Alaska court, Seattle is the place of business of the Goodroe Mining Co., and that it maintained offices here at the time the judgment was returned. The Goodroe mine is on Prince of Wales Island, near the coast of Alaska.

Dawson, Y. T.—Sourdoughs from the northern country gathered at Dawson recently to attend Yukon's twenty-fifth birthday. Aug. 17 is the anniversary of the discovery of gold in the Klondike, twenty-five years ago, and hundreds of pioneers of those first days joined with more recent citizens of the territory in a monster parade and sourdough banquet. Nothing but Yukon products were served at the banquet.

Forest fires are reported to be sweeping the valley of the Klondike above Dawson and endangering the flume of the Yukon Gold Co., besides interfering with the operation of dredges in destroying power lines.

MEXICO

Many Mining Properties Declared Forfeited—A. S. & R. Adds to Sierra Mojada Holdings—Mine Owners and Managers Meet in Chihuahua

Coahuila

Torreon—The mining agencies of the district have been advised by the Secretary of Hacienda that the following mining properties have been declared forfeited and open for redenouncement:

The San Francisco and Gama mines situated in the municipality of Guanacevi, Durango; [illegible], La Soledad, La Colorado, and San Sebastian, in the Cuencame district, of Durango; La Reina, Don Pascual, La Chula, and Santa Catalina, in the Arizpe district, State of Sonora; Ampliacion al Nazareno, in the municipality of Sombrerete, State of Zacatecas; Nueva Concepcion, in the vicinity of Catorce, State of San Luis Potosi; La Soledad and Ampliacion de la Soledad, in the Chapala district, of Jalisco, and the Maravillas, El Sacramento, Veta Grande, Los Angeles, and El Santo Nino, in the region of Tetipac, State of Guerrero.

Many of these properties have been big producers and still contain rich bodies of ore. They have been abandoned by dissolution of companies or death or disappearance of the former owners. A majority of them will be relocated as soon as they are known to be delinquent.

Chihuahua

Parral—H. C. Maili, of Parral, is making a resurvey of the Dolores mines, which he recently filed for record in the Inde district, in the State of Durango.

Marcos C. Jay is developing some silver-lead mines in the Guadalupe y Calvo district. It is a recently located group known as the Cuatro de Julio.

Pedro Moreno has taken over the Netzahualcoyotl mine, in the camp district.

Jose Moreno, of El Paso, Tex., has located some gold, silver, and lead mines in the municipality of Temosachic on which he is doing development work.

Thomas B. Holmes is doing development work on the Santa Rosa group of mines in the vicinity of Cusihuiriachic. Ramon G. Delgado is also starting to work the Ampliacion de Palmira, a group of mines which he has recently acquired by location.

The American Smelting & Refining Co., through Walter B. Gates, its representative at Sierra Mojada, has recently added additional holdings to its properties in the Sierra Mojada district by filing on about sixty acres of mining ground on the north side of the Sierra Mojada Mountains, near the old Tercera Zona and San Juan mines. The [illegible] and plans are being made by Max F. Quiron.

The A. S. & R. Co. has also recently taken over a number of rich silver mines in the Potrerillo district, in the State of Coahuila, including the old Esperanza mine, which was at one time a big producer of rich silver ore. Owing to the revolutionary troubles and other difficulties, it has been idle for a number of years, but it is understood that the A. S. & R. Co. will open it up immediately and put it in condition for making regular shipments of ore to the company's Chihuahua smelter.

A meeting of the leading mine owners and mine managers of the states of Chihuahua, Durango, and Coahuila was recently held in the city of Chihuahua. Among the principal owners and companies represented were the [illegible] [illegible], Penoles, Los Placeres and American Smelting & Refining Co. It is said that the meeting is expected to result in the resuming of operations of thirty-one producing mines in the three states, giving employment to a large number of idle miners.

Hidalgo

Pachuca—The government is replacing the 5 per cent tax on silver, and several of the leading operating mining companies are considering the advisability of shutting down. Some companies have already discontinued all operations, excepting development work, and El Bordo is operating with a production of 15 000 tons per month, and Santa Gertrudis only about 7,000 tons. Mining conditions are not improving in the district, and the outlook for the immediate future is rather unfavorable.

ARIZONA

Copper Depression Affects State Revenue

Phoenix—The slack copper production is beginning to affect the Arizona tax revenues, of which amount the mines contribute about 54 per cent. As a whole, the Arizona mines this year will pay much less than heretofore toward the cost of state and county administration, though there have been a few cases where the valuations have been materially raised. For instance, the International smelter at Miami has been raised $4,571,000, the Old Dominion smelter at Globe $368,000, and the Copper Queen smelter at Douglas $571,000. This year, due mainly to large legislative appropriations, the state will take 73c. on each $100 valuation, with county taxes added, making a heavy burden.

There is complication through the decreased value of agricultural lands, town property and livestock. Especially in the mining counties, efforts are being put forward toward economy in public service. Led by James S. Douglas, of Douglas, an effort was made to secure a special session of the Legislature, whereat to revoke the main springtime appropriations, but Governor Campbell refused the call, in the belief that the legislators hardly would turn against their own enactments.

The case of the [illegible] Copper Co. of Miami, against James R. Malott, involving [illegible] of five acres of mineral ground at Miami, is reported to have been decided by the Commissioner of the General Land Office in favor of the protestant.

In Yavapai county, litigation is promised over the location by Thomas Smart and others on July 4 of two fractional claims, in all about twenty acres, known as the Santa Cruz Nos. 1 and 2, [illegible] located by [illegible] V. Hopkins and W. [illegible] [illegible]. The ground lies between the property of the United Verde and Verde Central and has been considered a part of the latter's holdings. On [illegible] [illegible] it has been considered very valuable. Smart alleges that proper assessment work had not been done on the claims.

The officers of the Magma Chief

Copper Co. have been cited before the Arizona Corporation Commission on Aug. 26 to submit a complete statement of the affairs of the corporation. It has been alleged by stockholders that attempts have been made to sell nine claims, comprising the most valuable part of the company's property. The company originally was formed to operate copper claims at Superior, but latterly its activities have been transferred to claims in the Mammoth section of western Pinal County.

Prescott—A start has been made upon the hearing of the first suit of a number against the United Verde Extension Mining Co. by Verde valley farmers, who allege their holdings have been diminished in productiveness and value through the smelter's sulphur fumes.

The California Rock Salt Co. has been incorporated with $250,000,000 capitalization, with announcement of intention to carry on the business of mining, milling, leaching, and reducing all kinds of ores and minerals, including salt, at Constellation and other Arizona points.

Tucson — Sanford H. Hudson has asked judgment against the Sunset Co. on the basis of four $400 promissory notes alleged to have been given a year ago to the Copper States Mining Co.

Patagonia — The diamond-drill hole which is being sunk on the Hardshell property to prospect for the lower extension of the Alta vein is over 610 ft. deep. Quartz vein matter carrying considerable yellow iron pyrite has been encountered. Development work continues on the Bender property, and payable ore is being opened. Howard K. Welch is general manager.

NEW MEXICO

Georgetown Mining Co. Incorporated

Georgetown—The Georgetown Mining Co., with a capital stock of $1,000,000 and $2,000 paid in, was incorporated at Santa Fe, N. M., on Aug. 10. C. A. Peterson, of Chicago; Rua Ridenour, and Frank W. Vallacott, of Silver City, the latter being a well-known attorney, are the incorporators. This company was organized to take over a group of thirty-two mining claims owned by C. P. Cramer, in this camp. These claims cover a large portion of the old bonanza workings that helped to pile up a total of about $8,000,000 credited to this camp between 1872 and 1892, when work ceased.

UTAH

Reduction in Freight Rates Helps Miners and Smelters — Utah Station of U. S. B. M. Has New Microscope

The reduction in freight rates on bullion, which went into effect Aug. 11, bringing with it a reduction in smelting rates (one cent per ounce for silver and one-quarter of a cent on lead bullion), is expected to bring increased shipments to the Salt Lake valley smelters. The ore is expected to come from increased production and from stockpiles accumulated at a number of properties awaiting more favorable markets. The smelting companies are making the decrease in charges promised at the time smelting rates were increased to meet the heavier shipment rates.

The Salt Lake station of the Bureau of Mines at the University of Utah School of Mines has just received a new Leitz microscope, after a year's wait, for petrographic work. The services of the Salt Lake microscopic laboratory are offered free of charge to any engineer, mining company, or district with a problem, whose solution will enable the economical treatment of ore to be made.

The new schedule of power rates prepared by the Utah Power & Light Co., affecting the Utah Copper Co., as the largest user of power in the state and the only company at present coming under the classification which can take a minimum of 6,000 hp. and service at from 120,000 to 130,000 v., has been allowed by the state Public Utilities Commission to go into force Aug. 20. The new rates are lower than those fixed by the commission a few months ago and higher than those existing under the especial contract abrogated by the commission. The U. S. district court at Salt Lake City upheld the right of the commission to abrogate contracts held by large users, but rendered no decision as to the rates. An appeal to the supreme court was expected, but with the establishment of the new rates on Aug. 20, the matter is considered closed. According to a rough estimate, the Utah Copper will pay—when it is again operating—about $20,000 a month, or about $250,000 a year, less for power than it would have paid under the rates first fixed by the commission.

COLORADO

Liberty Bell Shuts Down

Telluride—After continuous operation for over a quarter of a century, the Liberty Bell mine, at Telluride, has shut down. Arthur Winslow is president.

Idaho Springs — Preliminary development work has been started on the Bertha property by the Utah-Colorado Mining & Milling Co., under the direction of Charles E. Havener, president of the company. Edward Manion is engineer in charge of operations. The company intends to undertake more extensive development work.

At the recent meeting of the stockholders of the Bonanza Mines Co., the following officers and directors were elected: A. E. Gees, president; Frank Heilig, vice-president and general manager; C. E. Angell, secretary and treasurer; and J. C. Shumaker, J. W. E. Caney, W. J. Briggs, and B. D. Arbuckle. A tunnel is being advanced to connect with the Chicago Belle shaft and unwater the old workings. The tunnel has been advanced 842 ft. and will be driven about 200 ft. more to complete the connection.

The Fraction mine is being developed and operated under the direction of H. E. Machol, of this place. A trial car of ore from development has been shipped to the smelter, the average value being 3 oz. gold and 40 oz. silver a ton. A new pocket of high-grade ore has just been opened, assaying up to 10 oz. gold and 400 oz. silver. Drifting is in progress in the fourth level, west heading, under territory that has produced high-grade pockets in upper levels.

Alice — The wire-rope tramway is nearing completion, and as soon as it is in operation the company's mill will be started on a twenty-four-hour basis, on low-grade concentrating ore recently developed.

Aspen—The Cowenhoven tunnel properties have been taken over by the Silver Mines Company of America, with Stuart Croasdale, of Denver, managing director, and J. T. Boyd, local manager. Extensive development work is under way.

Cripple Creek—The Isabella mine is being developed and operated under lease by the Heck Leasing Co. At present operations are conducted through the Empire State shaft, but it is the intention of the lessee to open the Lee shaft later. On the fourth level of the Maloney vein, a six-inch streak of 10-oz. gold ore has been opened.

Ward—The American Gold & Platinum Co. has completed installation of electric power in the Ogden mill, and it is planned to operate the mill up to capacity on ore containing gold and platinum. The Odgen electrolytic process is to be used in the plant.

OREGON

Platinum Discovered in Josephine County

Grant's Pass—Henry M. Lancaster, a well-known mining engineer and manager of the St. Lawrence Copper Mining Co., of Saltese, Mont., has secured an option on a large tract of land about sixteen miles from Grant's Pass, in Josephine County, Oregon, upon which has been discovered a ledge containing platinum, iridium, and a little gold. Numerous samples have been assayed, all but one of which contained platinum varying from 1 to 3 oz. Several contained iridium, one containing 2.60 oz.

As described by Mr. Lancaster, the vein lies almost flat, dipping into a steep hill, just above and partly in the bed of a creek. It is from 10 to 15 ft. thick, generally outcropping and in other places exposed by cuts for a distance of a mile and a half, all of which is included in the land under option. It is believed to be the "mother lode" from which came the platinum recovered in the sluice boxes by placer miners who worked the ground in that section many years ago.

Steps are being taken to determine the proper process for the treatment of the ore. So far as known, this is the first discovery of platinum in a vein or sulphide form, the limited production having been recovered from alluvial deposits. For this reason the discovery has created exceptional interest.

MONTANA

Anaconda Making Headway Fighting Fires

Butte—Expenses of the Anaconda Copper Mining Co., even with a suspension of its copper production, are approximating $500,000 a month, and from expressions had from officials in private conversation with friends, the view is expressed that Anaconda will lose no time in resuming copper mining partially at least, upon the first sign of any material improvement in the metal. Cornelius F. Kelly, president of Anaconda, cut short his visit in Butte, and, upon receipt of a call from New York, came in from his summer home at Swan Lake, and within two hours took a train for the East. John D. Ryan, chairman of the Anaconda board, who was en route to Butte, turned around at Hancock, Mich., awaited Mr. Kelly, and both returned to New York. It was stated in Butte that Mr. Ryan postponed his visit for about a month.

Anaconda is making good headway in smothering its underground fires in the Tramway Leonard group of properties in the southeast portion of the district. The burning zone at the Leonard has been filled in with Butte & Superior tailings up to the 1,600-level and plans are under way for filling this area. The sand tailings are poured into the burning zone through diamond-drill holes, and as much as 1,700 tons has been deposited in twenty-four hours. This treatment is proving effective, and if the supply of tailings holds out, Anaconda will achieve success in the fighting of these subterranean fires for the first time in the history of its organization. Fires from the Berkeley mine have worked their way into the Silver Bow mine.

Diamond drilling is in progress at the Silver Bow, and as soon as the holes are completed, a stream of tailings will be directed against the fire in this property. A careful examination of reclaimed ground in the Leonard and the Tramway mines shows not a trace of fire. These fine tailings penetrate all cracks and interstices in the stopes and the mass sets somewhat like a concrete body, effectually putting out the smoldering masses of fire. Fighting these fires has proved one of the costliest items which the Anaconda has had to face.

NEVADA

Florence, Black Prince, and Silver Klondike Mines Active

Pioche—The Florence group of claims, situated in the Stampede district, about one and one-half miles north of the summit, are now being worked on a small scale, the property being recently bonded to William J. Franklin, Jack Smith, and Charlie Smith. Work is being done in two places. At a point on the north and south contact fissure about 100 ft. north of the main tunnel, a foot of heavy lead ore was encountered this week. Assays from the strike showed gold, $1.20, silver, 75 oz., and 81 per cent lead content per ton.

The main tunnel, situated on the Adeline claim, which is 382 ft. in length, cut a small well-defined fissure about 15 ft. from its portal, and a winze is now being sunk from the tunnel on this fissure. This winze has now reached a depth of 45 ft., and with the installation of air pipe to aid ventilation, operations will be continued to greater depth.

James B. Wheeler, manager of the Black Prince Mining Co., intends soon to begin the development of the company's holdings in the active Highland-Stampede district. Considerable work has been done on the big manganese iron vein that outcrops on the claims which are situated about half a mile south of the Wheeler ranch, and assays of the headings already driven in the vein indicate a large tonnage that will assay about 15 oz. of silver and 3.5 per cent lead with a satisfactory excess of iron and manganese content over silica.

The mining operations at the Silver Klondike mine in Stampede Gap, near Pioche, are going ahead with energy. A small fault encountered several days ago, has caused a change in the original plan of drifting along the hanging wall of the dike which cuts through the property. It is on the contact with this dike that the large iron vein was encountered and through which the drift is being run. The face of the tunnel is in soft iron manganese vein filling, and progress is facilitated accordingly.

MICHIGAN

The Copper Country

Copper Shipments Exceptionally Light —C. & H. Campaigning for Economy

Houghton—So far this month only 1,200,000 lb. of copper has been shipped out of the Lake district, and unless shipments are speeded up, August will be the poorest month of the season of navigation to date for metal deliveries. A shipment of 300,000 lb. was made on Aug. 5, and a like amount was taken out on Aug. 14. Calumet & Hecla, Copper Range, and Quincy, made up both consignments. Such copper orders as are being received are small, and metal is piling up at both Copper Range and Quincy docks.

Calumet & Hecla has an order for 400,000 lb. of copper, which will be shipped early in September. Half of it will be exported to France, in the form of billets, and the remainder is for domestic consumers. This is the only business Calumet & Hecla now has on its books.

That there will be no resumption of mining by Calumet & Hecla and its subsidiaries this fall, is further indicated by the [illegible] to economize to the utmost extent in every department, doing away with every expense possible. Each department throughout the organization will "cut to the bone," eliminating [illegible] not absolutely essential. The power plant will continue to operate, but [illegible] sufficiently to supply power for the maintenance of pumps. To cut costs, electric pumps have largely replaced steam and air pumps throughout the properties and in so far as possible all necessary operations have been electrified. The central power plant at Lake Linden will serve all of the C. & H. mines. A new pump has just been installed in No. 4 shaft, North Kearsarge. It is of 150-gallons-per-minute capacity and will be ample to take care of all water. No. 1 shaft has three electric pumps, one in the bottom level, of 500-gallons' capacity and the other two in the upper levels.

Although it will take C. & H. and its subsidiaries several months to build up their organizations when mining is resumed, it has one big asset that can be put to work at capacity in producing copper without loss of time when metal conditions warrant. That is the reclamation plant on the conglomerate sands at Lake Linden. This plant is in a constant state of readiness, and in twenty-four hours could be placed on a maximum production basis of nearly 2,000,000 lb. of refined copper per month.

MINNESOTA

Cuyuna Range

Maroco Pit To Ship As Long As Possible

Trommald — Initial shipments from the Maroco pit of the Marquette Ore Co., were made on Aug. 15. Operators will ship to full capacity right up to close of navigation. Clean-up on top of ore has been completed in the west end of the pit, one shovel is now loadind ore in this area, and a second shovel will be used for stripping clean-up following hydraulic operations in the east end. Ore is dumped through an incline chute from the pit bottom to main shaft in the foot wall and from there hoisted to a washing plant for treatment by screens and logs. The mine now employs about 200 men on double shift.

Cuyuna—The Kennedy Mine (Rogers-Brown Ore Co.), which closed during the last week in July, has placed several crews on development work on the 362 level and is planning operation of the mine on part time during the winter months.

Ironton—Clement K. Quinn & Co. recently started up open-pit operations at the company's Mahnomen mine and is now making daily shipments to docks. The mine is a producer of both [illegible] ore and manganiferous iron ore and has a large reserve. It has been idle since the fall of 1920.

Riverton—Hydraulic stripping was resumed on Aug. 19 at the [illegible] mine after a fortnight's shutdown due to inability of the Range Power Co. to furnish current from its hydro-electric plant, owing to an unusually long period of dry weather. The new washing plant which was under construction is completed except for interior work and work will be started this fall on a separating and drying plant for the mine. John A. Savage & Co., of Duluth, are the operators.

THE MARKET REPORT

Daily Prices of Metals

Aug.	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
18	11.50@11.75	25.50	26.00	4.35@4.40	4.20@4.25	4.20
19	11.50@11.75	25.50	26.125	4.35@4.40	4.20@4.25	4.20
20	11.50@11.75	25.50	26.125	4.35@4.40	4.20@4.25	4.20
22	11.375@11.50	25.75	26.125	4.35@4.40	4.20@4.25	4.15@4.20
23	11.375@11.50	25.50	26.00	4.35@4.40	4.20@4.25	4.15
24	11.375@11.50	25.25	25.625	4.35@4.40	4.20@4.25	4.15

*These prices correspond to the following quotations for copper, "delivered": Aug. 18th, 19th and 20th, 11.75@12c.; Aug. 22nd, 23rd and 24th, 11.625@11.75c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Aug	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
18	67¼	67¾	71½	151½	153	23⅜	23⅛	24⅝	25¼
19	67⅛	67⅜	71½	152¾	154	23⅜	22⅞	24⅝	25¼
20	. .	. .	. .				. .	. .	. .
22	66¼	66¼	71	152½	154¼	23⅛	22⅝	24⅝	25⅛
23	66	66¾	70½	152⅛	153¾	23	22½	24½	25
24	66¾	67⅛	70½	150	151½	23	22⅜	24⅜	25

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Aug.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	Aug.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York, Foreign Origin	Silver London
18	365¾	99¼	62	38⅜	22	365½	99¼	61¼	37⅞
19	364¼	99¼	62⅛	38⅛	23	365¾	99¼	61⅜	38
20	365	99¼	61⅞	38¼	24	366⅝	99¼	62⅛	38½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, Aug. 24, 1921

Little encouragement can be obtained from the fluctuations in the metal market during the last week. Copper is now obtainable well below the 12c. level maintained by the large producers, and zinc has reacted to the 4.15c. price level of some weeks ago. Lead has held firm, as has been the case for some time, but in some quarters a slightly weaker tendency has been noticed in the last two days.

Copper

Whether the break in the London copper market was an honest one or caused by the efforts of manipulators is unknown. Some think that the prices were depressed so that American copper could be obtained on a lower basis, and that actually little or no metal could be obtained on the London market at the prices quoted. Others say that the slow revival of industrial activity in England has discouraged holders of copper and that they have decided to sell at a sacrifice. Whatever the true reason, the London decline has made consumers on this side think that they should be able to obtain copper for less than 12c. delivered. The principal producers have consistently refused to be stampeded, however, and have stuck to that figure, feeling that as long as they were able to realize 11⅞@12c. f.a.s. New York, for export sales, they would not attempt to compete for the small amount of domestic business in prospect. Some of the large consumers have suggested 11.50c. as a suitable price at which they might offer some business, but we have not heard of any actual sales being made at this figure. Copper has been offered, though, at 11⅝c. delivered, and business has been done at this level. Several million pounds could be obtained during the last three days at the prices which we quote, but buying has not been brisk. Export business through the Copper Export Association is reported as having been satisfactory, the metal going to Japan, France, and Germany.

Lead

The position of lead continues satisfactory and the price has not broken any to speak of from the figures reported last week, despite depression in the other metals and in the stock market. Most of the business has been done by the leading producer, even though independents have in some cases been willing to quote prices at a 5-point concession. No large orders are reported, but demand has been particularly well distributed, not only in different lines of business but also in various sections of the country. The demand for white oxide continues excellent. In the last two or three days there has been a more determined effort to sell lead on the 4.20c. St. Louis basis, and an excellent grade of lead is offered in lots of several hundred tons at that price. Desilverized lead is also obtainable in Chicago at 4.30c. Some inquiry has been made for lead for October delivery, but producers generally are unwilling to quote on this business. There should be no difficulty in buying lead as needed during the next few months, and it will result in a much healthier condition of the lead market if sales continue to be made for delivery within two months.

Zinc

Again weak operators have caused a slight recession by forcing their output on an unwilling zinc market. The 4.20c. price was well maintained until Monday, when sales were made at 4.175c. and at least one sale was made at 4.15c. Yesterday and today the metal was easily obtainable at 4.15c. for August and September delivery, although some producers are out of the market. October is quoted at 2½ points premium, instead of 5, as formerly. Producers feel that it is reasonable to expect an increased demand from galvanizing interests early in the fall.

Tin

There was considerable demand from consumers for tin last Wednesday, but since then it has died away, and the market has been narrow, with only a slight price range. The market has been marked by a scarcity of 99 per cent for spot delivery, and the price for that grade has been considerably nearer to that of Straits than for some time. Straits tin for forward delivery is quoted at approximately the same prices as for spot.

Correction: On Aug. 17 the price of 99 per cent tin should have been given as 25.25c., and of Straits, 25.625c. These were incorrectly reported in the *Engineering and Mining Journal* of Aug. 20.

Arrivals of tin, in long tons: Aug. 18th, London, 50; 23d, Liverpool, 50.

Gold

Gold in London, Aug. 18th, 112s. 6d.; 19th, 112s. 5d.; 22d, 112s. 3d.; 23d, 112s. 4d.; 24th, 111s. 11d.

Foreign Exchange

Interest in the foreign exchange market has been narrow. Sterling cables have been quoted one-half cent higher than checks as given on page 356. On Tuesday, Aug. 23d, francs were 7.71c.; lire, 4.25c.; and marks, 1.17c. New York funds in Montreal, 10⅝ per cent premium.

Silver

For the last few days prices in San Francisco have not been up to the equivalent of the New York and London markets. The market quickly recovered from the fall of Aug. 22, which would appear to indicate a better undertone at present levels, but in the final analysis the market depends on China.

Mexican Dollars—Aug. 18th, 47½; 19th, 47⅝; 20th, 47⅝; 22d, 47; 23d, 47[illegible]; 24th, 47[illegible].

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 19@20c. per lb.; 18½c. for imports, duty paid.

Antimony—Chinese and Japanese brands, 4.50@4.65c.; market dull. W.C.C. brand, [illegible] per lb. Cookson's "C" grade, spot 9@9½c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500-lb. lots.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $3@$3.25 per lb.; black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $160@$170 per oz.

[1]**Molybdenum Metal**—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal $70, Los Angeles, Cal.

Palladium—Nominally, $55@$60 per oz.

Platinum—Nominally, $75@$78 per oz.

Quicksilver — Nominally, $46@$47 per 75-lb. flask. San Francisco wires $46. Steady.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—22c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

---

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 20—Zinc blende, per ton, high, $23.90; basis 60 per cent zinc, premium, $21; Prime Western, $21@$20.50; fines and slimes, $20@$17; average settling price, all grades of zinc, $22.15.

Lead, high, $52.70; basis 80 per cent lead, $51@$50; average settling price, all grades of lead, $49.35 per ton.

Shipments for the week: Blende, 4,719; lead, 835 tons. Value, all ores the week, $150,470.

Buying ceased unusually early today, all orders being filled by 10 o'clock this morning. Buyers assert that offerings of ore were unusually liberal, permitting the early cessation of buying. One buyer made the statement that he could have purchased several thousand tons between 10 and 12 o'clock today on $21 basis if he had had buying orders.

There was a recession in lead buying. Though $51 was offered for a few lots early in the week, the week-end buying was desultory, and offerings were light on $50 basis.

Platteville, Wis., Aug. 20—No market or shipments.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,500@$2,000; No. 2, $850@$1,250; spinning fibers, $350@$850; magnesia and compressed sheet fibers, $225@$350; shingle stock, $95@$150; paper stock, $55@$70; cement stock, $16@$27.50; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Borax—Granulated, crystals or powdered in bags, carloads, 5¼c. per lb.; in bbls., 5½c.

Chalk—English, extra light, 5c.; domestic light, 4c.; heavy, 4c. per lb., all f.o.b. New York.

China Clay (Kaolin)—[illegible] $6.50@$8.00; washed, [illegible]@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $15@$20, f.o.b. American ports; powdered, [illegible]@$45, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

Feldspar—No. 1 soap grade, $7@$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, $6@$6.50; No. 2, $5@$5.50. Market dull. Large stocks are available and quotations are nominal. Producers report cancellations of orders. No. 1, Canadian, ground, $26 f.o.b. cars.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $13.50, f.o.b. Lordsburg, N. M. Ground acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, ¾@2⅛c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $45@$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $11.65; 75 per cent, $10.65; 75@74 per cent, $10.15; 70 per cent, $6.25; 68 per cent, $5.75; 68@66 per cent, $5.50.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 12c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $7.50@$11 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—6c. per lb.

Sodium Nitrate—$2.10@$2.30 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $12.50 per ton, f.o.b. in bulk, Western mines, spot and six months' contract; $22@$25 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.25 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 12c. per lb. of chromium contained; 4 to 6 per cent carbon, 13c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $65@$67, f.o.b. furnace; resale, $90, delivered; English, $65@$70, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $26@$25, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works. Imported material, $1.70@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $40; 50 per cent, $65; 75 per cent, $135.

Ferrotungsten—Domestic, 70 to 80 per cent W, 40@45c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$4.25@$4.50 per lb. of V contained, according to analvses and quantity.

Metal Products

Copper Sheets—Current New York list price, 19¾@20c per lb.; wire, 13½@14c.

Lead Sheets—Full lead sheets, 7¾c.; cut lead sheets, 8c. in quantity, mill lots.

Nickel Silver — 31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets 16¾c.; sheathing, 15½c.; rods, ⅝ to 3 in., 13¾c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina $50 per ton; 76 per cent, $90@$95 f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—$52@$55 per net ton.

Fire Brick—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $65@$70 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Aug. 23, 1921

In the steel market as a whole there has been no really noticeable increase in demand in the last week, but the improvement exhibited has been maintained. The passage of each week furnishes additional circumstantial evidence that steel prices, if not at bottom, are at least very near bottom as long as fundamental items of cost, including freight rates, remain as at present.

The Steel Corporation has at last announced a reduction in its rate for common labor from 37c. to 30c. an hour, the highest rate lately paid by independents.

Steel production is now at about 25 per cent of capacity, against a rate under 20 per cent at the middle of July.

Pig Iron—Prompted perhaps by advances announced by Chicago district furnacemen, all or nearly all the producers of basic pig iron in the Mahoning Valley and western Pennsylvania generally have announced an intention to demand $20, furnace, on future inquiries for basic iron, the market as made by recent sales being $18. If the advance is established bessemer may go up a dollar. There is little inquiry. We note a sale of 300 tons bessemer at $20, Valley furnace, and quote: Bessemer, $20; basic, $18@$20; foundry, $19.50, f.o.b. Valley furnaces, freight to Pittsburgh being $1.96.

Steel—With close competition, a sale of sheet bars has been made at $30, delivered Youngstown district.

Coke

Connellsville — Furnace, $3@$3.25; foundry, $4.25@$4.50.

---

[1] Foote Mineral Co., Philadelphia, Pa.

The Spread on Copper and Zinc Sheets

Some buyers who want copper sheets are looking into the matter closely and have asked why the difference in the cost between the metal and the product, says *Sheet Metal Worker*. This led to the question being submitted to the head of one of the New England copper rolling mills, who gives the following:

"The reason for the present spread between the price of ingot copper and sheet copper, as compared to the spread in the previous years, can be explained as follows: Everything has gone up in price. Freight rates have increased 110 per cent. Then, again, the fuel used, which formerly cost $2.65 per ton f.o.b. the plant, now costs $9.35 per ton. Where formerly $24.50 per 1,000 was paid for the lumber required in making the crates and coverings for sheet copper, it now costs $56. All lubricants required in making sheet copper now average 27¾c. per gal. Then again the labor cost, which formerly was 20c. per hour as a maximum, is now at a minimum of 45½c. per hour. These advances when taken into consideration show that copper is being sold today on a lower basis than when there was a spread of about half as much between the metal and the manufactured sheets."

The matter of the spread between the zinc metal and the rolled sheets was submitted to the American Zinc Institute, and the following is the presentation of the case of zinc:

"All of the reasons given in regard to copper apply equally as well to zinc. It has been found that labor costs increased from about 20 to 52½ per cent. The present spread between slab zinc and sheets, based on a fair selling price for the former, is not excessive, and a contraction of same would be warranted only in case of a general readjustment and an increased volume of business, which would permit spreading the overhead and cost over a greater production.

"Each of the above items factor as strongly in the manufacture of zinc sheets as they do in copper sheets. However, the spread between zinc and zinc sheets is apparently greater than it actually is, for the reason that market quotations on zinc are not quotations upon the grade of zinc which is used for the manufacture of the sheets. All of the manufacturers of zinc sheets manufacture a metal of a special purity for rolling, which metal must bear a considerably higher cost than Prime Western. The ores which are necessary carry premiums, and the extreme care necessary during the whole operation mounts up into a substantially higher cost than must be borne by Prime Western metal. During the last half year it has become exceedingly difficult to produce this high-grade metal."

An Estimate of Copper Consumption

The automotive industries are now consuming at the rate of 54,000,000 lb. of copper for 1921, against 99,300,000 lb. actually consumed in 1920. The electrical industry is 80,000,000 lb. behind last year; the telephone and telegraph 15,000,000 lb. behind.

The *Boston News Bureau* presents below a table showing the estimated current consumption of American copper by the leading industries of this country, including metal shipped abroad in finished form; figures being in pounds:

Consumption by	1921	1920
[illegible]	[illegible]	140,000,000
[illegible]	[illegible]	100,000,000
[illegible]	[illegible]	[illegible]
[illegible]	54,000,000	[illegible]
[illegible]	14,000,000	17,600,000
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Total	[illegible]	1,101,800,000

In shipbuilding, locomotive and car building the consumption of copper at present is at a low ebb. But with the rolling stock of American railroads in a sad state of repair and with an imperative demand for new equipment, it is probable this industry will increase its copper taking

Movements of Ores and Metals for July, 1921

Imports and exports of the more important metals and ores for July as reported by the Department of Commerce:

IMPORTS [illegible]

(In Pounds [illegible])

	[illegible] 1920	[illegible] 1921
[illegible]	[illegible]	
[illegible]	[illegible]	2,14[illegible]
[illegible]	[illegible]	1,70[illegible]
[illegible]		
[illegible]	[illegible]	5,4[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	
[illegible]		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		
[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	
Canada	565	
[illegible]	[illegible]	
[illegible]	[illegible]	
Australia	1,012,432	
[illegible]	[illegible]	[illegible]
Imported from (in part):		
Cuba, long tons	80	
Brazil, long tons	12,462	
British India, long tons	1,600	5,000
Tungsten ore, long tons	71	47
[illegible]	[illegible]	[illegible]
[illegible]		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		
[illegible]	4,029,725	1,058,406
[illegible]	[illegible]	[illegible]
Hongkong	2,318,059	22,400
[illegible]	[illegible]	[illegible]
[illegible]		
[illegible]	[illegible]	
Imported from:		
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	

EXPORTS OF COPPER, LEAD AND ZINC

(In Pounds)

	[illegible] 1920	[illegible] 1921
Copper		
[illegible]	[illegible]	
Unrefined, black, blister, etc.	83,277	
[illegible]	[illegible]	[illegible]
Exported to		
[illegible]	[illegible]	[illegible]
France	17,797,752	4,710,404
[illegible]	5,614,824	23,687,772
[illegible]	[illegible]	[illegible]
[illegible]	3,465,284	695,244
[illegible]	9,200,750	1,597,074
[illegible]	56,002	1,258,130
[illegible]		[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		
[illegible]		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		
[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
China	1,504	
[illegible]		[illegible]
[illegible]		
Dross	5,900	5,100
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]		[illegible]
[illegible]	[illegible]	[illegible]

MINING STOCKS

Week Ended August 20, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Ahmeek	Boston	46	41½	43	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*34	*31	*31		
Allouez	Boston	18	18	18	Mar. '19	1.00
Anaconda	New York	35	34¼	34¾	Nov. '20, Q	1.00
Arcadian Consol	Boston	1½	1½	1½		
Ariz. Com'l	Boston	8	7½	7½	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*28	*21	*25		
Bingham Mines	Boston	†9	†9½	9¼	Sept. '19, Q	.25
Calumet & Arizona	Boston	46	45½	45½	June '21, Q	.50
Calumet & Hecla	Boston	225	220	225	June '20, Q	5.00
Canada Copper	N. Y. Curb	....	....	*28		
Centennial	Boston	†9	†7½	7⅜	Dec. '18, SA	1.00
Cerro de Pasco	New York	25⅛	25	25⅛	Mar. '21, Q	.50
Chile Copper	New York	10	9⅞	9⅞		
Chino	New York	22¼	21⅜	21⅝	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*24½	*23½	*23½		
Con. Arizona	N. Y. Curb	....	.	*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1½	1	1		
Copper Range	Boston	31	30⅛	31	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*42	*38	*42		
Davis-Daly	Boston	6⅛	5⅝	6	Mar. '20, Q	.25
East Butte	Boston	7½	7¼	7½	Dec. '19, A	.50
First National	Boston Curb	*51	*50	*50	Feb. '19, SA	.15
Franklin	Boston	1⅝	1⅝	1⅝		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol	New York	15⅛	15	15	May '19, Q	1.25
Greene-Cananea	New York	20⅞	20½	20½	Nov. '20, Q	.50
Hancock	Boston	†3	†2½	2½		
Howe Sound	N. Y. Curb	2½	2⅜	2⅜	Jan. '21, Q	.05
Inspiration Consol	New York	31¼	30⅜	31¼	Oct. '20, Q	1.00
Iron Cap	Boston Curb		....	5½	Sept. '20, K	.25
Isle Royale	Boston	†19	†18	17	Sept. '19, SA	.50
Kennecott	New York	18½	17⅞	18¼	Dec. '20, Q	.50
Keweenaw	Boston	1 1/16	1	1		
Lake Copper	Boston	†3	†2	2½		
La Salle	Boston	1½	1½	1½		
Magma Chief	N. Y. Curb	....	....	*8		
Magma Copper	N. Y. Curb	18	17½	17¾	Jan. '19, Q	.50
Majestic	Boston Curb	*7	*7	*7		
Mason Valley	Boston	†1¼	†1⅛	1⅛		
Mass Consolidated	Boston	1½	1⅜	1½	Nov. '17, Q	1.00
Miami Copper	New York	20	19¾	20	Aug. '21, Q	.50
Michigan	Boston	†2	†1¼	1¼		
Mohawk	Boston	47½	46	46	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	4	3⅝	3¾		
Nevada Consol.	New York	10½	9¾	10	Sept. '20, Q	25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	13	12½	12½	Aug. '20, K	.25
North Butte	Boston	9	8⅝	8¾	Oct. '18, Q	.25
North Lake	Boston	*15	*15	*15		
Ohio Copper	N. Y. Curb	*7	*6	*6		
Old Dominion	Boston	22	21	21	Dec. '18, Q	1.00
Osceola	Boston	23	23	23	June '20, Q	50
Phelps Dodge	Open Mar.	†155	†145	..	July '21, Q	1.00
Quincy	Boston	34	34	34	Mar. '20, Q	1.00
Ray Consolidated	New York	12¼	12	12	Dec. '20, Q	25
Ray Hercules	N. Y. Curb	*25	*21	*22		
St. Mary's Min. Ld.	Boston	31	30	31	June '20, K	2.00
Seneca Copper	Boston	15½	15¼	15½		
Shannon	Boston	*85	*80	*80	Nov. '17, Q	25
Shattuck Arizona	New York	6½	6¼	6½	Jan. '20, Q	25
South Lake	Boston	†1½	†50	1		
Superior Copper	Boston	†3½	†2½	2½	Apr. '17,	1.00
Superior & Boston	Boston	1¾	1¼	1⅛		
Tenn. C. & C. cfs	New York	7½	7	7⅛	May '18, I	1.00
Tuolumne	Boston	*42	*34	*35	May '13,	10
United Verde Ex.	Boston Curb	23	22¼	23	May '21, Q	25
Utah Consol	Boston	3½	3½	3½	Sept. '18,	25
Utah Copper	New York	45¼	44¼	44½	June '21, Q	.50
Utah Metal & T.	Boston	1¼	1¼	1¼	Dec. '17,	30
Victoria	Boston	1¼	1¼	1¼		
Winona	Boston	*50	*45	*45		
Wolverine	Boston	10¼	10	10¼		
		NICKEL-COPPER				
Internat. Nickel	New York	13¼	12¼	12¼	Mar. '19,	50
Internat. Nickel, pf	New York	†84	†80	84	Aug. '21, Q	1.50
		LEAD				
National Lead	New York	72¼	71	71½	June '21, Q	1.50
National Lead pfd	New York	†110	†101	103	June '21, Q	1.75
St. Joseph Lead	New York	11¼	11¼	11¼	June '21, Q	.25
		QUICKSILVER				
New Idria	Boston	†*50		*50		
		ZINC				
Am. Z. L. & S.	New York	8	7	7½	May '20,	1.00
Am. Z. L. & S. pfd	New York	25	25	25	Nov. '20, Q	1.50
Butte C. & Z.	New York	4½	4	4	June '18,	50
Butte & Superior	New York	11¼	11½	11½	Sept. '20,	1.25
Callahan Z.-Ld.	New York	4¼	4¼	4¼	Dec. '20, Q	50
New Jersey Zn.	N. Y. Curb			116½	Aug. '21, Q	2.00
Success	N. Y. Curb			*2	July '16,	03
Yellow Pine	Los Angeles	‡		*55	Sept. '20, Q	03

*Cents per share. †Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	⅜	⅜	⅜		
Alaska Juneau	New York	1½	1⅜	1⅜		
Carson Hill	Boston	†14⅛	12	†14⅛		
Cresson Consol. G.	N. Y. Curb	1 13/16	1 11/16	1¾	June '20, Q	$0.10
Dome Extension	Toronto	...	†*65	*65		
Dome Mines	New York	16⅛	16	16⅜	July '21, Q	.25
Florence Goldfield	N.Y. Curb	*40	*37	*39		
Golden Cycle	Colo. Springs	*67½	*67½	*67½	June '21, Q	.02
Goldfield Consol	N. Y. Curb	*4	*4	*4	Dec. '19,	.05
Hollinger Consol	Toronto	7.10	7.10	7.10	Aug. '21, 4 wks.	.05
Homestake Mining	New York	57	57¼	57½	July '21, M	.25
Kirkland Lake	Toronto	*37¼	*37¼	*37¼		
Lake Shore	Toronto	†1.25	†1.21	1.21	Aug. '21, K	.02
McIntyre-Porcupine	Toronto	2.05	1.97	2.00	May '21, K	.05
Porcupine Crown	Toronto	†15½	†14	*14	July '17,	.03
Portland	Colo. Springs	†*43	†*40	*43	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	....	....	*4	May '19,	.05
Silver Pick	N. Y. Curb	*11	*11	*11		
Teck Hughes	Toronto	*16½	*15	*15		
Tom Reed	Los Angeles	‡....	....	*71	Dec. '19,	.02
United Eastern	N. Y. Curb	2 5/16	2 1/16	2¼	July '21, Q	.15
Vindicator Consol	Colo. Springs	*27	*27	*27	Jan. '20, Q	.01
West Dome Consol	Toronto	*8	*6	*7½		
White Caps Mining	N. Y. Curb	*5	*4	*4		
Yukon Gold	N. Y. Curb	*93	*80	*93	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*21	*19	*19	Apr. '20, M	.03
Batopilas Mining	New York	....	....	½	Dec. '07, I	.12½
Beaver Consol	Toronto	*28½	*27½	*27½	May '20, K	.03
Coniagas	Toronto	†1.65	....	1.65	May '21, Q	.12½
Crown Reserve	Toronto	*10	*10	*10	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3¼	3½	3½	July '21, Q	.12½
La Rose	Toronto	†*22	†*15	*18½	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	†*20	†*14	*15	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	†1.25	†1.15	1.25	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4¼	4⅜	4⅜	July '21, Q	.15
Ontario Silver	New York		....	3½	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	*13	*11	*13	Jan. '12,	.10
Peterson Lake	Toronto	*4	*4¾	*4¼	Jan. '17,	.01½
Temiskaming	Toronto		†*22	...	Jan. '20, K	.04
Trethewey	Toronto	*15	*10½	*10½	Jan. '19,	.05
		GOLD AND SILVER				
Barnes-King	Butte	‡	....	*60	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*72	*64	*68		
Cash Boy	N. Y. Curb	*5	*4	*4		
Consol. Virginia	San Francisco	*21	*21	*21		
Dolores Esperanza	N. Y. Curb	2	1⅝	2		
El Salvador	N. Y. Curb	*19	*17	*18		
Jim Butler	N. Y. Curb	*8	*7	*7½	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*4	*4	*4	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	¼		
MacNamara M. & M.	N. Y. Curb	*18	*15	*15	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.		....	4	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1⅛	1	1¼	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*78	*67	*77		
Tonopah-Extension	N. Y. Curb	1¼	1⅛	1 3/16	July '21, Q	05
Tonopah Mining	N. Y. Curb	1⅛	1¼	1 1/16	Apr. '21, SA	.05
West End Consol	N. Y. Curb	*82	*75	*82	Dec. '19, SA	05
		SILVER-LEAD				
Caledonia	N. Y. Curb	*9	*9	*9	Jan. '21, M	01
Cardiff M. & M.	Salt Lake	†1.11½	†1.07½	...	Dec. '21,	15
Chief Consol	Boston Curb	2½	2¼	2¼	Aug. '21, Q	.05
Consol. M. & S.	Montreal	15	15	15	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†2.40	†1.25	....	July '20, Q	.10
Daly-West	Boston	†3½	†2	2¾	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb			2	Apr. '21, K	.05
Electric Point	Spokane	†*8½	†*6½		May '20, SA	03
Eureka-Croesus	N. Y. Curb	*36	*24	*29		
Federal M. & S.	New York	†9	†5½	7	Jan. '09,	1.50
Federal M. & S. pfd	New York	22	21½	22	June '21, Q	1.00
Florence Silver	Spokane	‡	....	*11	Apr. '19,	.01½
Grand Central	Salt Lake	†*25	†*12½		June '20, K	.03
Hecla Mining	N. Y. Curb	4¼	3 15/16	4	June '21, Q	.08
Iron Blossom Con.	N. Y. Curb	*18	*18	*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†3.25			Sept. '20, Q	12½
Marsh Mines	N. Y. Curb			*3	June '21, I	.02
Prince Consol	Salt Lake	*22	*22	*22	Nov. '17,	.02½
Rambler-Cariboo	Spokane	†*5	†*3	3½	Feb. '19,	.01
Rex Consol	N. Y. Curb	*8	*7	7		
South Hecla	Salt Lake	†*38	†*35	20½	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb		..	*10	Oct. '17,	.05
Stewart Mining	N. Y. Curb	*5	*3	*5	Dec. '15	.05
Tamarack-Custer	Spokane	‡	..	1.80	Jan. '21, K	.04
Tintic Standard	Salt Lake	2.22½	2.15	2.15	July '21, Q	.05
Utah Apex	Boston	2¼	1¾	2¼	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	..	....	*2	Nov. '17,	.01
		VANADIUM				
Vanadium Corp.	New York	28	26¼	27½	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	...		47	July '21, Q	1.50
Asbestos Corp., pfd.	Montreal	....	†71	73½	July '21, Q	1.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	34½	33¼	34½	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	70½	70½	70½	June '21, Q	1.75
Am. Sm. pf A	New York	†69	†63	67½	July '21, Q	1.50
U. S. Sm. R. & M.	Boston	29½	29	29	Jan. '21, Q	.50
U. S. Sm. R. & M. pf	Boston	38½	37½	37½	July '21, Q	.87½

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
F. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
Associate Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
[illegible]
Consulting Editors

Volume 112 New York, September 3, 1921 *Number* 10

The Progress of Rock Drill Bits

DURING THE LAST several years a number of important articles have been contributed to the technical and Institute publications on the subject of rock drill bits and drill steel. Probably the most important principle described is exemplified by the double-tapered rock drill bits. The Carr bit was, according to an expert with whom we had the pleasure of discussing the subject, the first bit in which the double-taper principle was utilized. Although incorporated in the design of the bit and made use of, its importance was probably not recognized for some time.

Briefly, the double-taper bit is a cross-bit with all of the cutting edges lying in one plane and the wings brought back from the cutting edges within a conical surface, making an angle with the axis of the drill varying from a minimum of 5 deg. to a maximum of 7 deg. This conical surface is brought back from the cutting edges for a distance of ⅜ in., and from this point the wings fall within a 14-deg. cone to the drill steel. The result is that a bit is produced which has excellent reaming qualities and which permits, in many instances, a change from the customary ⅛-in. to a $\frac{1}{16}$-in. reduction in diameter for follower bits. It is thus possible to diminish the size of starting bits, with the result that there is a perceptible gain in drilling speed and a smaller total of energy required in overcoming the cohesion of the rock particles, as a smaller volume of rock is removed in drilling a hole of given depth. Manufacturers of drill-sharpening appliances have been chiefly responsible for the double-taper cross-bit, and the necessary appliances for its convenient manufacture at mines have been pretty thoroughly developed.

One company has pioneered a step further and developed what is termed a "double-arc" bit. This is similar in principle to the double-taper cross-bit, with the difference that the cutting edges are curved in the form of two arcs connected by a short bridge at the center. This bit has been tried out and has been found to give excellent results. According to our information, it has not been patented and has been given freely to the mining industry. There are thus available, in addition to the Carr bit, two well-developed rock drill bits, the cross-bit and the double-arc bit, both of the double-taper design. The Carr bit is, both in speed of drilling and stamina, as satisfactory for hard rock drilling as the cross-bit and double-arc bit. It is, however, harder to make and to maintain. Of the three bits, probably no one has special advantage in drilling as compared with the others. The double-taper cross-bit is the most used, principally because it is easy to form and maintain. It is important, however, to bear in mind in any discussion on rock drill bits that there is no *best* type of bit for *all kinds of rock*.

The significant features in modern rock drill bits have been described in the *Journal* and elsewhere, but the mining industries have been slow to take full advantage of the splendid work done for their benefit. There has been prompt acceptance of drilling machines of different types, but apparently only a small proportion of the total number of mining companies have taken advantage of the double-taper cross-bit and double-arc bit.

We can understand how efficient salesmanship can keep the mechanical drilling equipment up to the minute. The same force has contributed to the mechanicalizing of the drill-sharpening shop. Drill sharpeners and oil furnaces are now conspicuously employed. By their help a conscientious blacksmith can turn out bits conforming to accurate sizes and shapes. The technique has been well worked out, but how thoroughly does mining practice take advantage of the facilities thus afforded?

From our limited inquiry it would appear that the more progressive companies are keenly alive to the economies resulting from utilizing to the fullest measure proper mechanical upkeep of drilling machines, thorough lubrication by means of carefully selected lubricants, and the use of the best grades of drill steel accurately sharpened and hardened. We do not believe that the rank and file have, on the other hand, realized fully the economic advantage of doing this. Standards can be worked out for small as well as for larger organizations.

The economy resulting from consistent study of details of mining is in the aggregate large. Isolation and excessive conservatism are probably in a measure responsible for the slowness to take advantage of the progress that is being made. These can, however, be overcome by consistent study of technical publications and by visiting mining districts where variations in mining practice can be observed.

Offending Latin Americans

THERE IS A PROVINCIALISM which exhibits itself in a racial or sectional bitterness and depreciation of one people by another. We find it rampant in Europe, whether in Germany, France or England—a narrow snobbery that reminds one of the horizons of our childhood. Some Americans who are familiar with Latin-American countries complain that a certain type of superficial Americans, writers and otherwise, make patronizing statements concerning South America which have not even the merit of being true, to say nothing of being courteous. We have before us a letter from such a man who speaks [illegible] an article in the Century *Magazine* criticizing the City of Santiago, Chile. Concerning this he says:

"It is time that our Government took steps to discourage this kind of advertising for the U. S. A. There are a lot of people in the United States with nothing above their shoulders who are continually making derogatory statements about the Latin-American countries which a few of us who are living here are trying to show these people we are right, and endeavoring to promote better relations between the two countries.

"A great many of the statements in the article mentioned are greatly exaggerated, and the entire article is productive of no good whatever. It says the streets of Santiago resemble White Chapel, London; this is plain libel, the streets of Santiago compare in cleanliness very favorably with the streets of many of our large cities in the United States. It says the streets are badly paved; this is true in a few cases, but generally speaking the streets of Santiago compare very favorably with cities of like size in the United States. It says the Cerro Santa Lucia is the only place worthy of notice; this is indeed far from the truth, the interior of many of the churches are beautiful and some of the homes, with their enclosed patios, are well worth visiting. The Alameda, with its Sunday parade of well-dressed and comely señoritas, should be seen by every foreigner, and so one might go on describing features without number that are of much interest in the city of Santiago; and last but not least is the climate, excelling without fear of successful contradiction our own California. Tell the United States to call off their dogs. That kind of twaddle nauseates those of us who know."

Certainly we should be courteous in our designations of people and places. Nothing hurts personal and local pride so much as patronizing and slighting characterization; nothing makes for such ill-feeling in the end. It is sometimes difficult to subdue the irritation caused by foreign mannerisms, and if there is to be criticism, it will make toward better mutual understanding to seek the good and worthy which may be found everywhere, and to point that out equally with a kindly and generous appraisal of shortcomings.

Interest in the Comstock Revives

THE EXPENDITURE of a relatively large sum by the United Comstock Mines Co. at Gold Hill, Nev., in operations preliminary to the mining of a developed orebody (unmined ore and stope fills) approximating 2,250,000 tons of low-grade ore and stated to average between $5 and $6 per ton, is responsible for a new interest in the Comstock district. This well-known and historic mining district has contributed a comparatively small annual production during the last twenty years, amounting to less than $15,000,000.

Beginning in 1898, efforts were made to recover the levels below the Sutro tunnel. A number of companies co-operated, and the work of unwatering was concentrated at the C. & C. shaft and the Ward shaft. The latter was finally abandoned, and at the North End mines the 2,900 level was eventually recovered. Orebodies were discovered and worked in the Union, Mexican, Ophir, and Con. Virginia. These contributed a substantial quota to the production.

At present, the lower levels, up to the 2,250, on the North End group have been abandoned, and work at these mines has been restricted to following the minor fissures to their intersection with the main fissure. The old bonanza stopes on the Sutro tunnel level are also being reopened. A promising lead is being prospected in the Savage mine at the same level. A modest tonnage is being mined in the Chollar and Potosi, but the operations are not deeper than the 350 level. On the Gold Hill group the workings of the United Comstock Mines Co. extend to a depth of about 600 ft.

The present activity at Gold Hill succeeds a period during which efforts were made to work the levels below the Sutro tunnel in Yellow Jacket, Crown Point, and Belcher ground. These efforts were partly successful, but were discontinued after a fire. The working of waste dump and old stope fills continued, but was probably unprofitable. Stories about large tonnages of low-grade ores in the area north of and adjoining the three mines mentioned were current, but no mining was done to check them up. Alex Wise saw an opportunity here and proceeded to get financial assistance. The result of his and Herbert Humphries' preliminary work was the development of a low-grade orebody close to surface in the midst of the old workings. This proved sufficiently attractive to secure the capital necessary for large-scale operation. Thus vision, nerve, capital overcame inertia and vitalized this almost dormant area.

It is of great interest that the portion of the Comstock lode near the surface still contains such a large tonnage of ore that will probably yield a profit when worked under modern conditions. The deeper levels have been studied long ago. There is still a large portion of the lode contiguous to the Sutro tunnel level that challenges the engineer to more thorough work in prospecting. At depth, on the North End, the possibility of discovering new ore, except near old worked-out bonanzas, is seemingly remote.

An area characterized by strong persistent fissures and widespread mineralization is worth repeated investigation by experienced mining men, even though it may appear to have been completely exhausted. Not only should the usual conditions be studied, but the facilities, training, and results obtained by previous operators should also be subjected to close scrutiny. Only by so doing can the possibilities of apparently worked-out mines be visualized. That there are occasionally excellent mining potentialities in old mining districts is proved by the example of Gold Hill and by other instances in the experience of many engineers.

Catching the Wicked Smelter Trust Red-Handed: Foiled Again

TO BE VICTIMIZED, mulcted, deceived, duped, cheated, fleeced, tricked, gulled, cozened, defrauded, hoodwinked, and in other ways man-handled by "The Smelter Trust," whatever that may be, is the cherished prerogative of every independent miner. It is human nature to blame someone else when something happens that we do not like, and ore buyers and smelters are the logical target when a man who owns or operates a small property finds that he is not making a good living. Doubtless he in turn makes things warm for the laborers working for him, and also the Government fastens high taxes and unwelcome laws on the "trusts." As De Morgan rhymed it:

"Great fleas have little fleas upon their backs to bite 'em,
And little fleas have lesser fleas, and so *ad infinitum.*"

Of course, being near Wall Street (about three miles away), we suffer from propinquity; at least they say we do, and so cannot give the wails of the small operators the sympathetic consideration which is their due. Nevertheless, when one of them recently complained to us that he was being unduly penalized for a certain constituent in his ore, that he was being unjustly discriminated against by a certain smelter and could not ship to another which did not discriminate and penalize because the freight rate was just a little too high, our dander was up. The crooks shall be exposed, we vowed, if it brings down upon us the wrath of the mighty.

We had all the data—settlement sheets and all—and had the letter of protest all edited ready to go to the composing room, when it occurred to us to see from the settlement sheet just where the penalty came in, and just how it was that this down-trodden lessee had been mulcted of one hundred dollars, as he affirmed. We considered ourselves fairly familiar with settlement sheets, but we were unable to find out just where the cause of complaint came in, so we wrote for further particulars. This brought the following letter:

> "My agent wrote me in regard to the shipment of chloride ore and told me that it was a nice batch of ore, but that the chloride played hob with it and that I should send such ore as that to ———, where they pay no attention to the chloride. That if I had sent that shipment to ——— that I would have received one hundred dollars more for it than what the ——— smelters allowed me. When the superintendent here gave me my settlement and check I paid no attention to it but took it for granted that I had been penalized for a hundred wheels. Recently I sent to you the final settlement sheet for that shipment of ore, and no doubt but what you are right in that I was paid for the full amount instead of for 34 oz. of silver as I supposed. Personally I pay but little attention to accounts; I get the ore and leave all else to another. Perhaps our genial Supt. stretched a string and paid me in full for what the ore assayed and I did not notice it, a thing that perhaps the smelters would not have done. At any rate, I will be more careful in future before I try to break into print and I thank you for saving me from deeper shame than what you did save me. I hope this explanation will be satisfactory to you."

So there was nothing we could do after all, and in future if any one has a kick to register we hope that he will make sure of his facts first.

A View Concerning the Licensing of A Business Man

GOVERNMENTAL REGULATION is the panacea of the day. Soon we shall be Prussianized and shall have it determined where we shall live, what we shall have for breakfast, and whom we shall marry. Every one will be tagged, and either pup or master will be fined if caught without his license, which (in the case of master) enables him to work as a lawyer, an engineer, a shoe-shiner, or a parlor ornament. The *Iron Age* in July published an article by a successful business man, Mr. Alvan T. Simonds, a manufacturer of saws and knives, proposing that no man should be allowed to engage in important business without examination and securing a license, just as lawyers and doctors must do.

A subsequent writer in the same publication, Mr. Sterling H. Bunnell, the head of a firm of consulting engineers, however, points out regarding lawyers, doctors, and the like, that "the examinations, or investigations required prior to the granting of such licenses are not intended to determine whether the applicant will be successful in his own affairs, but only whether he possesses sufficient knowledge to avoid conspicuous errors likely to lead to accidents or danger to himself or others."

It is impossible to judge a man from an examination, Mr. Bunnell points out. "No mere examination can determine whether a man who has studied navigation and sailed the seas for years has in him the necessary qualities for a successful captain."

"All life activity is the result of individual initiative. The successful man is he who is able to create an idea, give it shape and form, and carry it out to a useful result. The qualities of success are often found in men totally ignorant of economic laws; yesterday keeping a small news-stand, today operating a large organization; yesterday carrying a hod, today building and owning a block of houses."

As a result of his analysis, the writer concludes with trenchant wisdom:

"At the present time, however, the civilized world appears thoroughly convinced that governmental interference with a man's right to practice his business in the best way he knows how is the most unfortunate experiment a nation can make."

Sulphur on the Spanish Main

MR. WALDEMAR LINDGREN sends us from the South an article in the *Panama Star and Herald* of Aug. 1, under the head of "West India News." News it is: it is along the lines of discussing popularly geological phenomena, which we have frequently advocated. The language of the article is mellifluous and erudite, and if there is any scientific term hovering anywhere near the subject, the author promptly reduces it to captivity and includes it in his glittering pageant. We should like to quote for the information of our readers, but it is hard to find the beginning and the ending, and the following bearing on the origin of the sulphur will be enjoyed by all:

> "The geologic mind readily understands that where these mineral agencies have combined for the creation of physiographic configuration and other physical features, there is every likelihood for the existence, in tropical regions, of such mineral and chemical concomitants. In this particular phase, we have sulphur and chalybeate deposits with their accompanying hot springs, known as *eaux bouillants*, all over the island. In the Parish of St. Andrew's, where this incident occurred, there is a large number of them, and perhaps more than may be found anywhere else in the country. Generally, where the locality is dry, and until rain or other moisture disturbs the elasticity of the latent sulphuroids, there may be no spectacular demonstration of the vitriolic atoms or the more elaborate display and distension of gaseous ignition. As soon as rain falls in these regions, there is the presence of the pungent odor which betrays the existence of sulphurous mineral matter, and cloudy fumes envelop the surroundings, while in some places evidence of some mineral remains may be seen in the shade of the volatile matter which the ebullitionary temperature of the spring may throw out upon the edges of the miniature geyser."

The author pauses for a moment to discuss a point in technical English concerning which he is meticulous —phenomenon vs. phenomena—and then returns to put some finishing touches on the theory of the origin of sulphur:

> "The designation *phenomenon*, in connection with this incident, is scientifically and dynamically incorrect. In these electrical discharges which combine with other mineral and chemical agencies, the activity and value are practically the *phenomena* of electrical forces. The question may arise as to whether electricity exclusively and absolutely, or originally and conductively, caused the disturbance or originated the electric movement of the galvanic [illegible]. The sulphuric acid has a very aggressive tendency toward other gases and [illegible] [illegible], the atmosphere with its oxygen and other [illegible] may harmoniously [illegible] until the [illegible] [illegible] travelling in space in a [illegible] and accelerated [illegible] impregnate the sulphurous [illegible] at a radius which must create an impact, or ignite the volatile fluid [illegible] in the ether."

At any rate, we imagine, as Mr. Lindgren did, that this is a theory of the origin of sulphur. We may as well give the boy a name. But as we peruse this we wonder if the Panamans would be worse off if they were not enlightened thus scientifically as to natural mysteries.

WHAT OTHERS THINK

Fair Play for the Graphite Industry

I have noted during the last year various articles and items in *Engineering and Mining Journal* dealing with graphite production and tariff requested by American producers. Some of the information given is inaccurate, although the generalized data are substantially correct, but in my opinion the net result of the publications does not give a fair idea of the industry.

As a premise I may state that our company (The Ceylon Company) started operations in January, 1917, and, under the able management of Floyd Weed, remained in continuous twenty-four hours a day operation until Christmas, 1920. During the years 1917 to 1919 inclusive we produced 23 per cent of the Alabama graphite in tonnage and 21½ per cent in value, and of the total United States crystalline graphite 13 per cent in tonnage and 13 per cent in value. The United States figures for 1920 are not available, but our percentages for that year are decidedly higher than the above figures. We were the first to use oil flotation on graphite in the United States, although I discovered after negotiating process rights that oil flotation had been previously used in Austria. We were the first to use ball mills for wet grinding of graphite ore, and in fact were the pioneers in present-day graphite ore milling. I mention these facts to indicate that our knowledge of the business, both from an economic and scientific standpoint, is not academic.

There is no question that we have had lower costs and greater profits than any graphite plant in the United States with the possible exception of one New York plant, and yet it is questionable, in view of Federal and state taxes and the present situation, whether our stockholders will ever get their original investment back. If personal income tax is taken into account, it is certain that some will not get back 60c. on the dollar on their investment unless some protection is afforded against foreign competition.

I am thoroughly familiar with the conditions and possibilities of other graphite districts in the United States, and there is not one graphite plant in this country which by improved mining or milling methods or better production or selling means can in normal times meet the open competition of Madagascar graphite with its high-grade ore and cheap labor, not to mention the present exchange situation. If a protective tariff is a sound policy, there is not a mineral industry in this country which is more clearly entitled to protection, in view of this country's exceedingly large reserves of graphite ore, the character of the foreign competition, and the necessity of the product as a war mineral.

Protective tariff as an economic issue is good doctrine to some and bad to others, but the industry is certainly entitled to a fair presentation of the facts. We are not begging for a helping hand, and in our particular case we are preparing to utilize our trained organization in other lines not so bitterly competitive, but we are certainly entitled to fair play and an equal chance with other industries in a similar or less unfavorable position if a protective tariff policy is adopted.

Birmingham, Ala. E. E. ELLIS.

The "Freedom" of "The Press"

Please allow me to congratulate you on your ready ability to put your finger on a sore spot. Your editorial on "The Triumphs of Journalism" in the issue of Aug. 20, touches a peculiarly sore spot.

I might change "sore" to calloused, so far as journalism is concerned, for in spite of frequent and inexcusable errors, even leading dailies, weeklies, and monthlies still insist that "The Press" is the greatest public educator—"the poor man's university." Yet it goes calmly on making inexcusable errors in its news items and even in its more formal papers.

Every position of leadership should carry an equal degree of responsibility. "Print," even today, exerts a tremendous influence over the well and even the liberally educated. "If you see it in the *Sun*, it's so" is fairly indicative of the attitude of the general reader as well as self-complacency of "The Press." This means, or should mean, a sobering influence on the part of "The Press." It is conspicuous by its absence.

Mistakes are bound to occur, errors are unavoidable, but either mistakes or errors that are obviously avoidable should not be allowed. A new and well-tested hoisting rope may break even under a "safe" load. Personal injury or death may follow. But the mine manager who ignores a "frayed" rope is criminally negligent.

Your remedy is obvious and practical. I have often wondered why editors have not employed engineers on their staffs or at least submitted items which are out of their lines to technical men. Even an encyclopedia would help in many cases.

"The Press" claims to be a public educator. But what is the advantage of being educated in things that "aint so"?

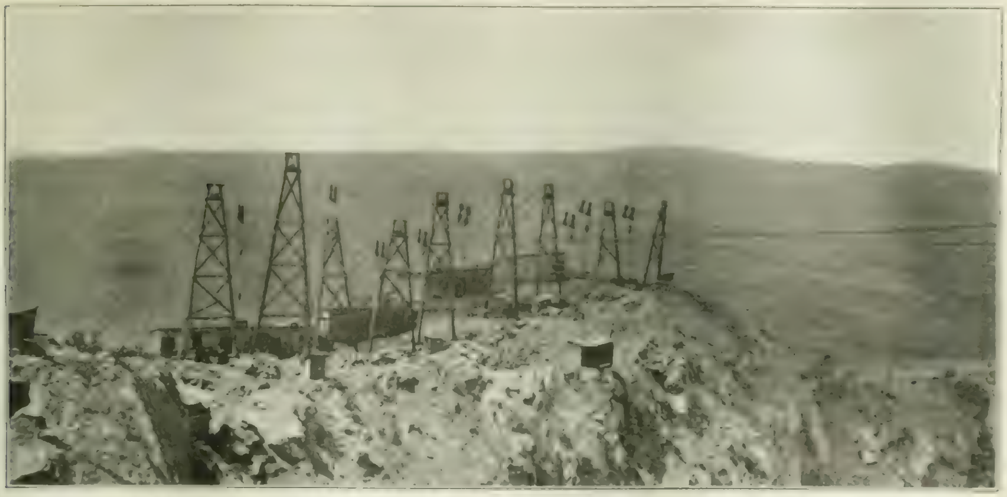
A daily paper may be excused from many casual errors owing to the haste of getting out daily editions on time. Monthlies and weeklies, however, have no such excuse. They have time to prepare and to exercise due precautions. Yet in the staid *Outlook* of May 25, an inexcusable error occurs. In an editorial on "The Discoverer of Radium" is this statement: "Intricate and innumerable experiments with radio-active substances led to the logical conclusion that *hornblende* must contain one radio-active element totally unknown."

This story is related of a celebrated French lexicographer. He defined a crab as a "fish that walks backwards." Descartes, on being asked if the definition was correct, replied that with two exceptions it was. "In the first place, a crab isn't a fish; in the second place, it doesn't walk backwards."

In one of New York's most aged and dignified magazines, several years ago appeared an article on some unpublished notes of our Mexican war. In one of General Scott's battles on his way from Vera Cruz to Pueblo, he sent a division of cavalry to silence the enemy's annoying battery. The description of the charge was exciting to the last degree. The gallant troopers charged up a slope of 45 deg., evidently unconscious that they had achieved the impossible. No mention was made of the effect of depressing the guns to an angle of 45 deg. With no effort at all I can recall very many instances of a similar nature.

If a manufacturer vaunts the superiority of his wares and then habitually sends out defective mechanisms he is called a fraud and is treated accordingly. Why should not "The Press" be treated in the same way?

West Haven, Conn. FRANK L. NASON.



NO. 4 PIT OF BLACK LAKE ASBESTOS & CHROME CO. END TOWERS OF CABLE DERRICKS. SHELTERS ON SIDE OF PIT ARE FOR SIGNAL BOYS

The Black Lake Asbestos Area

District Rich in Chrysotile Asbestos Deposited in Serpentine—Open-Pit Mining Using Derricks and Cables Is the Usual Practice—Much Labor Required—Welfare Work Not General

By Wyant D. Hubbard

Written for Engineering and Mining Journal

ASBESTOS of the chrysotile variety is mined in Canada in three main districts, the Danville, the Thetford-Black Lake, and the Broughton areas. As I have studied the occurrences in the Black Lake area, this article will be confined to a description of the geology and mining there.

Attention was first called to the serpentine of eastern Quebec by Sir William Logan in 1863.[1] His careful report was published in the "Geology of Canada," together with a series of mineralogical and lithological examinations by T. Sterry Hunt. The conclusion reached was that the serpentines were altered sediments derived from magnesian limestone, but Dr. F. D. Adams in 1882 showed unmistakably that these serpentines were altered igneous and not sedimentary rocks, as had been supposed. Since that time scattered reports and articles have been published concerning the asbestos- and chrome-bearing rocks of Quebec.

The asbestos-bearing serpentine belt of the Eastern Township of Quebec forms part of a series of basic igneous rocks which extends from Vermont through Quebec to the Gaspe Peninsula. These rocks are intrusive through sediments of Palæozoic age, mainly strata of Devonian and lower Ordovician time. In areas to the south, strata of Devonian and Silurian age are thought to be intruded by igneous rocks of this serpentine belt. The intrusive are therefore chiefly of Post-Ordovician time, and the evidence seems to indicate that they were intruded during the great igneous activity in the Devonian uplift in the northern Appalachian region.

The country underlain by the serpentine belt forms a range of subdued hills which have a distinctive relief. Abrupt profiles and steep faces are characteristics, due to the different rates of erosion of the various rocks composing this series. The range lies on the southeast side of the Sulton hills northeast of Sherbrooke, the main city of importance in southern Quebec.

ASBESTOS OCCURS IN SERPENTINE

The economically important rock is, of course, that which carries the asbestos form of serpentine. Two phases of this are recognized, the Thetford and Broughton. The country rock of the Thetford phase is a peridotite in places so rich in olivone as to become a dunite. The serpentine is found as narrow bands along fissures and cracks in peridotite. The asbestos occurs in the center of the serpentine bands and constitutes, roughly, one-sixth of the whole.

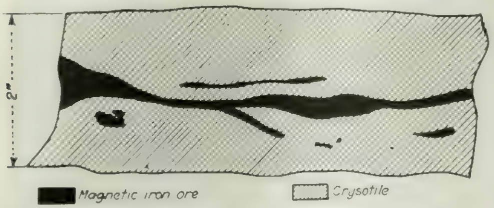
The cracks and fissures developed because of dynamic or other deformation, and are often found in a nearly rectangular arrangement. Smaller veins of minor importance have developed along lines normal to pressure exerted upon the peridotite and some in cracks due to the disintegration of the rock.

The asbestos of chrysotile variety of serpentine has developed in situ. Generally the mode of formation has probably been as follows: The original intrusive peridotite has been fractured, the fractures serving as channels for water, the principal agent in changing the peridotite to serpentine. A chrysotile is practically identical in chemical composition with serpentine. It is not probable that its composing minerals were brought either from above or below by water. Rather, the chrysotile represents crystallized portions of the inclosing walls of serpentine, the crystals or fibers having grown outward from the center of the original crevice, which is now represented by a core of iron ore found in the center of most veins of asbestos. Small veins which show no such core probably grew from one side of the wall only.

---

[1] [illegible] Memoir [illegible]

The changes necessary to convert peridotite to serpentine are essentially a loss of iron and an addition of water, and it is evident that two sources of water are possible, magmatic and meteoric. As by far the greater part of asbestos occurs along joints and strain fractures, magmatic water is thought to be mainly responsible for this alteration.



SKETCH OF ASBESTOS VEIN, SHOWING CENTRAL CORE OF IRON ORE

The Thetford type of asbestos deposit is found in segregations of the peridotite country rock which is rich in olivene. These segregations are found near the base of intrusive sills and in the central parts of stocks. Granite in masses and dikes has been intruded into the peridotite and serpentine, accounting possibly for the necessary pressure and heated water to alter peridotite to serpentine and chrysotile. The granitic intrusions are valuable aids in locating asbestos deposits.

DEPOSITS MAY EXTEND TO GREAT DEPTHS

The origin and structure of the asbestos deposits of the Thetford phase as outlined above may be summed up as follows: (1) The asbestos-bearing serpentine occurs in peridotite rock rich in olivene; (2) the most favorable occurrence of such rock is near the base of sills and in the center of stocks; (3) the waters which produced the alterations of peridotite to serpentine and to chrysotile probably were magmatic. This indicates that the deposits probably extend to great depths, and therefore mining can continue until the limits of profitable extraction have been reached.

The Black Lake area is roughly four miles long by two wide and adjoins the Thetford area on the northeast end. Active mining is confined largely to a hill high above the town, and it is on this hill that the four main companies are at present operating.

With the exception of one company, all mining is of the open-pit type, and operations are in general rather crude and inefficient. The pits are not large, 500 x 300 ft. probably being the size of the largest. Rock is raised by cable derricks and transported to the mill in small wooden cars, drawn, in one mine, by steam locomotives, and in the others by electricity.

The most important mine in Black Lake is the Amalgamated Asbestos Corporation. It is also the most progressive. Besides mining by the open-pit method, a tunnel is being driven toward two of the company's most distant pits, presumably to connect the pits with the mill, so that ore can be handled continuously regardless of weather conditions. As the tunnel runs under the present pits, the rock will probably be glory-holed into hoppers above the tunnel, loaded into cars and hauled to the mill by electric locomotives. The main object of this tunnel is evidently to cut down the heavy expense of snow shoveling in winter, estimated to amount to nearly one hundred dollars a day.

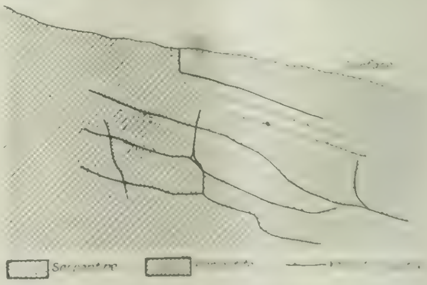
BLACK LAKE A TYPICAL PRODUCER

The Black Lake Asbestos & Chrome Co. is the second largest mine. As it is one of the oldest operators and is typical in many respects of the mining as practised in the district, a detailed description will be of interest.

Mine and mill are situated near the top of a serpentine ridge nearly 400 ft. vertically above a railroad. A dirt road about a mile long, with one extremely steep grade, serves for transportation of asbestos and supplies. In wet weather this road is a veritable sea of mud, due to the churning action of the wheels of heavily loaded teams. Pits are sunk in the side of the hill above and not far distant from the mill. The largest of these, No. 9, is about 150 ft. deep by 500 ft. long by 200 ft. wide. The entrance is 300 yd. from the mill hoppers.

The mill itself stands on a level about sixty feet below the bottoms of the deepest pits. It is rated at 850 tons' daily capacity and is supplied from bins built below the tracks leading from the various pits. The primary bin will hold about 350 tons. A machine shop stands above and to the west of the mill, the tracks from the pits leading directly into it. Practically all the local repair work of the mine is performed in it.

Operations in the pit are about as follows: The rock is drilled by tripod drills, holes averaging about twelve feet deep. These holes are spaced about eight feet apart and twelve feet from the wall, breaking the rock in benches. Large chunks too small to be hoisted separately are blockholed with plugger drills. None of the drills require water, as the rock is comparatively soft. Broken rock is hoisted by nine cable derricks, the reason for this large number of hoists being that, although a cable derrick is almost unlimited in longitudinal reach, it is decidedly limited laterally. Hence to cover the whole pit efficiently many derricks are used. Each derrick has a separate electrical hoist, which means that there are nine hoistmen. These hoists are situated back from the edge of the pit, and consequently the hoistman cannot see when to raise and lower his boxes. This necessitates having men stationed at the pit edge to signal the hoistmen. One signaler is sufficient for two derricks and one man dumps the boxes



SKETCH OF PIT FACE, SHOWING ARRANGEMENT OF ASBESTOS VEIN from two derricks. Three to four men are employed shoveling rock into the boxes. Three boxes are used with each derrick, enabling each hoistman to complete between ninety and one hundred loaded trips per ten-hour day. The boxes hold a ton and a half, and three of them fill a car.

As the cable derricks cannot cover the whole pit without an almost impossible network of cables, a steam crane is used to pick up boxes in places outside of the cables' reach. This crane runs on a track about twelve inches wider gage than the ore trains, which necessitates an extra rail coming into the pit. It also limits the usefulness of the crane, because new track has constantly to be laid.

MANY WORKMEN NEEDED

It can be seen from the above that the minimum number of men working in the pit under normal conditions would be distributed as follows: Number of hoistmen, 9; number of signalers, 4; number of dumpers, 4; number of loaders (3 to each derrick) 27, a total of 44, not including trip-riders, cranemen, bosses, or engineers.

The hoist motors for each derrick are electric and are rated at fifty horsepower. The horsepower of the crane is not known, but it must be at least seventy-five. This gives a total of 525 hp.

It would seem that two electric shovels could reduce costs and speed up operations to a marked degree. H. W. Rogers has shown conclusively that electric shovels operating on direct current will always be cheaper than steam shovels of the same capacity when labor, available capital, interest and amortization are taken into consideration. Two small shovels would probably be more satisfactory than one large one, because while one is moved away from a face for safety in blasting the other that will continue work. Marsh's admirable book on "Steam-shovel mining"[1] gives comparative costs of steam, oil, and electric shovels. Much less labor is required in the operation of mechanical shovels than in the operation of the lines and boxes.

An item of importance which could be improved without great expense is the haulage equipment. Steam locomotives are generally known to be one of the most inefficient of steam engines, and yet steam locomotives are used in this operation, for which coal must be hauled at a cost of approximately $4 a ton. Electric engines using a trolley would seem far more efficient in the long hauls from the pit and out on the dump. A storage battery locomotive could be used for shunting in the pit, although extreme cold might affect its usefulness.

LOOKING UP TOWARD BLACK LAKE [illegible] OF PIT IN [illegible]

As the working pits are all considerably above the mill, a system of gravity haulage could be arranged without undue expenditure. Inclined tunnels driven from mill bins to the bottom of the pit floors would not only save haulage distance but would do away with trouble about snow shoveling in winter. It is to curtail just this expense that the Amalgamated Asbestos Corporation is driving its tunnel.

The question of how to supply a property cheaply in the elevated location of the Black Lake mine is difficult of solution. To haul coal and heavy machinery up a road rising 400 ft. in a mile is costly and uneconomical. The average load of coal which a two-horse team can pull up the hill is 1,700 lb. The teams are required to make only four trips a day, and are paid $9, which means that it costs approximately $4 to haul a ton of coal up the hill. The transportation of heavy machinery would cost even more.

[illegible]

---

[1] "Steam-Shovel Mining," by Robert Marsh, Jr. McGraw-Hill Book Co., 1920.

A few teams are kept by the mine, but as the mine owns no storage shed near the railroad tracks, additional teams are necessary when a large shipment of machinery or coal arrives, or when a shipment of asbestos must be hauled down hill.

An aerial tramway running gfrom the mill straight down to a special siding with storage sheds would help to cut down expense. Asbestos and repairs leaving the mill could be run down without the use of any power.

The Johnston mine, situated halfway between the Amalgamated and the Black Lake mines, is not operating at present, but is reported to contain the richest deposit of this area.

A new mine, that of the Asbestos Crude & Fibre Corporation, is being opened on top of the hill near the Black Lake Asbestos Co. A 100-ton mill has been erected and a pit started, but the recent drop in the asbestos market has caused work to be stopped. From all indications the methods to be used will be similar to those employed elsewhere. A steam boom-derrick is to be used to operate the pit, and other power machinery is to be electric.

NO. 6 PIT OF BLACK LAKE ASBESTOS & CHROME CO VEINS OF SERPENTINE SHOWING IN BENCH FACE CABLES OF DERRICKS IN UPPER PART

Canada now enjoys a monopoly of the asbestos market, and this probably accounts for some of the inefficiency which would otherwise condemn the business. Hauling coal up a grade with a rise of 400 ft. to the mile, employing a larger number of men than necessary, and unnecessarily shoveling heavy snow in winter could not keep mines operating on a paying basis if no monopoly existed. This seems the more inexcusable when one considers that motor trucks, aerial or gravity haulage, and electric power are all available.

Such inefficiency indicates lack of foresight on the part of the management, particularly in the face of growing competition from other parts of the world. A South African engineer of note who made a report on one of the properties here made the uncomplimentary remark that farming was more suited to the men than mining. He was probably thinking that the large asbestos deposits of Africa, Russia, New Zealand, Australia, and the United States would soon furnish keen competition for Canada. One wonders how long it will be before most managers will recognize that changes making for a higher efficiency are needed.

Labor conditions are unsatisfactory. The average French-Canadian laborer is slow and not capable of rising much above the mucker stage. These men supply the bulk of the labor. The rest are Czechs, Russians, Austrians, and Italians, the last named being by far the most efficient workmen. Because of the autocratic labor policy of the management, the men have a low morale. By this I mean that the men are not encouraged to keep themselves and their living quarters clean, even when they occupy company houses; no incentive, such as a bonus, is provided to encourage a more efficient and higher standard of work. No amusements other than a high-priced moving-picture show and an occasional ball game are at hand, with the result that the younger element in the town is not on as high a standard as it might be. Because Quebec does not have compulsory education, many boys who should be at school are employed as hoisting signalers and general errand boys, when not running the streets.

For some time I worked with this type of workman, and many of their remarks showed that they were anything but favorable to this state of affairs. "We do everything two times, three times over; waste money; no good practice. Why not right first time?" is a remark often heard. Another: "If only I had learning and could speak English good I could be a manager." Would not a little help to such men result in a large gain to the mines?

It is generally recognized now that ten hours is too long a shift. In Black Lake the ten-hour shift is still in force, and for this the men receive 32½c. an hour. Before the recent cut it was only 40c. When one considers that many of the men have to climb a steep hill for over a mile to get to work, it is not surprising that at the most only about eight hours of work is done.

I recently talked with one of the leading managers, and he heartily condemned all laborers as ungrateful. When I suggested better houses, educated mine doctors, a well-conducted hospital and better hours and pay he laughed, and said the men would not appreciate such things—that they would abuse them. It is a recognized fact, however, that a clean, self-respecting man makes a reliant, efficient, and alert workman; the type of man conspicuous for his absence in this district.

On the whole, the Black Lake mining district can be summed up as potentially rich because of its inexhaustible ore reserves and its firmly established place in the asbestos market, but practically poor because of inefficient labor.

Preliminary Roughing Concentration by Sorting, Jigging, and Tabling—Part II*

A Diagrammatical Representation of the Principles Underlying The Separation of Grains of Various Sizes and Specific Gravities in Jigs Automatic Discharge Devices and Why They Are Not Perfect

BY EDWARD S. WIARD
[illegible] Engineering and Mining Journal

THE ORDINARY FORMULA which governs separations by jigging in water is the free-fall formula of the form $V = F[D(s - 1)]^{\frac{1}{2}}$. F is a constant whose value depends upon whether the answer for the velocity, V, of a body falling freely in water is desired in feet, meters, inches, or other units; and whether the diameter of the falling particle, D, is to be in feet, meters, inches, or other units, the velocity desired either being in the same unit as the diameter, or in some other unit. The velocity fall depends upon diameter and specific gravity, the greater the diameter the greater the velocity; and the greater the specific gravity, the greater the rate of fall. When jigging under the free-settling formula, the sizes at which a smaller grain of superior specific gravity will have equal settling velocity with lighter gangue grains determine the extreme ranges of size at which pairs of any two minerals can be jigged and the grain of superior specific gravity separated.

Eliminating the square root and the constant, F, there remains, as the equation of equal settling, $D(s - 1) = D'(s' - 1)$, D and s being the diameter and specific gravity respectively for the large grain of low specific gravity, and D' and s' the diameter and specific gravity respectively of the small heavy grain. By substituting the proper specific gravities, the ratio of D' to D, or the free settling or screen ratio, is obtained. Rittinger's free-settling ratio of 4.01 for galena to quartz is obtained by substituting 2.67 for the specific gravity of quartz and 7.7 for the specific gravity of galena, and means that a grain of galena of any given size will, in jigging, separate with a quartz grain the diameter of which is less than 4.01 times that of the galena grain. The smaller such quartz grains are, within the limit imposed by the ratio, the more quickly will separation take place. The *difference* in the velocities of fall for any two fragments of different size and specific gravity is a measure of the rate at which they can be fed to a Harz jig of given size.

Richards, by his experimental jigging work, increased the free-settling ratios for various pairs of minerals to higher figures, which he denominated hindered-settling ratios, the quartz galena pair being [illegible]. The greater the difference between the ratios of any two minerals, each with quartz, the more rapid will be the separation and the greater the capacity with which jigs may be fed.

In free settling, the grains must be considered to be so far apart and so few in number that they do not affect the specific gravity of the fluid in which they fall. In jigging with a closely packed mass of grains the specific gravity of the fluid is not 1, as given in the formula, but is the average of the water and the grains which displace the water. This increase in specific gravity of the fluid by the presence of suspended solids favors the separation of smaller grains of heavy mineral than the free-settling formula indicates.

In obtaining the formulas for velocity of fall, the downward impelling force is equated with one for fluid resistance and the velocity of fall is obtained by transposition.

Under the principle of Archimedes, the downward impelling force must be equal to $vw(s' - s)$ where v is the volume of a grain, w the weight of a unit of water, and s' and s are the specific gravities respectively of the falling solid and the fluid through which it falls. If the solid falls through water the formula becomes $vw(s' - 1)$. The velocity under this force is $\frac{s' - s}{s'} gt$. If there be no fluid resistance, there is accelerated motion and the velocity at the end of any time, t, in any particular fluid, depends only upon the specific gravity of the falling body.

COMPUTATION OF SEPARATION RATES

To obtain some inkling as to why it is possible to separate smaller heavy grains from large light grains than would be indicated by the free-settling ratio, some substitutions will be made in the fall formula, omitting, for convenience, the gt portion of the expression. In water, the fall for quartz specific gravity, 2.67, and galena specific gravity, 7.7, would be proportional to 0.625 and 0.870 respectively. The rate at which separation will take place would be proportional to the difference of these two figures, or 0.245. In the bed of the jig, due to the presence of the ore, the specific gravity of the mixture would, of course, be higher than that of water. If for argument it is assumed to be 2, the figure for quartz will be proportional to 0.250, and for galena to 0.740, and the rate at which separation will take place will be proportional to 0.490, just twice as great as in the first instance. In one of Richards' experiments there was a partial separation on prolonged jigging of 0.0683-in. quartz and 0.0095-in. pure galena, a ratio of over 7.

Whatever the actual ratio of settlement, it makes no particular difference in an explanatory discussion of jigging separations. Because of simplicity, the free-settling formulas will be used in what follows. In the mills the screen sizes are, or used to be, very much nearer to one another in point of size of opening than is necessary under the free-settling ratio. A common screen system is, or used to be, through 20 mm. on 12 mm., through 12 mm. on 8 mm., through 8 mm. on 5 mm., and so on. Under the free-settling ratio, the step from 20 mm. to the next size for galena ores will be obtained by dividing by 4.01 and the next size screen would have holes of approximately 5 mm. The sizes are closer together so as to aid in middling separation. The advantage obtained by close sizing was often defeated by poor screen work.

---

*Continued from Aug. 27 issue.

FREE-SETTLING FORMULA DETERMINATIONS

Taking the 20-mm. on 12-mm. size, with the assumption of perfect screen work, let us see at what point, in using the free-settling formula, clean gangue will issue with middlings. Substituting in the formula:

$$20(2.67 - 1) = 12(s' - 1),$$
$$\text{or } s' = 3.78$$

In the case of galena grains, the percentage of lead in the 12-mm. size can be obtained by the following relations: In 100 lb. of mixed gangue grains, specific gravity 2.67, and pure galena grains, specific gravity 7.7, with an average specific gravity of 3.78, where X and Y equal the weight, respectively, of quartz and galena,

$$X\,2.67 + Y\,7.7 = 378$$
$$\text{and} \quad X + Y = 100$$

By substitution, Y is found to equal 14.8 lb. or per cent. Since galena contains 86.6 per cent of metallic lead, the 12-mm. particle will contain 12.82 per cent of metallic lead. Since, at a later point in this paper, a sizing device is described, containing the sizes given below, some figures on equal-settling grains for the openings of this device will be computed here for reference:

Through 1 in. on 0.85 in.
Through 0.85 in. on 0.70 in.
Through 0.70 in. on 0.55 in.
Through 0.55 in. on 0.40 in.
Through 0.40 in. on 0.25 in.

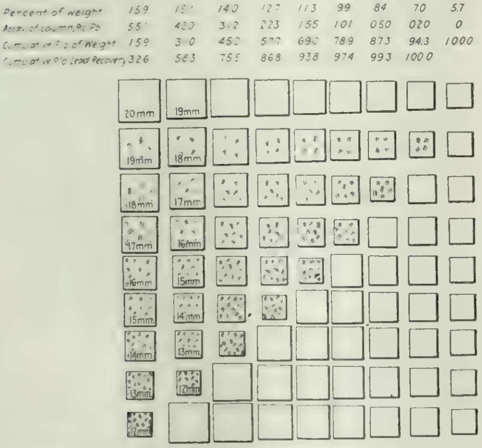

Percent of weight 159 151 140 127 113 99 84 70 5.7
Assay of column, % Pb 551 430 3.2 223 155 101 050 020 0
Cumulative % of Weight 159 3 0 450 577 690 789 873 94.3 1000
Cumulative % Lead Recovery 326 583 755 868 938 974 993 1000
20mm
19mm
19mm
18mm
18mm
17mm
17mm
16mm
16mm
15mm
15mm
14mm
14mm
13mm
13mm
12mm
12mm

DIAGRAM COVERING GRAIN SIZES FROM MINUS-20 TO PLUS-12 MM

This close range of sizes cannot be obtained by ordinary screens. Picking out such a size as through 0.55 in. on 0.40 in., and going through the same procedure as with the 12-mm. grain, the heavy small grain will be found to contain 10.83 per cent of metallic lead.

Close sizing in middling separation is desirable but not necessary. What is required is a compact screen device which can be adjusted to give any desired degree of close sizing and which will do good work with large capacities. Such a device is sorely needed to take the place of the long trommel or screen lines, with their large first cost, mechanical troubles, and high upkeep.

In order to understand the true nature of the roughing problem, attention will be concentrated on the size through 20 on 12 mm., and it will be further assumed that a galena middling is under discussion. That portion of the middling field with a grain assaying under 12.82 per cent metallic lead will be discussed.

EXPLANATION OF DIAGRAM

In the pictorial diagram the grains are arranged by 1 mm. drop in size from and including a 20-mm. grain down to and including a 12-mm. grain. At the top of the diagram there is this range of size by 1 mm. differences from left to right of pure quartz. Under each size at the top is indicated pictorially in vertical columns the grains which have free-settling falls equal to that at the top of each column, and differing in size from one another progressively by 1 mm. That these grains may have equal settling in each vertical column it is necessary to increase their specific gravity, going from top to bottom, by the requisite amount.

The first vertical column shows nine grains of varying size and each of different specific gravity. The second column shows eight grains of different specific gravity, which is all that could be had for equal settling under the fixed conditions, and to make the count equal to nine, an extra quartz grain 19 mm. in size is added for reasons to be explained. Similarly in the third column two extra 18-mm. gangue grains are added and in the same way the deficiency in the count of all the other vertical columns is made up by adding quartz grains of the same size of those at the top of each of the columns.

As to whether the diagram gives pictorially a correct representation of true middlings, an answer can be made in a number of ways: First, it does represent a middling of more than average difficulty in tailing elimination; second, the answer to the objection that the diagram should show an equal number of grains of each size would be that the diagram does not represent the grading as it comes originally from the screen, but after much elimination of concentrates and rich middlings before the remnant represented by the diagram becomes what might be denominated "final middlings." The requisite number of grains to balance the count as to size is without the boundaries of the diagram. The "assay of the diagram" is 2.58 per cent lead, and represents only a part of an original feed to a hypothetical multi-compartment jig, and with an assay, of course, higher than the portion represented by the diagram, passing to the portion of the jig represented by the lower compartments, or to jigs working purely on the roughing principle for the completion of the roughing treatment.

Further, to make it clearer that the diagram does not violate grading principles, attention is called to the first vertical column. There may have been in the feed eighteen 20-mm. grains, but to satisfy conditions both as to size and specific gravity, seventeen of them must have been of greater specific gravity than the top or pure quartz grain shown in the diagram, and, as is evident, these seventeen would have been removed before coming to the treatment phase that the diagram represents. The same conclusion would be true with respect to the other sizes shown on the top line, but in these cases, as it is possible to put in other gangue grains of the size of the several grains on the top line, it is done for a reason to be explained. In the second column, for example, there are two 19-mm. gangue grains, and the fifteen others, since there is one of this size in the first column, may be considered to have been eliminated before coming down to the phase represented by the diagram, or to have had a greater rate of fall than those of the second vertical column.

When the smallest size is reached, that of 12-mm. grains, the diagram shows nine grains of pure quartz and nine others containing varying amounts of lead, the richest grain in the diagram in point of lead being the 12-mm. grain at the bottom of the first column. When the 12-mm. size is reached, we have the full number of grains, viz., eighteen, which has been considered in the foregoing discussion. This does not preclude, hypothetically, other 12-mm. grains being in the original feed from the screen, but, as must be evident, such grains would be richer than the one at the bottom of the first column and, to satisfy the equal-settling factor, be coupled up with larger grains of less specific gravity. Ultimately carrying this train of thought out completely, and into the field outside the diagram, the smallest, or 12-mm. grain, would attain to the pure galena grade.

When, following the result just noted, the next vertical column of an enlarged diagram is laid down, the count of grains would be reduced to eight, for the 12-mm, having reached the grade of pure galena, would have to be dropped. The 13-mm. grain in this column would then become pure galena, and in constructing the next following column, one would have to be dropped, reducing the count to seven. The final column would contain one 20-mm. grain of pure galena. It must be evident that in thus extending the diagram to the left the top grains of each column in such extension must each be of 20-mm. edge, the successive grains going in that direction getting richer until the grain of pure galena at the extreme left is reached.

It will be evident on reflection that by thus extending the diagram an equal count of all the different sized grains as they come from the screen will be obtained, and the unequal count in the field of the actual diagram will be explained.

PRACTICAL APPLICATION OF PROPORTION RATIOS

The argument that the diagram does not show proper proportioning of waste grains, there being only one of the 20-mm. size to, at the other extreme, nine of the 12-mm. size, is met by the known result of unlocking, for, in practice, there would be more mineral-free grains of the smaller sizes than of the larger. The diagram does indicate a "final middling" of great complexity and difficulty of treatment, as has already been stated. So long as the diagram is kept symmetrical, that is, with nine grains to the column, any desired complexity and difficulty of treatment can be illustrated by substituting for the waste grains any desired number and grade of mineralized grains. But this can hardly be carried to the point where no separation of middling from tailing would be possible. In other words, there would have to be finer grinding before any practical separation of middling from tailing could be effected by a roughing operation.

It is not believed that the grouping of the grains into arbitrary sizes and the use of a regular figure will offer any difficulty when translated into conceptions of actual grains of irregular shape. The squares of the diagram will be understood to represent all the grains the cube root of whose volume falls within the range of the length of side of the square nearest to it in this respect, and the differences in specific gravity (of the irregular grains) are taken care of in a similar way.

TAILINGS CONTENT REFLECTS DEGREE OF SUCCESS IN ROUGHING

It now remains to conceive of the diagram as the remnant of a portion of an ore suitable for roughing, the remainder of the portion having been removed by previous jigging operations, leaving the more difficult part, in point of separation, covered by the diagram for immediate consideration. The aim in further jigging of this remnant would, of course, be the withdrawal in the form of further middling of as much of the metallic content as possible. The richer such middling, and the smaller the tonnage rate of withdrawal, the greater will be the success, viewed from one angle, as a roughing operation. From the other angle, success in treatment will be measured by the amount of tailings made and the low metallic content of such tailings. The greater the amount of tailings made, and the lower it is in percentage of lead, the greater also is the success in roughing. The two aims war with one another, and the best that can be done will be a compromise.

In the diagram, the waste grains represent 33.6 per cent of the weight. If all the grains which are mineralized could be withdrawn, the result would represent a 100 per cent recovery with a sloughing off of waste of 33.6 per cent. An inspection of the diagram will show what can be effected theoretically by taking off in middlings compartments the material represented by the various vertical columns, starting from the left of the diagram.

In theory it would seem possible to draw off from a single compartment as great a range of middling as would be desired. Referring to the diagram, it should be possible to draw off from one compartment the grains represented by columns one, two, three, and so forth, in one operation, carrying the separation of middlings to any desired point to the right in the diagram and wasting the balance of the diagram as tailings. The cumulative per cent of weights and metallic contents at the top of the diagram will show what should be possible theoretically.

If the diagram be turned around so that the left-hand vertical row of grains becomes a bottom tier, a picture will be presented of the arrangement of the grains in the compartment of a jig after a sufficient amount of the material represented by the diagram had been introduced to fill a compartment and no more, and the material had been jigged for a limited number of strokes and the jigging then being stopped. Of course, the grains in each row of the bed in the compartment would be arranged higgledy-piggledy and would not be in the graded arrangement shown on the turned diagram, but there would be in each row representatives equivalent in size or grade to those of the diagram.

"STATIC" ARRANGEMENT OF GRAINS

For convenience it is preferred to call this arrangement of the grains obtained under the fixed conditions which have been recited the "static" arrangement, the one which will be retained after sufficient pulsions to allow the separation and settling influence to come fully into play. While a jig is running, being steadily pulsed by the eccentrics and constantly receiving fresh accessions of feed, the static arrangement of the grains will not prevail, or at best it will prevail only imperfectly. If top discharges be used on the jig, and they be set so as not to take out too many of the lower layers forming in the bed, it would seem possible to remove such layers continuously by means of the discharge, provided the discharge is so set that the rate of removal is not greater than the rate of settlement and separation. In practice, neither the static arrangement can be maintained nor can the lower layers be removed perfectly by the automatic discharges, even when the rate at which the lower layers tend to receive accessions remains constant.

Principle of Automatic Discharge Devices

To refresh the memory of those familiar with automatic discharge devices, and for the benefit of those unfamiliar with them, it may be stated that they consist essentially of a pipe or closed passageway which ends near the screen of the jig and has an outlet to the outside of the jig at a point lower than the surface of ore and water in the compartments. The ore and water surround the discharge, but only the rich lower layers of the bed can enter it. Under static conditions, using the word static in its ordinary sense, the column of grains outside the discharge, ranging from the poorest at the top to the richest at the bottom, will just balance the column of rich grains within it. To provide for friction and velocity head to remove the lower layers, the outside gate of the discharge must be set at a lower point than would be necessary to ballance the columns of grains within and without the discharge. Automatic discharges are adjustable both for the discharge point and the depth in the bed. They can be pushed down to the screen or be pushed down or raised to any desired point above it.

When the jig is in operation there is no longer the arrangement of grains indicated by the turned diagram, because of the confusion produced by grains of high settling rate settling through those of lesser settling rate. This confusion is, of course, greatest at the entry point of the compartment. It must be evident that the grains of greater settling rate interfere with the proper settlement of those of less rate and that the latter are carried farther along in the compartment than they would be if it were not for such interference. There must then be, in order to cope with the problem of "final middlings" removal, either a very long compartment, which is precluded on mechanical grounds, or a plurality of compartments. The total area spread can be determined by experiment.

Range of Removable Grade

The following example will furnish a criterion as to what can be done in the way of range of grade removable from a single compartment. The assay of the whole diagram is 2.58 per cent lead; this corresponds to a specific gravity of 2.82 and this in turn to a grain of about 15 mm. edge. This grain would have a place about midway in the fourth vertical column of the diagram. This column will mark the limit of a single separation.

It is not believed that removal in the first compartment used to treat the diagram ore should be attempted beyond this point and with further removals based on this principle for the other compartments and the rest of the diagram. It will be seen that the greater the rate of middlings withdrawal the greater will be the general confusion of the upper layers. At the extreme of withdrawing through the discharge all the material entering the compartment, there would be no gradation from the top to the bottom and the bed and discharging material would be the same as that which enters.

Origin of Jig Work Inefficiency

Some of the reasons for inferior jig work in practice have been touched upon. They may be summarized by saying that either the jigs are driven beyond their capacity, based on area, or that, owing to defects in detail or in operation, the maximum separative capacity is not obtained.

At the Bunker Hill & Sullivan mills, years ago, Caetani showed that a dump of jig tailings containing 2 to 3 per cent lead could be graded up to 5 to 6 per cent lead with a recovery of about 60 per cent. This was effected partly by an improved Harz jig but mostly by what, in effect, amounted to increasing the number of jigging compartments or the jig surface spread of the jigs over which the tailings originally passed. It was in effect giving the ore more of the separative area required to effect a close separation. I have been through a number of similar experiences.

The removal of the lightest middlings is, however, impossible with top discharges, and, unfortunately, on jigs fed from screens, these are the only practical devices for continuously removing the screen accumulations. Successful mechanical devices for moving the lower layer of the jig bed to a common discharge point have almost insuperable difficulties to overcome. Anyone who does not agree on this point has my well wishes in trying his inventive bent, and he might begin, in lieu of ideas of his own, on endless moving jig screens, rake conveyors, or other devices of such ilk. The rub does not come so much in moving the lower layers as in getting them out of the jig without disturbing the balance of the bed. Jigs with shaking screens and operating on the principle of discharging the lower layers through, are not adapted to the separation of the lightest middling grain, advocates of this type of jig to the contrary notwithstanding. With fixed screens, the jigging of coarse sizes through the screen is entirely impracticable.

Theoretical Recoveries Not Realized in Practical Work

In the average mill employing jigs to make tailings and middlings, that is, using jigs in the ordinary way, making concentrates at one end and middlings and tailings at the other, the uninitiated observer will note with surprise mineralized grains going over the tailboard of the jig, and he will be quite correct in imagining that such grains should have been recovered in the jig or by jigging, or the bulk of them at any rate. As a reference to the diagram will show, all of the mineralized grains cannot be recovered, and in practice, owing to the inferior action of the automatic discharges on middlings, far more middlings grains are lost than would be indicated in theory and also very much richer grains are recovered than in theory would be recoverable.

In the average jig mill there is not sufficient jig area to effect a close separation, but the poor work of the discharges would defeat a close separation even if there were. In the next part of this paper, dealing with experimental work, it will be shown that the Harz jig is very sensitive to slight differences in specific gravity. Material containing less than one-half of 1 per cent of lead was effectively jigged and an enriched product was recovered, but not by the aid of the automatic discharges. They were tried, but were a complete failure, and were quickly discarded.

As long as material can accumulate in any compartment of a jig so that there is as marked a difference in specific gravity between the bottom and top layers as there is in the concentrate and rich middlings compartments of a jig, it will be impossible for any of the light material in the upper layers to be drawn down into the discharges contaminating the concentrates or middlings. In practical parlance, the closing off of the discharges until such rich lower layers accumulate is termed "making a bed." The jig is not allowed to discharge products until a bed is formed, and it is maintained by suitably adjusting the position of the discharge opening after the discharges are opened to let out the concentrates and middlings.

In discharging material with automatic discharges it is necessary to drag the grains in the lower layers from the farthest point in the compartment, as well as from points nearest to the discharges, against the frictional resistance of the screen and against the friction of the upper layers. The force for producing discharge is at best feeble, and it cannot exceed the average specific gravity of the column outside the discharge. The maximum discharging force would be obtained if the discharge opening were lowered to the depth of the screen and would then be equal to $2\,w\,a\,s\,h$ where w is the weight of a unit of water, a is the area of the discharge opening, s is the average specific gravity of the column outside the discharge, and h the head or depth of column of grains outside. Since w, a, and h are practically the same throughout the jig, they may be eliminated in making comparisons, and there remains s, to which the pull of the discharges will be proportional at a maximum. Actually, of course, the force is very much less than $2\,w\,a\,s\,h$, for if there is to be even a semblance of separation there must be a column of grains within the discharge to counterbalance those in the column outside the discharge. The conditions under which this balance is maintained have already been discussed. The effective head is of course the difference in weight of the two columns and is much less than the maximum $2\,w\,a\,s\,h$ and grows increasingly less as successively lighter material is removed.

It will be convenient and simple to think of the force of the discharges as being proportional to the specific gravity, s, of the material entering the compartment, and it will be seen at once how the force for moving the grains diminishes from compartment to compartment while the work to do increases, for the rate of removal by the discharges becomes successively greater as the tailing end of the jig is approached.

In attempting to remove the lightest middling the millman finds that the automatic discharge draws in grains along the lines of least resistance. It will pull from all the layers from bottom to top in its immediate vicinity, and the middlings grains at some distance from the discharge will be unaffected by it. Because of this defective action, an undue amount of waste will come out of the lower discharges of a jig, and as this displaces true middling grains which are too far away from the discharge to be drawn toward it, they will pass either to the next compartment or to waste.

To Be Continued

Properties Domestic Talc Should Possess

HIGH-GRADE prepared talc may be divided into two classes, dependent upon use: (1) massive talc, used for lava gas-burner tips and electrical insulation, pencils, and tailors' chalk; and (2) ground talc used for toilet powder. The mining and preparation of massive talc does not present special difficulties, and foreign competition is not a large factor.

The production of high-grade white talc suitable for the manufacture of toilet powder is a problem which requires considerable attention, according to R. B. Ladoo in U. S. Bureau of Mines *Reports of Investigations*. Until the last few years most of the toilet-grade talc consumed in this country was imported mainly from Canada, Italy, and France. A small, irregular production of white talc was obtained from North Carolina, Georgia, and Virginia, but this material fluctuated so greatly in quality and quantity that it was not largely used by manufacturers of high-grade toilet powders. Gradually a wall of prejudice against all domestic talcs grew up in the toilet trade, and has been fostered by people interested in the sale of imported talc in preference to domestic.

Aside from import duties, the principal point to be considered in meeting foreign competition is the comparative quality. A difference of a few dollars in the price of a ton of talc is of little importance to the manufacturer of toilet powder, for the cost of the talc is an unimportant part of the cost of a package of finished toilet powder. Since definite, standard physical tests for quality of talc are lacking, comparisons of quality are largely governed by personal opinion and prejudice. Some of the qualities demanded of talc for toilet powder are: pure white color, good slip, freedom from grit, fine grain size, and freedom from lime. Opinions of consumers differ as to the necessity for insisting on all of these qualities.

It is probable that lime is not as objectionable an impurity as has been sometimes claimed, for some Canadian talcs that are comparatively high in lime are imported and used in large quantities in this country. Another objection sometimes raised to some domestic talcs is that they tend to "ball up" or collect in small clots when poured out or shaken from a can. This is a property common to most very finely ground materials, and is, in a way, an index to fineness. If this property is objectionable it can be easily remedied, with a decrease in cost of production, by coarser grinding; but to most consumers extreme fineness is a virtue and not an objection. In the essential qualities of pure white color, freedom from grit, and fine grain size it is a well-established fact that the best California talcs equal or surpass the best imported talcs. In the desirable qualities of slip and freedom from lime some of the best California talcs equal some of the best imported talcs and in other ways excel imported talcs. Some of the largest consumers of toilet-grade talc have expressed complete satisfaction with high-grade California talcs and have used them regularly in preference to Italian talc.

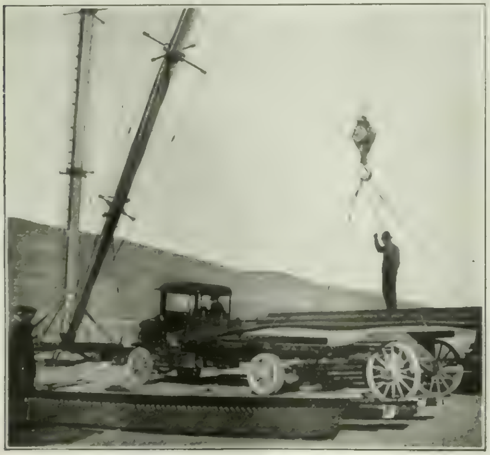
Transportation of Dredge Material at Dayton, Nev.*

Unloading Device—Use of Two and One-Half Ton Motor Truck—Short Haul—Cost Analysis of Truck Operation—Team Haulage of Heaviest Pieces

By George J. Young
Western Editor, *Engineering and Mining Journal*

THE HAULAGE of equipment and construction material for its new gold dredge from the rail head near Dayton, Nev., to the dredge site was begun by the Gold Canyon Dredging Co. several months before actual construction started. Owing to unforeseen delays, the interval preceding construction was unduly prolonged, but, as a result, a large part of the hauling was done before there was critical need of any material.

The road between the railroad spur and the dredge site is one mile long, and free from excessive grades. It was improved and put in good condition before heavy hauling began. A 2½-ton motor truck was purchased, and it was planned to use it for hauling all except the larger parts. Two-wheeled trailers and heavy wagons were used with the truck. The truck was also intended for bringing the construction crew to and from their work.


UNLOADING AT DREDGE SITE FROM TRUCK AND TWO-WHEELED TRAILER

HAULING ERECTION CREW BETWEEN DAYTON AND DREDGE SITE

A spur track for the receipt of freight was constructed on the Southern Pacific line from Mound House to Churchill, at a convenient point 2½ miles from Dayton. The expense for this purpose was $1,746, the Gold Canyon company paying $659 of this. At the spur an unloading rig was installed. This consisted of a 1⅜-in. cable supported by a single mast and crossed posts, one end of the cable being anchored and the other end arranged for tightening by tackle placed between it and the anchorage. A crab to which was attached a 10-ton chain block enabled weights up to 10 tons to be lifted from the railroad cars and transferred over the truck or wagon and lowered into position. The heaviest weights were removed from the cars by rollers and supported on cribbing. At the pit unloading was done by the derrick, which had a lifting capacity of 15 tons, a maximum radius of 100 ft. and a maximum lift of 70 ft. at a 45-deg. angle of the boom.

In hauling the heaviest parts it was planned to put "deadmen" at 100-ft. intervals along the road and to move the wagons carrying the parts by rigging used in conjunction with the motor truck. This plan was abandoned, as it was feared that damage would result to the truck if it were so used. Arrangements were then made with a teamster to haul the heaviest pieces at a reasonable price for ten horses and three men. One intermediate section of the ladder, weighing 20,000 lb., and one upper tumbler, weighing 16,500 lb., were hauled by team. Up to Jan. 19, 1920, the truck had success-

UNLOADING FROM RAILROAD CAR AT SPUR TRACK, USING STATIONARY CABLE AND CHAIN BLOCK

---

*The second article on the [illegible] of the Gold Canyon Dredging Co. The [illegible] construction [illegible] who was in [illegible] charge of the [illegible] for the preparation of this article [illegible] of the Metals Exploration Co. and the Gold Canyon Dredging [illegible] fully hauled the upper section of the ladder, weighing 35,000 lb., and loaded on two wagons; one ladder hoist drum weighing 17,360 lb., on one wagon; one gantry cap weighing 9,170 lb., partly supported on body of truck and partly on trailer; and two upper suspension blocks, each weighing 7,500 lb. and supported on truck body.

CABLE USED IN UNLOADING [illegible]

The approximate amount of material hauled is given in the following table, the cumulative totals being listed under each date:

TABLE I. DREDGE MATERIAL HAULED BY [illegible]

Material	To Feb. 3 Pounds	To Mar. 23 Pounds	To May [illegible] Pounds	To June [illegible] Pounds	To July, Pounds
[illegible]	[illegible]	19,051	[illegible]	[illegible]	[illegible]
[illegible]	146,960	178,083	[illegible]	[illegible]	[illegible]
[illegible]		168,720	[illegible]	[illegible]	[illegible]
[illegible]	493,940	744,660	[illegible]	[illegible]	[illegible]
Totals	656,854	1,110,514	1,639,418	1,937,460	2,080,314

Truck operation began Dec. 17, 1919, and continued more or less intermittently throughout the construction period, although most of the hauling of dredge parts was finished by the end of June. Until March 1, the cost analyses of operating the motor trucks were not reported in detail, but after that date a detailed analysis of each month's operation is available, and this has been condensed in Table III. The costs given are direct operating costs and include repairs. No attempt was made to include depreciation.

TABLE II. MOTOR TRUCK COSTS AT [illegible]

	Dec. 17, 1919, to Jan. 1, 1920	[illegible]	[illegible]
[illegible]	82	[illegible]	[illegible]
[illegible]	$0.28		
[illegible]	$22.96	[illegible]	[illegible]
[illegible]	$0.50	[illegible]	[illegible]
[illegible]	$1.25		
[illegible]	$24.71	[illegible]	[illegible]
[illegible]	148	[illegible]	[illegible]
[illegible]	1.67	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]

The adaptability of the motor truck to mining conditions is excellently illustrated by this example. The length of haul was comparatively short, and the truck would have made a better cost record over a longer haul. Much of the incidental service about a mine, however, is restricted to short hauls, and ore haulage represents a service of a different order. The example here given, therefore, will be useful to mine managers and superintendents in making comparisons with haulage by teams over short distances.

Suggested Changes in Low's Methods Of Analysis

A few improvements over the methods given in Low's "Technical Methods of Ore Analysis" are suggested by A. Whitby and J. P. Beardwood in the *Journal of the Chemical, Metallurgical and Mining Society of South Africa.* As a first example the authors of the paper state that they believe Low deals with the assay of nickel and cobalt on wrong lines, as he overlooks the common association of those metals with arsenic and iron. His procedure is to take down with nitric acid and chlorate and add ammonia to dissolve out the nickel and cobalt. It has been found, however, that an arsenate of iron tends to dissolve in the ammonia. Arsenic must therefore be removed, and the best results are obtained with aqua regia treatment followed by citric or tartaric acid, sodium hydroxide, and sodium sulphide. After digestion, the insoluble sulphides can be filtered off and treated by ordinary methods, the arsenic being in the filtrate.

Another point arises in the determination of chromium in chromite. According to Low, the filtrate, after fusion in nickel crucible with sodium peroxide and the usual treatment, is apparently free from chromium. This has been found to be incorrect, on account of certain reducing actions which tend to retain chromium in the precipitated hydrates. This difficulty may be overcome by adding successive washes of hot sodium peroxide solution to the filter. The effervescence of oxygen tends to break up the insoluble matter and oxidize any chromyl salts present. These washes are best boiled by themselves and are then added to the main filtrate.

In his latest edition, Low states that 4.74 gm. of ammonium molybdate should be used for making up the standard solution in the Alexander method of determining lead. His earlier editions say 8.5 gm. per litre. The commercial salt has the composition $(NH_4)_6Mo_7O_{24}4H_2O$ and, with 8.5 gm. to the litre, gives the factor 0.00996 gm. per c.c. The quantity used by him in making his present solution, which is half the strength formerly used, should be a little above 4.25, but nowhere near 4.74 gm.

TABLE III. [illegible]

	[illegible]	[illegible]	May	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	184	[illegible]	[illegible]	101	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	$1.40	[illegible]	[illegible]	$1.60	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	$106.90	[illegible]	$446.47	[illegible]
[illegible]							
[illegible]	[illegible]	[illegible]	$45.14	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	$46.41	[illegible]	$3.31	[illegible]	[illegible]
[illegible]							
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1,224	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]							
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	$1.67	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	1.04	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

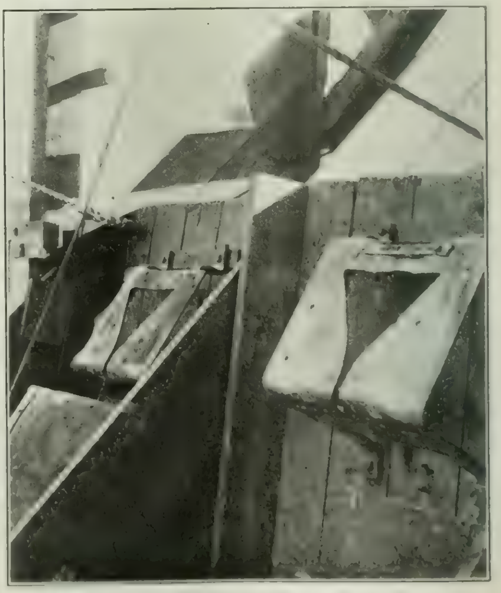
SHAFT SINKING CREW, WATER LILY SHAFT, EUREKA, UTAH

World's Shaft Sinking Record Made in Tintic District, Utah

THE world's shaft sinking record has been made in the Water Lily shaft of the Chief Consolidated Mining Co. in the Tintic district, Utah, by the Walter Fitch, Jr., Co., shaft and tunnel contractors, under the supervision of J. D. Matheson and H. W. Jarvis, foreman. The shaft is vertical and divided into three compartments 4 ft. 4 in. x 4 ft. 6 in. each. The surface equipment consists of two small hoists and two compressors which are operated electrically. Hoisting was done through two compartments with 17-cu.ft. rim-hung buckets. These buckets discharged their load on top by means of an automatic dump (shown in an accompanying cut) into 18-cu.ft. tram cars. No crossheads are used, but the hoisting compartments are lined with lagging on the inside and the entire shaft is lined on the outside. Eight by eight shaft timbers were used.

The first 367 ft. of sinking passed through a porphyry formation which proved to be favorable mucking material but offered difficulties in drilling on account of its sticky character. The last 60 ft. consisted of what is known locally as white lime shale—a moderately hard, close-grained limestone.

The sinking was done on a 3-shift basis with an average of 5.7 shaftmen per shift. Most of the timbering was done on day shift and on the four o'clock shift. Shaft sets were placed at the rate of 2.8 sets per day by an average of 4.8 timbermen. The timber was installed from a suspended steel bulkhead, which hung from the last set and made it possible to carry on the timbering and mucking or drilling operations simultaneously. An average of 72.5 buckets of muck were hoisted each shift. It was necessary to drill 23.9 holes for each round. The average powder consumption was 15¼ lb. of gelatine powder per foot. The average footage per day was 13.8 ft., making a total footage for the 31-day period, from July 15 to Aug. 15, of 427.5 ft. All men were paid the standard scale and a bonus that increased proportionately with the footage. During the 31-day period shaft operations were delayed 13 hours on account of failure of power and headframe repairs.



AUTOMATIC DUMPING DEVICE USED DURING THE SINKING OF THE WATER LILY SHAFT

BY THE WAY

Attention

The Arizona Board of Equalization is valuing copper bullion for taxation purposes at 15.7c. per lb. The members of the board are cordially invited to look at the monthly average prices of copper published regularly in the *Engineering and Mining Journal*.

Unlucky Thirteen

Thirteen crates of ore and rock weighing 3,400 lb. have been sent to Phœnix, Ariz., by the Tom Reed Gold Mines Co. as an exhibit in its appeal from the decision of the Mohave County Superior Court in the United Eastern case. This can hardly influence the learned judge, weighty evidence though it be. With winter coming on, 3,400 lb. of coal would be more appreciated, to say nothing of thirteen cases of contraband.

Lack of Secondary Enrichment

"Short bit h'ago," said Cap'n Dick, "w'en tha mines in Bisbee closed daown, Jan an' 'Arry Thomas started for tha farmin' country to look for a job. H'after day or two they foun' a farmer 'oo needed some 'ands an' tha firs' moornin' h'out 'ee puts Jan an' 'Arry diggin' spuds. 'Baout tha middle o' tha shif' 'ee gaws to call they for dinner and 'ee fin's 'Arry daown to one h'end o' tha field w'ere 'ee 'ad sunk a bloody 'ole 'baout five feet deep. 'W'ot's doin' daown there,' sez tha farmer. 'W'y, dam-me,' sez 'Arry, 'I did 'ave a bit o' pay dirt h'on surface, but tha bloody begger's pinched h'out daown 'ere.'"

A Streak of Oil

J. H. Walker, of Colorado Springs, promises to give all a run for their money who invest with him at 10c. per share. In fact, he promises to pay $5,000 to anyone who loses money on investments through his advice. What more can one want? He has worked nearly four years on the geology of Colorado, he claims, and has disapproved of the location of hundreds of wells in the United States, located by the best geologists in the world, but, to date, has not failed himself. All of this is greatly reassuring. At present he is drilling several wells on the same structure on state land in El Paso County, Col., and invites all to come and see him. He picked up a nice oil sand, non-productive at 145, 260, and 335 ft., he claims, but is after a gasser and a gusher; "the kind you read about but seldom see," he says. To quote further from his advertisement:

> "We believe we have 'treed' the finest structure in the West. We believe structures are found on streaks of oil extending across the state and accordingly we have ten [illegible] leases on this 'streak of oil.' I have followed and made a map of this 'streak of oil' and I find oil and gas have been found at depths ranging from 300 to 1,500 ft. in wells on either side of this 'streak of oil.' Many wells would be producers had they been drilled properly. Gas is being utilized from many of these wells. Did you know that Colorado oil is the highest grade known to science? It would bring over $10 per barrel!
>
> "A gusher or gasser where we are drilling would benefit every taxpayer in the state since one-eighth of the oil and gas must go to the State of Colorado. Therefore we cannot see how you could lose your money if you invest with us to assist in the drilling of these wells. We do not claim to be a 'sure shot' in geology, but we do agree to leave the holes in the ground. Every cent will go into these holes."

The stockholder, indeed, will be in a bad way if Mr. Walker does not leave the holes in the ground. But the only alternatives are to fill them up with sand or pull them out, "both of which he'll do neither," as the Irish attorney said.

From the Newspapers

Rich deposits of petrifix of copper, native sulphur, and gypsum will be opened by the railroad proposed between Bernalillo and Cuba, N. M.

S. J. Marsh, prospector, miner and president of the Cariboo Gold & Platinum Reduction Co., combines the practical mind of the miner with the aspirations and dreams of the scientist. Among other things, Mr. Marsh declares that several years ago he conceived the theory of "relativity," so widely heralded recently by Professor Einstein, which is said to be really understood by less than a score of men. He has for a long time been of the opinion that the ancients were right in their alchemic ideas about gold, and proposes to write a book which will attempt to prove that gold actually grows like fungi, though naturally at an incredibly slow rate. Mr. Marsh's theories regarding the glacial epoch are extremely revolutionary, and differ radically from any found in accepted textbooks. He has also written four papers on his investigations in connection with the fourth dimension. He is also an authority on astronomy, geology, physical science, chemistry, and navigation.

There is some discussion as to which is the right word—"pyrite" or "pyrites." A third form, "pryites," is peculiar to San Francisco.

The blue color of the potatoes raised in Marengo County, Ill., is caused by the petroleum content of the soil.

Search for a lost river—a river of gold—will be undertaken this year by several prospectors, including old-timers from the Yukon and Alaska, who are now here outfitting for the long journey into the north country. This lost river bed, where the Peace River once flowed, is somewhere in the big bend of the Peace, bisected by a line drawn from Fort St. John to the mouth of the Battle River.

Miner-Men

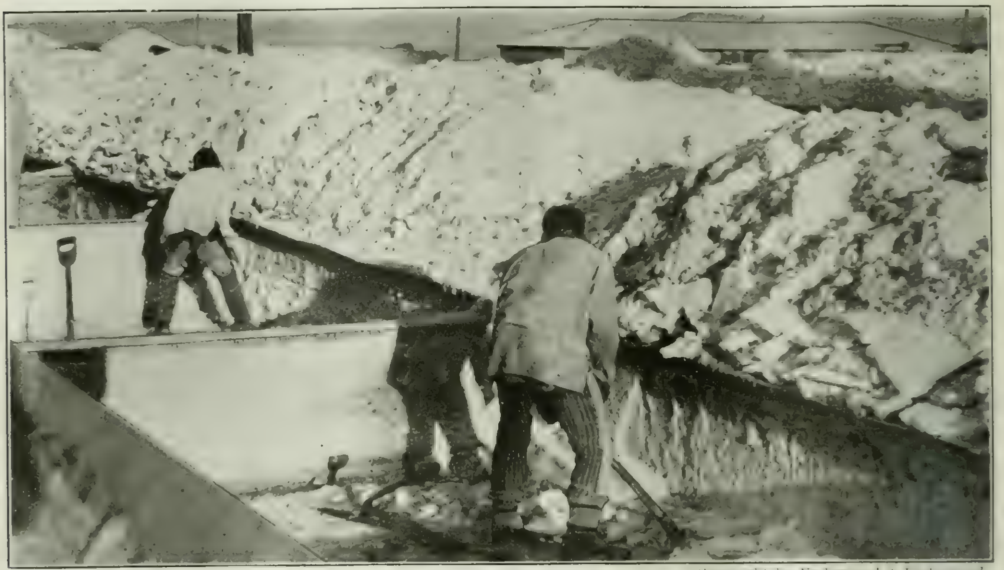
By Edwin [illegible]

A thousand songs for the [illegible] the world
around.
A thousand songs for the soldier [illegible] to be found;
But never a song for us [illegible] who toil in the under-
ground.

God never gave breath to a [illegible]
we can claim!
God never sent danger [illegible]
[illegible]
As it walks in the depths [illegible]
from whence we came.

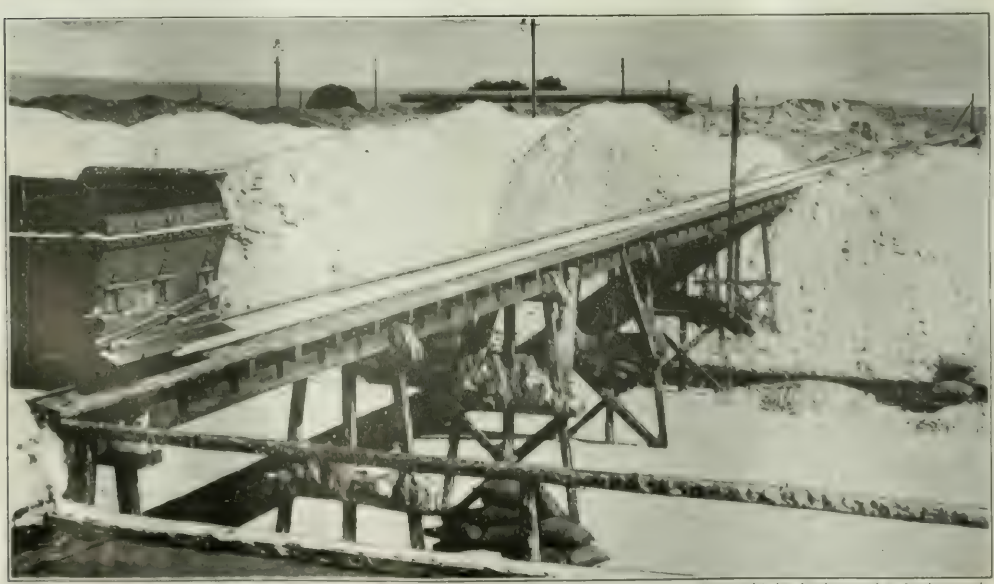
So give us songs for the [illegible] to make us
strong
[illegible] faith [illegible] help us carry along.
A [illegible] Has not [illegible]
worthy a song?

Handling Chilean Nitrate



Copyright by Underwood & Underwood

CHILE'S GREATEST EXPORT TRADE IS IN NITRATE. THE INDUSTRY IS DEPRESSED AT PRESENT, DUE TO HIGH PRICED STOCKS AVAILABLE ABROAD, AND THE DROP IN SALES. MORE THAN HALF THE OFICINAS HAVE SUSPENDED OPERATIONS, RESULTING IN UNEMPLOYMENT AND DISTRESS. THESE MEN ARE SHOVELING NITRATE, BENEATH A SCORCHING SUN, FROM A TANK ONTO A DRAINAGE BOARD



Copyright by Underwood & Underwood

NITRATE PILES READY FOR SACKING AND SHIPMENT AT THE OFICINA MARIA. CHILE'S NITRATE INDUSTRY CONTRIBUTES ABOUT NINETY PER CENT OF THE COUNTRY'S REVENUE THROUGH AN EXPORT TAX

HANDY KNOWLEDGE

A Review of Drilling—Part II*

By George J. Young
Western Editor, Engineering and Mining Journal

Consumption of Drill Steel

R. H. Bedford and William Hague gave the drill-steel consumption at the North Star mine in the A. I. M. E. *Transactions*, Vol. 49, p. 346, as equivalent to 1 lb. of steel per 2.44 tons broken for drifters and 2.95 tons for stopers. H. T. Mercer and A. C. Paulson, *Transactions*, August, 1920, give the results at the Champion mine (Lake Superior copper district) as follows:

	Tons Broken per Lb. Steel		Tons Broken per Lb. Steel
1913	7.8	1917	[illegible]
1914	7.0	1918	[illegible]
1915	14.2	1919	16.4
1916	18.5		

B. F. Tillson gives complete data for several years' operation of the New Jersey Zinc Co.'s mines which indicates a consumption of 1 lb. drill steel for 49.7 cu.ft. rock broken (4.1 tons estimated) in the Franklin mine and 34.25 cu.ft. (3 tons estimated) in the Sterling mine. At a Mother Lode mine in California, in medium ground, an approximate figure given ranged from 6 to 8 tons per pound of drill steel. At the North Star mine, the rock broken is diabase, tough granodiorite, and quartz. At the Champion mine, the rock is much less hard and tough. At the New Jersey zinc mines the ore is composed of the "combined oxides of iron, manganese and zinc, zinc oxide and silicate of zinc," associated with a highly crystalline limestone. Masses of feldspar and numerous trap dikes are encountered in the orebody.

Other things being equal, the hardness and toughness of the rock will determine the amount of steel consumption. The use of dull steel increases breakage. B. F. Tillson gives an example of a stoping drill steel, used without a bit, failing in thirty-seven minutes or after receiving an approximate total of [illegible] blows. To avoid this condition, so strikingly illustrated by the example, it is essential to standardize the drill changes for each important rock condition in the mine. Thus, for the hardest and toughest rocks, a drill change of 12 in. may result in material decrease in breakage. For hard rocks, 18 in. and for medium rocks 24 in. such changes may be readily attempted. A consistent study of drill steel changes and the degree of dullness resulting under different rock conditions would result in the selection of standard drill changes. It should not be overlooked that reducing the length of drill change has an important effect upon the footage drilled per shift. Excessive length of drill change may mean lower drilling rates, the result of using drill bits. Too short a drill change may mean excessive time consumed in changing drills. Given proper hardening, a drill bit will cut a hole of given diameter to a certain depth before becoming dull. Beyond this point the bit becomes progressively duller and the conditions for steel breakage more acute. According to C. R. Forbes and J. C. Barton ("Comparative Tests of Hammer Drill Bits," A. I. M. E., October, 1917), the drill bit will cut a certain distance and no more, no matter what the air pressure is. Thus it is essential to determine experimentally the limit of hole depth for bits of different gages.

Aggregate length of cutting edges is another factor. The Carr bit has a minimum, the four-point intermediate and the six-point the maximum, length of cutting edges. Five-point and six-point bits are seldom used, as they possess no advantage except for starting holes, and hence may be disregarded. The Carr bit represents the maximum concentration of blow; the four-point less. It would thus appear that the Carr bit would become more quickly dulled than the four-point bit. Thus the drill change for this bit is probably less, although no definite experimental data on this point are available. Reasoning from theoretical conditions it would appear that the critical dullness resulting in danger of steel breakage would be sooner reached with the Carr than with the four-point double-taper bit.

The carbon content is, in the opinion of some mining engineers, a controlling factor in steel breakage, other conditions being equal. Medium carbon steel, 0.8 per cent, is less subject to breakage, which increases rapidly as carbon content goes up. It would thus appear that in cases of excessive steel breakage, a lower carbon steel should be experimented with, if other factors have been controlled.

It is evident that there is a minimum consumption of drill steel at any one mine for a given output. To attain this minimum, good steel, suitable cross-sections and weight, proper blacksmithing, and intelligent drill running are essential. Failure of any one of these conditions means a larger, and failure to meet all of these conditions properly may mean a prohibitive, consumption of steel.

Drill Bits

The cutting end of the drill, its shape and size and the hardness given the steel are critical features, and in the case of hard and tough rocks the efficiency of drilling may depend more upon this than upon any other single factor. A great amount of experimentation has taken place in which many kinds of bits have been tried out, but the cross-bit continues to be the most used, and next to this is the Carr bit, although it seems probable that the Carr bit has little or no advantage over the double-taper, four-point bit except under special conditions. The double-taper bit has also been somewhat established in general practice and deserves a greater acceptance. The Carr bit is more difficult to form and maintain, and for this reason has been, under many general conditions, discarded. The double-taper cross-bit is the easiest to make and maintain. George H. Gilman has discussed the subject of drill bits and drill steel in an illuminating and instructive way. From his several papers on the subject I have condensed and abstracted some of the more important points.

The drill bit performs two functions. The cutting edges cut the rock and the side or cutters ream the hole sufficiently to provide enough clearance to allow of the rotation of the drill. Without this side clearance the drill could not be operated for longer than a comparatively short interval. The reaming action wears the sides of the drill and gradually reduces its diameter, so that the following drill must be of smaller diameter, in order to continue the hole to greater depth. The cross-bit, as once formed, was tapered back from the cutting edges to the bar at an angle of approximately 14 deg. This resulted in the reaming action falling upon a comparatively small area at the outer edge of the wings. The diameter of the bit was rapidly diminished in drilling a short distance, and follower drills were reduced in diameter from ⅛ to 3/16 in. for each successive size. As a consequence, drill holes had to be started of a diameter of from 3 to 2½ in. in order to bottom at the required diameter of 1⅞ to 1¼ in. Starting diameters of the size given necessitated drill steel of proportionate diameter.

---

*Continued from Aug. 27 issue.

The next step was the introduction of the double-tapered cross-bit. The outer extremities of the wings for a short distance back of the cutting edges were forged to be contained with a conical surface making an angle of from 5 to 7 deg. with the axis of the drill. The remaining portion of the outer surfaces of the wings was brought back to the bar in a 14-deg. cone. The result of this was to give a reaming line instead of a point, as was the case with the single-taper cross-bit. As the outer line of the wings wore off, more surface came into play, and the reduction of the bit diameter for a given length of drilling was diminished.

The next step consisted in making the forward extremities of the wings cylindrical instead of tapered for a distance of about ⅜ in. back from the cutting edge. This gave a reaming surface and still further diminished the reduction in bit diameter. Cylindrical reaming surfaces are not suitable for dense tough rocks, as they do not provide sufficient clearance to permit the drill to be rotated easily. Gilman says:

> "A reaming surface may be employed to advantage only when the rock conditions are such that natural transverse whipping action of the drill bit when struck by the hammer will cause it to cut a clearance for itself. The effect of this action is emphasized in ground of a granular nature in which the rock particles are readily disintegrated from the side walls by the natural crushing action of the bit, under which conditions it will cut a round hole of greater diameter than the maximum diameter of the bit. Inasmuch as such reaming qualities, dependent upon the area of the surface in contact, provide for wear-resistng qualities, it is advisable to employ as great a reaming surface as the conditions of the ground will permit without imposing undue duty upon the rotating mechanism of the drill. [Note—hammer drills provided with independent and adjustable rotating mechanism permit greater advantage to be taken of this principle]. For all conditions of ground where a reaming surface is not permissible, it is recommended that the reaming qualites of the bit be determined by a reaming edge, the clearance angle of which should be as slight as the conditions of the rock will stand. A clearance angle for the reaming edge of 5 deg. should be employed in preference to an angle of 7 deg. unless the greater clearance is essential to secure the required freedom of rotation, for the smaller the amount of reaming clearance the less will be the reduction in gage diameter by wear of the bit in service."

Under average mining conditions the cutting-edge angle used is 90 deg. For softer and more friable rocks a more acute angle can be used. Gilman recommends a greater angle than 90 deg. for hard brittle ground, and in ground of a flinty nature, which shatters readily, a cutting angle of 120 deg. is advantageous. H. T. Mercer and A. C. Paulson, in describing drill practice at the Copper Range mines, in the Lake Superior copper district, state that a 100-deg. cutting angle is used upon a double-taper four-point bit, the reaming taper being 7 deg. Both the Carr bit and the double-arc bit follow the same principles with reference to the reaming surfaces and cutting angles. Gilman says with reference to high-center or low-center bits:

> "The practice of making bits with concave or convex cutting edges is largely a matter of opinion, based upon the conditions encountered. A convex or raised center bit is often desirable in starting drill holes, especially with stoping drills equipped with a pneumative feed, while concave bits will assist materially in maintaining the alignment of the drill holes. However, tests that have been conducted show no advantage as regards stamina or drilling speed when compared with flat-ended bits identical in all other respects."

Although the double-taper four-point bit admits of the use of a 1/16-in. change of bit size, this change can be used only where skilled blacksmiths are available and close gaging is practiced. Generally, owing to lack of skilled blacksmiths, the ⅛-in. bit change rules in the majority of cases. Upon the Copper Range mines in Michigan, according to H. T. Mercer and A. C. Paulson, changes in bit diameter of 1/16 in. are in use. The dimensions of a set of steels are as follows:

	Length as Made	⅞ in Steel Bit Diameter	1 in. Steel Bit Diamete
Starter. .	3 ft. 0 in	1 7/16	1½
4-ft. drill	4 ft 10 in	1⅜	1 9/16
6-ft drill	6 ft. 6 in.	1 5/16	1⅜
8-ft drill	8 ft 4 in.	1¼	1 5/16
10-ft drill. . .	10 ft 2 in.	1 3/16	1½

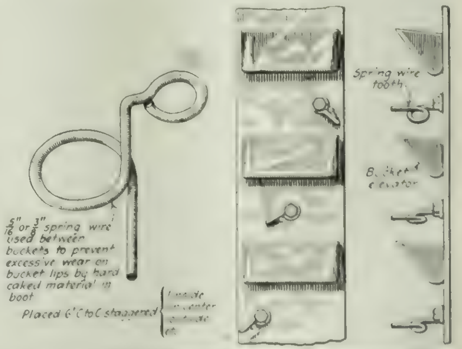
To Be Continued

Bucket Elevator Improvement

By Charles Labbe

Written for *Engineering and Mining Journal*

In elevator boots where the wet or coarse material cakes as hard as rock, the lips of the buckets become so badly worn that they have to be replaced, the remaining part being perfectly good. To prevent some of the wear, a spring tooth such as that shown in the accompanying illustration is made out of 5/16- or ⅜-in. steel wire, and is fashioned with an eye and hole for an elevator bolt of the size used. The tooth is bent ⅜ to ½ in. out of the bucket line and is made not over ½ in. longer than the bucket lip. These teeth are fastened to the belt between buckets, one being placed about every 6 ft. and staggered, one in the center and one on each side. This device placed on a bucket elevator taking coarse material, minus 2 in., helped greatly in keeping the material loose.


Spring wire tooth
Bucket elevator
5/16" or 3/8" spring wire used between buckets to prevent excessive wear on bucket lips by hard caked material in boot
Placed 6' C to C staggered
center

SPRING TOOTH TO PREVENT WEAR OF BUCKET LIPS

THE PETROLEUM INDUSTRY

Conditions in the Tampico Oil District

The existence of petroleum in the Tampico district of Mexico has been known for many years, its presence being manifested by surface pools containing *chapopote*, or crude oil, but, according to the Mexican *Boletin de Petroleo*, the first oil for commercial purposes was not produced until 1901. During that year the yield amounted to 10,345 bbl. The production gradually increased until in 1911 it was 12,552,798 bbl.; in 1919, 87,072,954 bbl., and in 1920, 163,540,000 bbl.

On March 31, 1921, there were 387 producing wells in the district, yielding a total of 3,689,969 bbl. every twenty-four hours. Nearly all of these wells are gushers, few pumps being necessary for extraction.

There are 215 oil-tank steamers employed in conveying the oil from Tampico and other smaller ports in the oil region to all parts of the world. About 78 per cent of the product goes to the United States. A large majority of the steamers belong to American companies.

The depth of the wells varies according to the location. There are a few wells in the State of San Luis Potosi, near Valles, where the average depth is 3,700 ft. At Panuco and Topila, the principal oil zones of Tampico, the oil deposits are found at approximately 2,200 ft.; at Tepetate, Chinamapa, and Amatlan, 1,900 ft.; Cerro Azul, 1,700 ft.; at Potrero del Llano, 2,000 ft., and Furbero, 2,200 ft. Most of these districts are in the State of Vera Cruz. On the Isthmus of Tehuantepec flowing wells are brought in at from 600 to 1,000 ft.

The cost of drilling a well in the Panuco and Topila region is estimated at about 100,000 pesos, or $50,000 United States currency. In the districts of Chinamapa, Amatlan, and Zacamixtle the cost ranges from 150,000 to 200,000 Mexican pesos.

The Mexican oil is composed of about 9 per cent naphtha, 10 per cent illuminative, from 50 to 70 per cent fuel oil, the remainder containing various substances such as lubricants, paraffine, and asphalt.

Up to March 31 there were 1,557 miles of pipe lines, which have been and are constantly being extended throughout the extensive oil regions. There are fourteen refineries now in operation and others in course of construction.

Various municipal, state, and federal taxes are imposed on the wells, structures and production, but the biggest item of expense of this nature is the export duty. Crude petroleum, fuel oil and gas oil pay an export tax of 10 per cent of their value; gasoline and kerosene, 6 per cent of their value; lubricating oils about 20 mills per liter; paraffine, 2 pesos per ton; asphalt 25 centavos per ton, and natural gas 5 per cent of its value.

Many of the big oil companies are paying as high as 40 to 50 per cent dividend on their millions of dollars of capital stock.

According to a recent issue of *Commerce Reports*, petroleum shipments from the Tampico fields totaled 17,185,331 bbl., of 42 gal. each, for the month of June, 1921, the greatest volume of shipments for any month of this year, except the record total of January. June figures show an increase of 3,418,794 bbl. over May shipments, and a decrease of 1,417,167 bbl. from those of January, 1921.

San Joaquin Valley Oil Operators Protest Wage Scale

SAN FRANCISCO CORRESPONDENCE

The leading operating companies in the San Joaquin Valley have declined to meet the representatives of the oil workers for the purpose of renewing the agreement expiring Aug. 31. The operators state that the agreement will not be renewed, and the present schedule of wages will remain unchanged except that the $1 per day added on July 1, 1920, to compensate the increased cost of living will no longer be paid, because of the general decline in prices.

The oil workers have addressed a telegraphic appeal to President Harding and members of his Cabinet, asking their intervention and giving warning of a general strike, though the common opinion is that there will be no strike.

Government Bureaus To Assist in Arkansas Field

WASHINGTON CORRESPONDENCE

Owing to the promise of the new oil field near Eldorado, Ark., plans have been made by the U. S. Bureau of Mines and the U. S. Geological Survey to send specialists to the region to render such assistance as they can toward its development. The Bureau of Mines already has aided in helping to exclude salt water in some of the wells.

Oil-Well Machinery Exports Active

Oil-well machinery valued at $708,923 was exported during July, 1921, according to the Bureau of Foreign and Domestic Commerce. This compares with $458,704 in July, of 1920. Exports of all other types of mining machinery during July, 1921, were valued at $482,677, as compared with $676,336 in July, 1920. Exports of pumps and pumping machinery in July, 1921, were valued at $513,749. This compares with $936,560 in July, 1920.

New Recording Office at Whitehorse

A new recording office has been established at Whitehorse, Yukon Territory, for the purpose of recording claims in the Fort Norman oil district. Previously it has been necessary to record the claims at Edmonton, and claim owners were compelled to travel to the recording office via Skagway and Vancouver, B. C. The new office will save the prospectors a trip of over 2,000 miles, which consumes practically a month's time.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Licensing of Mining Engineers Inadequate For Purposes Intended

Majority Opinion, as Voiced by Members of Mining and Metallurgical Society, Indicates Opposition to Licensing Plan, but Co-operation With Other Interested Bodies Is Offered

ON ACCOUNT of the great interest shown by the members of the Mining and Metallurgical Society of America in the question of licensing of mining engineers, as evidenced by their replies to a questionnaire on this subject, the executive committee has decided to place the report of the committee appointed for the purpose of analyzing the replies received, before the members in advance of its publication in a bulletin. The report follows:

To the Members of the Council,
Mining and Metallurgical Society of America.

Dear Sirs:

In accordance with the instructions which your Committee on Licensing of Mining Engineers received from President Spurr, we beg to submit to you the following report:

One hundred and twenty-eight letters have been received in response to the letter of the president asking for an expression of opinion. The responses have been classified as follows:

A—Unconditionally opposed	81
B—Opposed on general principles, but would favor uniform state laws with reciprocity or general Federal law	12
C—Opposed, but would accept licensing as a matter of expediency and would join in attempting to steer legislation	4
Total opposed	97
D—In favor, conditionally	16
E—In favor, unconditionally	5
Total in favor	21
F—Doubtful	8
G—No opinion	2
	10

The difference between B and C and D is that B and C are opposed on principle while D favor the principle, but wish to avoid the annoyance and expense entailed in individual state licenses.

Those unconditionally in favor of licensing base their attitude on the desire for higher professional standing and better protection of the public. Obviously, however, these are matters as to which those of the opposition are equally concerned, even though their solicitude may not be voiced or may be but inferentially or negatively expressed. It is also to be observed that those conditionally favorable must be considered as virtually of the opposition, in view of the weight of negative opinion bearing on the conditions stipulated.

Briefly, the point of view of this opposition is to the following effect: Licensing would neither improve nor safeguard professional standing, partly because professional qualifications could not be adequately formulated in such a law, and partly because of probable miscarriage in its administration.

In determining professional qualifications it is necessary to take into account not only the technical ability called for by the work in contemplation but also character and the lay attributes acquired of the engineer in that connection. Often, technical ability is secondary to the other factors, and the matter of qualifications is a question of something inherent—or earnest, rather, than of something required—something that no conceivable licensing system could measure.

Administration would not only be confronted with difficulties, due to the considerations just mentioned, but, in all probability, would suffer from the play of politics as well as from undue regard for local interest.

Consequently, it is widely held that licensing would be of no real advantage to the profession; that, even with state reciprocity, it would involve useless expense and hardship, and that it could not possibly result in the exclusion of the unfit. Some, indeed, are of the opinion that licensing would afford cover to the unfit and thereby tend to lower the standing of the profession.

The maintenance of professional standards is regarded as essentially a professional matter, although it is recognized that a strong incentive to excellence is provided by the discernment of employers and clients.

The position of the public in relation to the question of licensing is discussed from the standpoint of employers, as well as investors, in the replies.

Employees are considered to be already protected, or in the way of being protected by legislation applying to those directly responsible. Whether mine managers should be regarded as sharing responsibility, and be required to qualify by examination for a license, as in South Africa, is not, as a rule, touched on. It may be observed in this connection, however, that, even in South Africa, licensing does not extend to consulting engineers.

Investors are believed to be as well protected as possible and more liable to suffer than to benefit through licensing. Their position is different from that of the general public in relation to the other professions, for their transactions are not of such urgency as to preclude inquiry and verification, the means for which are ample. Licensing would not relieve them of the need for precaution, since, as already stated, it would not eliminate the unfit from the profession, although, it might, in some instances, give rise to a false sense of security and thus obscure that need.

In conclusion, your committee begs to recommend that an analysis of the correspondence on the subject of licensing mining engineers be placed before the members for their information. As to the proper course of the society on this matter, your committee further recommends that the society should not take independent action in opposition to licensing mining engineers, but should stand ready to co-operate with other interested bodies to that end if joint action appears to be called for.

(Signed) W. L. HONNOLD,
Chairman,
A. M. SMOOT,
F. F. SHARPLESS,
J. VOLNEY LEWIS,
H. G. MOULTON.

Mexico Protests Against Reduction of Export Taxes

According to reports that have just appeared in the Mexico City dailies, the President of Mexico, General Alvaro Obregon, has made declarations of great interest to oil and mining men. He is reported to have said, by way of a general reply to the numerous petitions which have been received by the government asking for the reduction of the export taxes on oil and silver, that sooner than grant what was asked the government would prefer that the oil should remain in the subsoil and the silver in the veins until such time as these commodities could be exported with profit both to the producer and the country; that he regarded both the oil and mining industries as merely transient ones, and that as such they should at all times contribute their share to the revenues of the nation; that most of the oil and silver industries in Mexico are in the hands of foreigners, and that in consequence practically none of the profits derived from these industries remain in the country; and that if the taxes were reduced or remitted Mexico would see her mineral resources exhausted without any profit to herself. Sooner or later, the president is reported to have said, the prices of both oil and silver are bound to rise, and then both wells and mines could be operated profitably for all concerned, including the nation, which is the real owner of all subsurface wealth; that it is far better for the interests of Mexico that her oil especially should not be produced in such quantities as to adversely affect the markets of the world, as has been the case of late; and that, finally, the government is in a position to stand the loss involved in the paralyzation of both industries.

The Oil Controversy Between the United States and Great Britain

In a report embodying the results of a recent trip abroad, Van. H. Manning, director of research of the American Petroleum Institute, writes as follows concerning the oil controversy between the United States and Great Britain:

"The establishment of an oil mandate principle assumed by mandatory powers has been the subject of numerous discussions between the representatives of the governments of the United States and Great Britain, with particular reference to Mesopotamia during the last fourteen months. The recent mutual exchange of assurances between these governments is that they find themselves in general agreement that the world's petroleum resources should be thrown open to all nations and that opportunity to explore and develop these resources wherever found should without discrimination be freely extended. While these governments appear to be in accord as to the principles involved, the adjustment of a division of the mandate territories is yet to be worked out in a way that will establish reciprocal relations as should exist between the United States and England.

"There are influential interests in England who feel that a closer relationship could be established by an amalgamation of American and English capital in development of the oil fields in the Near East. It is a fact that British and French capital is working jointly in the acquirement of oil properties in Rumania and elsewhere. Can we lay down a definite policy? Do we know what we want and what to do with it when we get it?"

MEN YOU SHOULD KNOW ABOUT

C. O. Lindberg, of Los Angeles, was recently in San Francisco on business.

Alexander Richardson, principal of the Camborne School of Mines, Cornwall, is in New York this week.

Louis D. Huntoon has just returned from the Alma district of Colorado, where he was engaged in examination work.

G. C. Martin, of the Alaskan division of the U. S. Geological Survey, is now engaged in work in the Tanana district.

K. Tawara, of the metallurgy department of the Imperial University of Tokio, Japan, visited Mesabi Range iron mines last week.

Colonel B. F. Millard, of Seattle, is in New York with a view to financing a group of platinum claims four miles from Grant's Pass, Ore.

C. E. Abbott, general superintendent of ore mines for the Tennessee Coal, Iron & R.R. Co., at Bessemer, Ala., was a recent visitor on the Mesabi Range.

D. G. MacLachlan, general superintendent of the Armstead mines, Talache, Idaho, has returned to his Spokane home after several weeks in a hospital.

J. S. Diller, of the geologic staff of the U. S. Geological Survey, has completed his field work in the Lassen Peak area and is returning to Washington.

J. A. Stewart has resigned as assistant superintendent of the Ramapo Ore Co., Sterlington, N. Y. His present address is 3,910 12th Ave. South, Minneapolis, Minn.

R. T. Walker, of the U. S. Smelting & Refining Co., Salt Lake City, Utah, made a complete inspection of the Franklin camp, southern British Columbia, during August.

Edwin Ludlow, president, and **F. F. Sharpless**, secretary, of the A. I. M. E., will leave on Sept. 5 to attend the organization of the Charleston, W. Va., Section of the Institute.

A. M. Swartley, of the Oregon Bureau of Mines, conducted a survey of the mineral resources of the territory in the vicinity of Canyon City, Grant County, Ore., during August.

James B. Kennedy, **J. R. Gross**, **Fred Tod**, and **R. C. Steese**, of the Brier Hill Steel Co., accompanied by **J. S. Lutes**, manager of mines for the Tod-Stanbaugh Co., visited the properties of the latter company on the Mesabi Range last week.

Olaf P. Jenkins, of the Washington Geological Survey, is now in western Washington, making an examination of iron-ore resources. This work is in accordance with an act passed by the last state Legislature, authorizing such an investigation.

A. H. Brooks, in charge of the division of Alaskan mineral resources of the U. S. Geological Survey, is at present making an inspection tour in the Kantishna district. He expects to be in Anchorage on Sept. 15, and will sail for Juneau on Sept. 21.

Dr. S. C. Lind, superintendent of the U. S. Bureau of Mines experiment station at Reno, Nev., was in Denver recently in connection with research work to be undertaken by the Government with a view to the further development of the radium industry of Colorado.

H. Foster Bain, of the U. S. Bureau of Mines, will be in Salt Lake City on Sept. 28 and 29, when a dinner will be given in his honor at the Commercial Club of the city. Mr. Bain will be asked to speak at a meeting of the Utah Section of the American Institute of Mining and Metallurgical Engineers.

Cleveland A. Dodge, of New York, vice-president of the Phelps Dodge Corporation, accompanied by **G. H. Dowell**, general manager, and **Arthur Notman**, superintendent of the Copper Queen properties at Bisbee, Ariz., recently visited the Mesabi Range, studying mining and transportation methods and equipment.

John McNair, comptroller, **W. K. Knox**, assistant secretary, **H. M. Kalagner**, and **W. A. Meyers**, general store manager for the Phelps Dodge Corporation, and **O. M. Palmquist**, purchasing agent of the Old Dominion Copper Co., of Globe, Ariz., are at Clifton, Ariz., working on detail inventory.

Mining engineers and metallurgists recently in New York City included: A. H. Wethey, Paris, France; **R. T. Wilder**, Matehuala, Mexico; **J. R. Thoenen**, Evansville, Ind.; **A. C. Langden**, Palouse, Wash.; **L. R. Lane**, Havana, Cuba; **J. S. Cunningham**, Charleston, W. Va.; **Verne Frazee**, Moweaqua, Ill., and **M. G. Cheney**, Graham, Tex.

Sir Archibald Mitchelson, a leading British financier, formerly associated with the late Lord Rhondda, is visiting Canada in connection with the reorganization of the Davidson Consolidated Co. of Porcupine.

JAMES F. CALLBREATH

James F. Callbreath, secretary of the American Mining Congress, was tendered a banquet at the Davenport Hotel, Spokane, Wash., on Aug. 18, by local and Coeur d'Alene mining men. During the course of the evening Mr. Callbreath outlined many details of the forthcoming meeting and exposition of the American Mining Congress, to be held in Chicago.

George Otis Smith, director of the U. S. Geological Survey, returned to Washington from London last week. The primary object of his visit to England was to serve as a member of the organization committee of the International Geological Congress, the next meeting of which is being arranged for August 1922 at Brussels.

Dr. Smith visited various government scientific institutions in England whose work corresponds to that of the Survey. It is interesting to note, he remarked, that such official bureaus and organizations number not fewer than [illegible] a [illegible] under [illegible] as [illegible] different government departments or bureaus.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

WEEKLY RÉSUMÉ

International Nickel Co. suspends operations. Anaconda's tax views are accepted. Superior Copper Co. abandons operations. White Pine Extension moves its surface plant to another property. Silver mining in Mexico is being heavily taxed. Erupcion Mining and Ahumada Lead companies to work on a larger scale. Mexico trying out a system of labor arbitration.

Senator Smoot would exempt gold mines from excess profits tax. Two more experiment stations provided for by Foster Act. Conduct hearings on compulsory metric system.

Porcupine Davidson Gold Mines takes over Davidson Cons. Mines closing in Colorado through lack of funds. Opp mine, in Oregon, to be reopened. Railway conditions unsatisfactory in Guanajuato. Penoles mine active in Chihuahua. Silver Hoard mine, in British Columbia, makes a strike. Western Chemical to manufacture sulphate.

International Nickel Suspends Operations

It is officially announced that the mines and smelter of the International Nickel Co. at Copper Cliff and Creighton will close down on Sept. 1 for an indefinite period. The refinery at Port Colborne will also suspend operations. The reason assigned is business depression and the accumulation of heavy stocks for which there is no market. Six hundred employees are affected. Of the three big nickel companies operating in the Sudbury district, the only one in operation after Sept. 1 will be the Mond Co., which is producing on only a limited scale.

Anaconda's Tax Views Accepted

Returns To Be Based on Operation of Company as a Whole

Tax officials in Montana recently made an effort to tax the individual output of mines, and, if the effort had been successful, it would have entailed further tax outlays for the companies of Butte. Heretofore, as all the mines of the Anaconda company virtually were connected, and were operated jointly, and with one central air-compressing plant, it was the output as a whole which afforded a basis for tax calculations. Under the statute for the state, as interpreted by tax officials, it was contended that each property should be taxed upon its individual output. In other words, the matching of a loss by one mine against a profit by the other would be prohibited. In this case, several departments of the Anaconda company would show a profit for the year.

The Montana board of equalization has decided to accept the view of the Anaconda Copper Mining Co. and take its return on ore produced from its properties as one mine. There was a disposition on the part of the state board to require each mine owned by the company to make a separate report, but after listening to officials of the company and others, the board became convinced that under the circumstances it would be right to accept one report for all the mines on the Anaconda hill. John Gillie, general manager, informed the state board that the company had more than 2,500 miles of levels and tunnels and that there are twenty-six operating shafts and eight air shafts working to extract ore. He said that it cost $6,000,000 a year to keep the mines of Butte open while not hoisting a pound of ore.

White Pine Extension Surface Plant Being Moved

The surface plant of the White Pine Extension Co., owned by the Resource Development Co., of Detroit, is being dismantled preparatory to shipping it to Michigamme, Marquette County, to be set up as a temporary plant at the Imperial iron mine, owned by Henry Ford and recently reopened after a long period of idleness. The Imperial mine is part of the property of the Michigan Iron, Land & Lumber Co., the upper peninsula (Michigan) Ford subsidiary. The removal of the surface plant probably seals the destiny of White Pine Extension. The mine was under development by the Stanton interests, in association with a number of Detroit men. The results have been only of mediocre character. The problem at White Pine Extension is one involving an extensive development and the use of the flotation system.

Superior Copper Co.'s Property Abandoned

The property of the Superior Copper Co., a subsidiary of Calumet & Hecla, which has been closed since December, 1920, has been permanently abandoned. The ground has been thoroughly explored by means of diamond drilling, crosscuts, and drifts, but has been found to be badly faulted and the lodes of such character as to offer no inducement for further expenditure.

Silver Mining in Mexico Heavily Taxed

Revenue Laws Still Being Threshed Out by Officials

Guanajuato—The outlook for the immediate future in the mining camp of Guanajuato is extremely gloomy. Beginning with April 1 of this year, the federal government conceded for a period of four months a considerable reduction in the export tax on silver. It had been hoped that when the four months' period referred to had expired, no great difficulty would be experienced in obtaining an extension. In the meantime, however, the curtailment of operations in the oil-producing regions of the country caused a loss to federal revenues of between four and five million pesos monthly, and probably on account of this the government decreed that beginning with Aug. 1 the old schedule of the export tax on silver would be used, despite the most determined efforts on the part of the representatives of practically every mining company in the republic.

The government is probably now at its wits' end to find the money required for its current needs, as every industry in the country is in a deplorable condition, and figures that even if some of the mines or smelters close down, many will continue operations, and that the receipts from the silver tax will be greater than they have been during the last four months, in which it is probably right. It is a case of charging all the traffic will bear, regardless of consequences. At the present price of silver the tax amounts to 5½ per cent, to which has to be added the "infalsificable" tax, amounting to about 1 per cent, and the state tax of 2 per cent, making in all direct payments to the government of about 8½ per cent. In addition to these direct payments there are a number of indirect ones, which in addition to freight, express, insurance, and refinery charges, bring the realization cost on silver to most companies up to about 15 per cent, a heavy burden for even a rich mine, and an almost impossible one for a low-grade one, such as are all the mines in the Guanajuato camp.

Following hard on the heels of the increase in the silver tax comes another blow in the form of an extraordinary income tax, to be, for the present at any rate, levied for one month only and payable in September next. Every mining company that has produced either this year or last will, in all probability, have to pay 4 per cent. The tax should produce a large sum, which, after deducting collection expenses, will be applied to the purchase of merchant vessels as a means of decreasing the high cost of living, says the decree.

Mexico Trying Out System of Labor Arbitration

Councils Organize To Conciliate Differences Between Employer and Employee

In the mining news published in the July 2 issue, reference was made to a labor law enacted by the Congress of the State of Guanajuato in which the formation of councils of conciliation and arbitration to settle differences between capital and labor was provided for. These councils have now been formed in the various industrial centers of the state, and in the city of Guanajuato, the center of most of the mining in the state, already a number of claims brought by workmen against the different mining companies are being heard by the local council. No decisions have as yet been rendered, but they are awaited with considerable interest. Any decision given by a local council can be appealed and carried before the Central Council for the State. A decision by this Central Council is, according to the state law under discussion, final, but many feel that this point is not constitutional, and that the ordinary civil courts of the country can, if necessary, be appealed to. Most of the claims are for three months' pay, or for wrongful dismissal, one company alone, which has just been obliged to shut down on account of exhaustion of its ore supplies and cash resources, having been the recipient of over thirty claims, with fresh ones coming in daily. There are a few claims for compensation for injuries received. One of these latter claims refers to an accident which happened as far back as 1915, and which was the victim's own fault. Though it is expected that most of the cases will be successfully fought, there is considerable loss of time in attending to them, as well as some expense, and the whole business forms one of the many irritating factors that go to make the life of a mine manager in Mexico today anything but a pleasant one.

Western Chemical Co. To Manufacture Sodium Sulphate From Its Mineral Deposits

The Western Chemical Co. has given publicity to plans for the erection at San Pedro, near Los Angeles, of a factory, to cost $150,000, to be the first unit of what is to be a great plant to handle the threnardite secured from a lease of 600 acres of Arizona state lands in the neighborhood of Camp Verde, Ariz. The material is to be purified into commercial sodium sulphate for paper and glass manufactures, sodium sulphide, used in the canning and dye industries; glaubers salts, and hyposulphites. An active market for the sulphate already has been developed in Sweden, Norway and Denmark, where the paper mills have offered to take the new mill's entire output of 200 tons a day.

In view of the unsettled trade conditions, the proffered contracts have not been closed, the same disposition having been made of pending South American contracts. The new plant will be on the west basin of Los Angeles Harbor, where the raw material will be received from railroad cars and the product handled by gravity into deep-sea vessels. The company already has a $200,000 plant, thirty miles west of Tonopah, Nev., turning out twenty tons a day each of potash-alum and flowers of sulphur.

Copper Discovered in Shetland Islands

Special Cable by Reuter's to Engineering and Mining Journal

London, Aug. 24—Important deposits of copper have been discovered in the Shetland Islands. The lodes, upon analysis, yielded a high percentage of the metal. It is estimated that 500,000 tons of copper ore are readily available. Engineers are laying down a plant, and mining will start in September. The ore extends to a depth of 500 ft., and it is declared that the supply is inexhaustible and superior to the Spanish product. A London syndicate has acquired the rights over an area of ten square miles.

Old Hematite Mines Reopened in Austria

Special Cable by Reuter's to Engineering and Mining Journal

Vienna, Aug. 16—The brown hematite mines at Spitz, a village on the left bank of the Danube, about forty-five miles from this city, which have been idle for sixty years, were recently reopened, and it is announced that the ores contain 45 to 50 per cent of iron and more than 2 per cent of manganese.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Bureau of Mines Supervising Oil Production on Public Domain

As a result of having been selected to handle the operating features of the Oil Land Leasing Act and to supervise operations on the naval oil reserves, the Bureau of Mines is finding that a task of real proportions has been assigned to it. The oil wells on the public domain now produce over 12,000,000 bbl. of oil per year, yielding the Government a royalty of at least 2,000,000 bbl. The work of supervising this production is increasing constantly as new fields are brought in. There is also necessity for supervision and occasional technical investigation in connection with mining on Indian lands.

The Bureau has organized, to care for this oil work, a staff of approximately twenty-five petroleum engineers, well drillers, oil gagers and oil clerks. The engineers and drillers supervise the actual methods employed by operators in drilling and handling their wells, and assist operators in adopting approved methods. The oil gagers and clerks measure the oil produced and compute royalties accruing to the Government.

The headquarters of the field work is in Denver, Col., through which the various field offices report and from which data are forwarded to Washington. To supervise work in their respective adjacent fields, field offices are maintained at Winnett, Mont.; at Casper, Wyo.; at Shreveport, La., and at Bakersfield, Cal. For all this work, $94,020 has been allotted.

Pittman Act Silver Purchases

Purchases of silver under the Pittman Act during the week ended Aug. 29 totaled 151,000 fine ounces. This brings the total purchases to 70,204,330 fine ounces.

Appropriation Made for Bureau of Mines Mineral Investigations

"Mineral Mining" has been allotted $125,000 of the appropriation allowed the Bureau of Mines for the current fiscal year. It is from a general provision of the appropriation act that the Bureau derives its main support for studies of the ores and metals for which no specific provision is elsewhere made. Studies are also made of health and sanitation in Western metal mines. To this work, $[illegible] has been allotted. This study is directed specifically to the investigation of dust and humidity as affecting health and efficiency. An allotment of $[illegible] is made for statistics covering metal mine accidents. In an effort to improve quarry technique and to find uses for quarry wastes, $[illegible] has been set aside. Laboratory research on non-ferrous alloys is to receive $14,870.

The internal budget of the Bureau of Mines in addition shows the following allotment of funds for specific purposes: General expenses, $76,900; investigating mine accidents, $409,065; testing fuel, $142,510; non-metallic investigations, $35,000; investigations of petroleum and natural gas, $135,000; expenses mining experiment stations, $200,000; inspecting mines in Alaska, $7,325; care of buildings and grounds of the Pittsburgh Station, $50,000; operating mine rescue cars, $160,000; enforcement of the oil leasing act, $132,000.

Two More Experiment Stations To Be Established Under Foster Act

As the time approaches for the consideration of next year's appropriations, there is a renewal of the interest on the part of certain mining regions in the two mining experiment stations which are yet to be established under the Foster Act. Ten mining experiment stations were authorized by the Foster Act, but only eight of these stations have been established. Considering the present state of the Treasury, it is hardly probable that Congress will appropriate for more than one of these stations this year.

Of the remaining two stations, it is believed that one should be devoted to underground mining problems and one to the fundamental problems of chemistry and physics as applied to mining and metallurgical industries. Obviously, the former station would be established in the Rocky Mountain region and the latter in the East. Probabilities favor the establishment of the Western station first.

Will Conduct Hearings on Compulsory Metric System

A subcommittee of the Senate Committee on Manufactures has been designated to conduct hearings on a bill by Senator Ladd, of North Dakota, providing for the compulsory adoption, after ten years, of the metric system of weights and measures. Senator McNary, of Oregon, will act as chairman of the subcommittee. The other members are Senator Weller, of Maryland, and Senator Jones, of New Mexico.

It is the intention to have limited hearings soon after the Congressional recess, so that the proponents and opponents of the legislation may state their views as to the desirability of such a law. It then is the intention to circulate as widely as possible a stenographic record of the hearing, with the idea of acquainting the public with the problems involved. Later, during the regular session of Congress which begins in December, it is planned to have further hearings, after which an attempt will be made to secure favorable action by the committee, thereby securing a place for the bill on the Senate calendar, where its consideration would be taken up in due course.

NEWS BY MINING DISTRICTS

London Letter

Far East Rand Costs the Lowest — Broken Hill Mines To Use Chemical & Metallurgical Corporation's Process

By W. A. Doman

London, Aug. 15. — Mining returns from the Rand for the last month afford an interesting study in the matter of working costs. Admittedly it is not easy to make any very effective comparison, because there is no standard method of presenting the returns. Each group seems to follow its own policy, for although the influence may be but small, it is something, and it is frequently the practice to include miscellaneous revenue with profit, without stating working costs, and so disguise the actual expense figure. Contrary to the view generally entertained, a big tonnage milled does not necessarily mean the lowest expense ratio per ton, as may be seen from a comparison of production and costs in the following statement:

	Tons	Working Costs Per Ton s d
Crown Mines	201,000	24-8
Government Areas	140,000	21-2
Randfontein Central	127,000	26-8
East Rand Proprietary	127,000	27-7
New Modderfontein	90,000	22-9
Van Ryn Deep	49,300	27-6
Geduld	45,300	23-6
Modder Deep	42,500	22-1
Consolidated Langlaagte	42,300	24-4
Langlaagte Estate	40,300	26-0

Generally speaking, the most economical working is with the newer companies on the Far East Rand, which doubtless is the result of improved layout methods and arrangements. Some of the older companies, such as Crown Mines and Randfontein Central, were not started on the best basis as big units for economical working, they being amalgamations of already existing mines. The East Rand Proprietary Mines suffers perhaps the most in this respect, though the rapid exhaustion of its profitable ore reserves, and the great distances separating the working faces naturally increase the cost of stoping. The Modder Deep, which mills only a moderate tonnage, as mines go on the Rand, is fortunately placed, its twin shaft layout being particularly suitable.

Perhaps the arrangement at a bigger mine would not prove so effective. The Van Ryn Deep, although a relatively new mine, is an expensive property to work, the cost per ton being only a penny below the East Rand Proprietary, which is the highest cost in the list.

At the meeting of shareholders of the Chemical & Metallurgical Corporation some hopeful statements were made. It is decidedly interesting to learn that, even at the high level of working expenses now ruling, the corporation can operate at a materially lower cost per ton treated than was contemplated when the undertaking was formed. Claims made as regards recovery were unquestionably high. In regard to complex ores, formerly thought to be commercially worthless, the processes used by the Corporation can recover from 90 to 100 per cent of the lead contents; the silver recovery has been improved from about 30 per cent to over 90 per cent, and the zinc recovery from about 85 per cent to over 95 per cent, depending to some extent upon the nature and grade of the ore handled. Mr. Cocking, an independent chemical engineer, has studied the Elmore process, and gives it a remarkable blessing. Seeing that the process is designed to treat material which has already borne the full cost of milling, there would seem to be a vast field for its application. So impressed are they with the results obtained that certain parties connected with the Broken Hill mines, in Australia, have decided to complete an agreement for using the process, and will erect a plant locally as soon as practicable. This should prove the beginning of another era for the Broken Hill field, for it is apparently only by a great reduction of working costs, or by a higher recovery of metals, that the mines can again be rendered profitable, with wages and materials at their present levels and under existing unsettled conditions.

On previous occasions I have referred to the difficulties experienced by the Cam & Motor mine, in Rhodesia. The ore is of a somewhat complex nature, so that hitherto the ore reserves, of something like 400,000 tons averaging about 37s. per ton, have not yielded a profit. The treatment plant has been reconstructed, and although the first few runs were of an unsatisfactory character, news has now come to hand that the corner is turned, and it is estimated that the profits for the current month will be between £7,000 and £8,000.

CANADA

British Columbia

Silver Hoard Mine Makes Strike

Ainsworth—One of the most important strikes made here this season is reported from the Silver Hoard mine, where Messrs. Grant Bros. and Rogers, lessees, in following up a showing opened up by the Silver Hoard Co. some time ago, when making an excavation for a boiler house, uncovered a wide body of ore, carrying silver values of from $75 to $125 per ton. The find is believed to be capable of producing upward of a carload per day, and is close to the surface. The lessees started operations only recently, under provisions of a lease extending two years.

Greenwood—Messrs. Nelson, Jackson and Lofstad, local miners and prospectors, are starting active development of the Riverside mine, at Rock Creek, a few miles west of here.

Nelson—Spokane interests have obtained an option on the Bayonne group, in what is known as the Bayonne country. Ground is believed to be owned by Butte and New York interests. An engineer's exmination is being made to ascertain the possibilities of the group, upon which considerable was expended in development some years ago.

Salmo—Trail investors have been conducting active development on a group of claims near this point, and with encouraging results. A 600-ft. crosscut has been run, which cut the vein at a depth of 380 ft. Drifting at that level disclosed oxidized lead ore with good silver values.

Trout Lake—Craig and McLean, owners of the Noble Five group for a number of years, and who have been developing the property by following a small stringer, have opened up an encouraging showing of copper-gold-silver-lead. Development of a number of other prospects in the vicinity of Trout Lake and Ferguson is being continued and good assays are being obtained during the course of this season's development on the Mansfield claims on Silver Cup mountain. A start has been made by M. R. Leahy, owner of the Horn Lead group and manager of Mansfield Mining Co., on gathering a collection of Lardeau district ores for exhibition at various mining conventions.

Cranbrook—A meeting of Columbia Section A. I. M. E., to be held here the latter part of August, has had to be dropped because of inability of a large number of the members of the section to be present.

Stewart and Alice Arm—A first shipment of twenty tons of high grade ore has been made by the Fish Creek Mining Co., whose property is situated on Fish Creek, Portland Canal district. As soon as the road which the Alaskan administration is building up the creek is completed, it is the intention to install a compressor. Extensive alterations to the dock at Stewart are being made preparatory to the construction of ore bunkers by the Premier Mining Co.

Encouraging reports come from Marmot River, where the Patricia group is being developed, together with the Washington, Prince George, and other properties. Work on the former is to be continued through the winter.

A new strike is reported on the Dolly Varden, Alice Arm. The lead was uncovered on the surface about 20 ft. above the old workings, and picked samples are said to have assayed 267 oz. in silver.

A. H. Lawry, of San Francisco, Cal., recently visited and inspected the Dolly Varden.

New Hazelton—The John Gariel silver property, Copper River, is being opened up, with satisfactory results. A trail is being constructed, finances being furnished jointly by the provincial government and the owner. With transportation facilities, and the ready obtaining of plant and supplies assured, development will be expedited.

Rossland—The new concentrator of the Le Roi No. 2 is in operation. The ore on the dumps is to be treated first, after which attention will be given to the mining of the property.

All of the efforts made to induce the Great Northern Ry. to restore service on the Red Mountain branch between Northport, Wash., and Rossland have so far been unsuccessful. It is still hoped, however, that the Dominion Board of Railway Commissioners will be prevailed upon to give the case a hearing.

Trail—The Trail Mining Co.'s property, near Salmo, the ore of which is an oxidized lead containing silver, has been developed recently by the driving of a 600-ft. tunnel. The main lead is 16 ft. wide. On the construction of a road it will be possible to begin shipping.

One quarter of a million tons of ore and concentrates were received at the Trail smelter this year up to and including Aug. 7. Of the actual total, 250,980 tons, 246,140 tons was from the properties of the Consolidated Mining & Smelting Co., and 4,840 tons was custom ore. Ten properties shipped ore to the smelter from Aug. 1 to 7. There were included the Freddy Lee and the Majestic, of Sandon; the Kokomo, of Beaverdell, the Skyline, of Ainsworth, and the Bingo.

The Associated Boards of Trade of Eastern British Columbia, made up of the boards of trade for Trail, Nelson, Rossland, Kaslo, Penticton, Princeton, Creston, Slocan district, Nakusp, Cawston, Revelstoke, Grand Forks, and Greenwood, have indorsed a memorial of Trail Board of Trade requesting imposition by the dominion government of a tariff on copper rods and various scrap metals imported into Canada from the United States. It is expected the memorial will be indorsed by various coast boards of trade also.

The California Mining Co., owners of gold bearing properties in British Columbia, will resume operations as soon as alterations in the mill are completed, according to reports.

Ontario

Porcupine Davidson Gold Mines Takes Over Davidson Consolidated

Porcupine—The shareholders of the Davidson Consolidated, at a special meeting held in Toronto on Aug. 24, ratified the sale of the assets of the company to a new company to be known as the Porcupine Davidson Gold Mines, capitalized at £1,000,000. The old company was capitalized at $5,000,000, of which $4,000,000 was issued. Shareholders of the old company retain their securities, the old company obtaining in payment for its assets £175,000 preferred stock and £450,000 common stock in the new company, together with £50,000 cash. A sum of £200,000 is to be set apart for working capital. The stock of the new company will be divided into 1,500,000 preferred shares and 2,500,000 common shares, each of 5s. par value. Dewatering of the mine has already been begun.

An early resumption of work at the Porcupine V.-N. T. is anticipated. It is planned to bring the mill up to a daily capacity of 150 tons. There is a large tonnage of medium grade ore already developed at the 400-ft. level, and at the 600-ft. level the main vein is about 20 ft. wide, of which about 12 ft. carries average gold content of $11.50 to the ton. It is proposed to make the 600-ft. one of the main levels and to open up other main levels at 750 and 900 ft. deep.

Work has been started on the Ankerite Extension in the southern part of the Dome area of the Porcupine field, where it is believed that a contact zone extends through the property, with prospects of valuable ore deposits.

Officials of the Keora deny the report that the property will close. On the 250 level the vein has been crosscut for a width of 35 ft. and the last round showed considerable free gold in the face.

Plans are under way for the financing of the Barry Webster property in Skead township, where good assays over a large width are reported.

A new gold strike is also reported from the property of the Lightning River company south of Lake Abitibi. The vein is exposed for a length of 200 ft. and a width of 5 ft. and shows a considerable amount of free gold.

Cobalt—July was Nipissing's best month for the current year, during which there was produced ore of an estimated net value of $166,383. Total production for the year to date was $1,050,000. There was no underground development of importance during the month.

The O'Brien was the only shipper from Cobalt for the week ended Aug. 6, when one car of [illegible] tons was sent out.

It is officially stated that the Hudson Bay will resume milling operations for the treatment of about 6,000 tons of broken ore. After this is completed the management will determine whether to undertake further development or close down.

The La Rose has dewatered its Violet

property and is resuming active development.

The shaft on the Waldman property of the Oxford-Cobalt is down 50 ft. and has encountered some high grade and a substantial amount of milling ore.

The Bailey Silver Mines during July shipped 1,262 tons of ore. The Bailey custom mill was operated at capacity, realizing gross earnings of $12,129.

Ore shipments over the T. & N. O. Ry. in July totaled 168 tons, O'Brien shipping 32, La Rose 43, Kerr Lake 23, and Coniagas 70. Of this 55 tons went to the Deloro plant, 70 tons to the A. S. & R. Co., at Perth Amboy, and 43 to the Pennsylvania Smelting Co., at Carnegie, Pa.

Kirkland Lake—The Lake Shore during July produced bullion to the amount of $49,155, from the treatment of 1,967 tons of ore, being an average recovery of $24.99 per ton. The mill ran 92.60 per cent of possible running time.

Structural work on the 100-ton mill of the Ontario-Kirkland will be completed within a month. The machinery is arriving and production is expected to commence about the new year. A quantity of ore averaging about $15 per ton is ready for milling.

Goudreau—Claims are being staked in this area on an extensive scale. Following the Murphy strike, the original discovery, an area two miles wide and six miles east and west has all been staked, in addition to claims which have been located to the north and east.

Boston Creek—The results of diamond drilling at a depth of 500 ft. on the Miller Independence have so far been encouraging. A porphyry intrusion has been cut showing a width of 14 ft. in one hole and 12 ft. in a second, adjacent to about 2 ft. of schisted rock.

MEXICO

Erupcion and Ahumada Plan Operations on Large Scale—Plans Perfected for Railroad To Join National Ry.

Chihuahua—The Erupcion Mining Co. and the Ahumada Lead Co., which have large holdings in the northern part of the state, in the Sierra de los Lamentos, will soon resume operations on a large scale. The development of the properties will consist of a tunnel 1,200 ft. long, and several winzes, which have exposed a body of lead-silver ore 1,200 ft. in length, 200 ft. in width and 25 ft. in thickness. It is stated that this is supposed to be the largest single body of high-grade lead ore in the world. The development of the property is only partly begun. The formation is one of the characteristic cave or fissure deposits so common in the northern plateau of Mexico, and is similar in its general characteristics to the camps of Sa. Eulalia, Naica, and Sierra Mojada.

The construction of a fifty-mile railroad from the mine to some point of the National Ry. north of Villa Ahumada was authorized on Aug. 8, at a meeting of the stockholders of the Erupcion Mining Co. at Anthony, N. M. Authorization took the form of a vote to increase its capital stock from $1,000,000 to $1,500,000 and to accept the proposal of the Ahumada Lead Co. to guarantee sale of the half million excess. The $500,000 will be used to build the road. The Ahumada Lead Co. is composed of such mining operators as Colonel John C. Greenway, Dr. L. D. Rickets, and others connected with the Calumet & Arizona and New Cornelia companies.

A survey of the routes now in progress will be completed by the end of August. The Mexican government has granted concessions for the road. The concessions reach through to the Compañia Minera Erupcion y Anexas S. A. and appended interests represented by the Compañia Minera Polomo S. A. They are controlled by the Erupcion Mining Co. The Ahumada Lead Co., a Delaware corporation, in turn owns a majority of the Erupcion stock.

Peñoles and Other Lead Mines Shipping Ore

Federico Moye is to resume operations on his mine La Carambola, of the Cusi camp.

The Peñoles Mines Co., owners of the San Toy, Inglaterra and many other mines in the Sa. Eulalia district, is shipping high-grade silver-lead ore to the smelter of the A. S. & R. Co. at Avalos. The company is employing at the present about sixty men, which number will be greatly increased, as the company intends to resume work on a large scale in the near future. W. F. Eaton is manager.

The owners of the Dolores mine, at Sa. Eulalia, Escobar & Stiles, have purchased the adjoining property, El Continente, and have started operations on both properties. A fifty-ton concentrating plant will be put on the property to treat lead-silver ore, the product of which will be shipped to the smelter.

The A. S. & R. Co. at Avalos, near Chihuahua, has five furnaces going. The sixth one will be blown in soon. Gold-silver and lead bullion is being produced in large quantities.

The Dolores mines, one of the units of the Dolores Esperanza Corporation, which has its properties situated at Dolores, at a distance of thirty miles from the Madera station of the Mexican North Western Ry., has finished its reconstruction work. The mine, which was closed down for many years on account of unsettled conditions, was put again in condition for operation and a new cyanide plant, Dorr equipment, with a daily capacity of 200 tons, has been erected. The plant at Madera is furnishing all power needed, and shipping of silver and gold bullion was started after many years of interruption. James S. Colbath is general manager, with residence at El Paso, Tex., and Roy A. Sulliger is superintendent of the mines.

La Reina de Plata Mining Co., of the Sa. Eulalia camp, has shipped to the A. S. & R. Co. smelter at Avalos twelve tons of high-grade silver-lead ore, running 406 ounces of silver and 30 per cent of lead, in the last week.

Guanajuato

Railway Conditions Unsatisfactory—Mine Development and Improvement Progressing

The congestion of traffic on some of the railroad lines is still great; on others, there seems to be an improvement. For instance, shipments from any of the seaports and from Laredo and Piedras Negras take sometimes months to reach any point in central Mexico, though on the line from Ciudad Juarez little or no delay is experienced. No reductions have been made in any freight rates, as was promised some months ago; on the contrary, in some instances, rates have been raised.

General conditions in the state are good, as there are no political troubles or bandits, and no particular labor dificulties.

The Peregrina Mining & Milling Co. suspended operations a few days ago, mainly on account of the depletion of its orebodies. The company has for some time been working at a loss, and the recent increase in taxation finally caused the management to close down. The Peregrina mine is an old one and has probably been worked for hundreds of years. The present company acquired the mine and began operations about fifteen years ago, and has milled almost continuously ever since, over a million and a quarter tons having been treated in its plant.

The Guanajuato Consolidated Mining & Milling Co. continues the alterations to its mill, which remains shut down. At its Sirena mine the company is doing development work which is greatly increasing its ore reserves. Production will not be renewed in all probability for some time.

The Guanajuato Reduction & Mines Co. continues to operate its mines and mills at full capacity. Its new mill and plant in the La Luz district is running smoothly, and the metallurgical results are well up to expectations.

The Cubo Mining & Milling Co. is treating about five thousand tons monthly in its mill and cyanide plant. Development work is being pushed ahead, with reported satisfactory results.

The United Mines Co. continues to develop its holdings at La Luz. Satisfactory progress is being made in the new shaft.

All development work on the Esperanza properties at Santa Ana, under bond and lease to the Pinguico Mines Co., has been stopped for the present. The shaft of the Pasadena mine is being deepened. It is proposed to sink this shaft until it cuts the El Monte vein in depth. The evidence on hand so far indicates that Guanajuato is what might be termed a comparatively shallow camp. So little deep work, however, has been done that this evidence can only be considered as presumptive.

ARIZONA

Louis d'Or M. & M. To Expand Operations

Miami—At a directors' meeting held in Chicago of the Louis d'Or Mining & Milling Co., in consultation with C. E. Hart, general manager, much new exploration work was planned, including another shaft and the sinking of additional diamond-drill holes. A pilot mill is to be erected, a larger hoist is to be placed in the first shaft as soon as it reaches 500 ft. depth, an electric plant will furnish light and minor power, a large administration building will be erected, including quarters for the engineering force, and the assay building will be equipped with a chemical department that can make tests upon structural building materials.

Active development work is reported on the Celtic group of mines, north of the Greater Miami group. The main tunnel, No. 4, now is in 300 ft. and is expected to strike the main ledge within 60 ft. more. Ore taken out gives assays of 17 oz. in silver and 9 per cent copper. The owners are H. H. MacDonald, of Ray, and Owen Morris, of Globe.

Tombstone — J. L. Melgren & Son have purchased all the interests of the Tombstone Co-operative Milling Co. The mill was originally started with eight shareholders, each of whom was to take a certain period of the mill time, but there was disagreement that ended in the Melgrens buying out the six other members. A new steam plant will be installed, and water secured from a well. Custom ores will be received.

Duncan—It is reported that the old Carlisle and Jim Crow mines have been purchased from George H. Utter by George F. Wilson, H. V. Snell, and W. D. Fisk, of Globe. The same people purchased several years ago the New Year Gift mine from Utter, and have since developed an ore reserve of about 24,000 tons. An effort was made a short time ago to get the mine owners of this district to co-operate and treat their ores in the cyanide mill of the Duncan M. & M. Co., which is within three miles of the Carlisle and adjoins the Jim Crow ground. No results have as yet been apparent, though it is stated that the plan is not dead by any means.

Patagonia — An encouraging strike has been made in the new development tunnel on the Bender property, where a southwest dipping vein has been opened which contains streaks assaying from 20 to 100 oz. silver a ton. The diamond-drill hole on the Hardshell property is down 825 ft., and is in a lime-quartz formation.

NEW MEXICO

Application for Receiver for Octo Company Denied

Lordsburg—Returns from the last car of silver ore shipped by the Co-operative mine, it is claimed, show 4,300 oz. silver in the 35 tons shipped.

The application for a receivership for the Octo Mining Co., brought by Lawrence R. Boyd, was thrown out of court as insufficient.

Messrs. Crites, Williams, and Nicholas, who are interested, it is reported, with John A. White in the Last Chance mine, have been visiting the property with their engineer, Matt Chestnut. The property is developing satisfactorily. The upraise from the 275 level has been connected, and a rich showing of native silver ore has been encountered on the 275 level; 15,000 tons of ore that will run from 15 to 30 oz. have been blocked out. It has been decided to install a compressor plant, develop a water supply, and build a fifty-ton mill to handle the ore. A mill would probably not be built at the present but for the excessive treatment charges made by the El Paso smelter, which is the only smelter receiving ores in this territory at this time.

The Great Eagle Fluorspar property has been shut down temporarily pending a change in superintendents.

COLORADO

Mines Closing Because of Lack of Funds

Ouray—The Ouray Union was closed down recently by the refusal of the men to work longer without payment of past-due wages; the men filed a labor lien, but agreed to give the company a reasonable time before bringing suit. The company had been for some time engaged in remodeling the mill, equipping the mine, and in general preparing for active work, but was not able to complete financing the work. The mine, which produced heavily a good grade of gold ore a few years ago, is said to still contain a good deal of ore besides having good undeveloped territory. The plant is practically complete now, and the company is actively negotiating for more funds.

The Chipeta M., M. & S. Co. is still closed down on account of lack of funds. Most of the stock sold recently was placed among coal miners on the eastern slope in Colorado, and these subscribers declare themselves unable to resume payment of their subscriptions until coal mining is resumed in the fall. The company has just completed the delivery of an air compressor and most of the work of installing pipe lines, erecting buildings, and constructing electric line has been completed.

After a short period of inaction, the Hidden Treasure Mines Co. has resumed operations at its mine just northwest of the Camp Bird. A change in management, and evidently in plans, is shown by the work now being carried on by F. R. Baer, the new manager. A small mill, to be used as a test mill, is being erected at the mine, machinery for this plant being bought in the vicinity. Jigs, followed by Huntington mill regrinding, and tables and flotation, will be the essential features. The plant will probably be ready for operation before snow falls.

The Silverton Ry. has applied to the I. C. C. for permission to abandon its line from Silverton to Joker Tunnel via Red Mountain, and is now advertising locally to that effect. This is the railway built by Otto Mears, the San Juan pioneer, in the days when the famous Red Mountain copper-silver mines were active. A large tonnage of high-grade copper-silver ore was hauled by this road for some years. The passing of this almost historic railroad is not being actively opposed, since there is little going on in the Red Mountain district. The Barstow is the only shipper, and the railroad company declines to repair its road for hauling the fifteen carloads offered by the Barstow.

Owing to the refusal of the Silverton Ry. to run trains for Barstow concentrate alone, the operators of that mine, under the C. R. Wilfley lease, are hauling their year's accumulation of concentrate to Silverton by wagon, and there loading on the D. & R. G. R.R. for shipment to the smelter at Durango. The operators have made a preliminary estimate of $100,000 for the year's production.

The Mountain Top Mining Co., of which G. H. Beebe is manager, is in high-grade ore again, and making a splendid production. A new Hardinge mill has just been purchased, and when it is received the underground mill will be doubled in capacity, with the addition of other machinery.

Telluride—Operations have been resumed at the Alta mine by the Belmont-Wagner Mining Co., a subsidiary of the Tonopah-Belmont Mining Co., under the management of John M. Warner. The Black Hawk tunnel will be advanced to connect with the mine workings, so that ore can be delivered directly to the mill. At present the mill is operating on tailing. About sixty men are employed. The force will probably be increased to 200 in the near future.

Cripple Creek—The Queen mine will be reopened in the near future under the direction of John T. Milliken. The shaft will be sunk 250 ft. and laterals will be advanced to develop the vein.

UTAH

Revision in Tax Laws Considered

Revision of the taxation laws of Utah to be voted on in the form of amendments [illegible] by the electorate of the state is being undertaken by a commission appointed last year for this work by the state Legislature. William Bailey, chairman of the commission and of the state Board of Equalization, in a paper read before the commission, has furnished a general outline of the state taxation laws and of the work before the commission. It has been decided, following Mr. Bailey's suggestion, to take up one at a time the questions to be examined, and to start out with the classification of property for taxation purposes.

It will be remembered that in Utah mining property is assessed according to the surface valuation placed on the ground and according to the value of improvements, and the production of mines at three times the net proceeds. This system of taxation was felt at the time of its enactment to bear heavily upon the mining industry, and efforts were made to bring about changes which would not place what was regarded by mining men as a disproportionate share of taxation upon mining. Any changes which may be proposed as the work of the committee progresses will therefore be watched with interest.

Eureka—The Little May is starting to sink its two compartment shaft from the 200 to the 300 level. Drifting with encouraging results has been done on the 200 level. The mining committee of the Salt Lake Commercial Club adopted a resolution Aug. 19 congratulating the Walter Fitch, Jr., Contracting Co., which is sinking the Water Lily shaft in the eastern holdings of the Chief Consolidated, with having broken the world's shaft sinking record. The shaft was sunk 427½ ft. in one month.

Lead furnaces at the Valley plants operating Aug. 20 were as follows: The United States Co. at Midvale had four lead furnaces in blast, including one on matte concentration. The large new stack at this plant is being built, the foundations having been completed and the brickwork being up about 100 ft. This stack will be 465 ft. high or over when completed. The A. S. & R., at Murray, had four lead furnaces in operation. No lead furnaces were in blast at Tooele.

Salt Lake City—The Utah-Apex, of Bingham, is presenting in the U. S. district court at Salt Lake City its objections to the accounting of the Utah Consolidated for ore taken from ground formerly in dispute and lately adjudged to belong to the Utah-Apex Co.

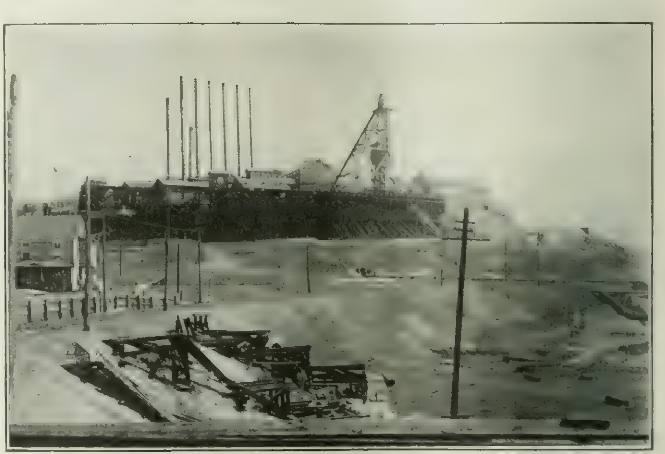
Alta—The Little Cottonwood Transportation Co., operating a narrow-gage railroad between Alta and Wasatch down Little Cottonwood Cañon, is applying to the Public Utilities Commission to be allowed to make a 25 per cent increase in freight rates. The shipping season for this road begins late and ends early, and operation is over steep grades. The petition states that shippers agree to the increase, and the management gives the closing down of the road as the only alternative to making the proposed increase. The present daily loss is placed at $50.

MONTANA

American Gem Mining Syndicate Producing Sapphire in Phillipsburg District

Phillipsburg—The American Gem Mining Syndicate, of Phillipsburg, is mining sapphire such as used in electric meters, watches, chronometers, and for dies used in drawing wire and shaping leads for pencils and for other purposes where a hard substance is necessary. Mining is carried on by the hydraulic method, the material being washed into sluice boxes. When a sufficiently large clean-up is made, the material is jigged to remove as much of the sand and gravel as possible. It is then gone over by hand, and defective stones and waste material are removed. The stones are screened for sizes suitable for the purposes for which they are intended.

The sapphire is found in sand and gravel in the gulches and has probably been carried there from a volcanic capping which previously may have covered the surrounding hills and has been weathered out in time. The company's head office is 509 Merchants-Laclede Building, St. Louis, Mo. L. M. Rumsey, Jr., is president. There is no company named the Gem Mining Co., as previously reported.



Schoettner Studios Butte

ANACONDA COPPER MINING CO.'S NEVER SWEAT MINE, BUTTE, MONT.

Butte—Anaconda Copper Mining Co. will drive a crosscut on the 1,900 level of the Gagnon mine with the object of cutting a vein which on the 2,800 level has disclosed a copper-producing zone in a fissure of great width, which nearer the surface is of a silver-zinc character. The opening of this body of copper ore in a portion of the Butte district, where it was not definitely known that copper existed in tonnage, was regarded by engineers as indicating further possibilities. Anaconda during the last week resumed repair work on the "big" flue at the Washoe smelting works, employing forty men.

Davis-Daly Copper is increasing its daily tonnage, more than 400 tons being hoisted one day in the last week of ore carrying more than 5½ per cent copper. Immediate operations of the company are showing a profit despite the prevailing low current quotation for copper. Station cutting on the 750 level of the Hibernia shaft is nearing completion, and crosscutting for the North and South Hibernia veins will be undertaken soon.

Hesperus Mining Co. is making arrangements to resume operations at the shaft of the Butte New England Copper Co., situated to the south of the Colorado mine of the Davis-Daly, and plans now under consideration contemplate the sinking of this shaft from the 250 to the 500 level.

East Butte's smelter, mill and the levels of its Pittsmont property are being overhauled, presumably in anticipation of an inspection, which, rumors have it, is in connection with negotiations concerning a possible sale, to whom is not known, but which gossip connects with the Davis-Daly and the W. A. Clark interests, with opinion veering stronger toward the latter. A drift driven in the Pittsmont mine 230 ft. in length, averaging 6 ft. in height with a 20-in. gage track, by two men in twenty-nine days, the men doing their own piping and track laying, is believed to have established a record, according to William Maxwell, Montana State Mine Inspector.

John D. Pope, manager of the Boston & Montana Development Co., says that the 750 mill of the company, in the Elkhorn district, is just about ready for operation and that there is no doubt ore will be run through the mill by Sept. 15, the date set a short time ago. The company has developed about 40,000 feet of workings, or nearly eight miles. There are thirty known veins, only five partly developed. Tests show that the average value per ton of ore is $20. Fully 1,000,000 tons of ore is ready for mill treatment.

Neihart—Drilling rig at the Silver Dike property is working upon its third test hole, two holes having been drilled to a depth of 150 ft. each. General impression prevails that satisfactory results have been had, although nothing official is obtainable. The American Zinc Co. is believed to be back of the testing out of the Silver Dike, the tonnage of which is extensive if an average of silver values can be had which will assure a profitable milling return.

Jardine—Refinancing plan is announced by the Jardine Gold Mining & Milling Co., whereby a new company, known as the Jardine Mining Co., is launched, with its shares exchangeable for those of the old corporation at the rate of one for one, plus 5c. a share. Pittsburgh interests are back of the refinancing.

Saltese—Wilson Mining & Smelting Co. has let a contract for driving a crosscut 100 ft. This working already is in 420 ft. and it is believed a short distance farther will be sufficient to reach the vein. A depth from 500 to 600 ft. will be attained.

Troy—Montana Morning Mining Co. will resume operations, with a program designed to place the property upon a producing basis soon. The main tunnel cuts a 16-ft. ledge of good milling ore at a depth of 225 ft.

NEVADA

Operations Normal — Mineral County Buys Power Line

Tonopah—All the larger companies are operating under normal conditions. The Tonopah Extension has unwatered the Victor shaft to the 1,880 level, and development operations will start immediately. The Rescue-Eula, North Star, and Midway have begun operations. The eastern part of the Jim Butler Tonopah Mining Co. has been taken over under lease by the New California Tonopah Mining Co. Development work will be carried on from the 900 level of the Wandering Boy shaft. The West End has shipped $62,000, which represents the clean-up for the first half of August.

Divide—The Tonopah Divide, Divide Extension, Brougher Divide, Rosetta Divide, and the Kernick Divide are at present operating. The North Divide Extension and the Victory Divide have reorganized and will begin operations soon.

Klondyke—The Knox Divide is drifting on the 130 level, and shipping a regular tonnage to the Belmont mill. The Ben Hur is carrying on considerable development work, and lessees on the Original Klondyke have been shipping regularly.

Luning—The power line from Lundy to Hawthorne has been purchased by Mineral County from the Nevada California Power Co. The ownership of this line will be transferred on Oct 31, 1921 Mineral County will complete its power line to Luning, Mina, and Simon by Nov. 1, 1921, and the power purchased from the Nevada California Power Co. at Lundy will be distributed over the county power line to the above mining districts.

The Watson and O'Boyle gold strike, about nine miles north of Luning, has been sunk to a depth of 20 ft. Ore of a good grade is being taken from the shaft. The Silver Chief prospect in the same locality has opened up 2½ ft. of lead-silver ore of shipping grade.

Goldfield—The shaft of the Goldfield Deep Mines has reached the 800 level. When the shaft has reached the 1,000 level, a station will be cut on the 800 level and pumping machinery will be installed.

Tule Canyon—Lessees on the Jaegers property of the Silver Hills Nevada Mines Co. have opened up two feet of high-grade silver ore. A number of new leases have been granted, and considerable work is being done on this section of the property.

Hornsilver—A. I. D'Arcy and associates have taken over the Orleans Hornsilver Mining Co. They will begin underground development and build a mill.

Mina—The work of building a power line to the mine and mill of the Simon Silver-Lead Mines Co. has begun, the county having purchased all material. The Nevada-California Power Co. is expected to begin delivering power in September. The mill is ready to start as soon as power is available.

CALIFORNIA

Carson-Afterthought Suit Being Tried

Placerville — The buildings of the Good Hope mine, twenty-five miles east of here, were destroyed on Aug. 16 by a forest fire which burned about one square mile of timber.

Grass Valley—Thomas Bath reports having cut a vein of good free gold ore in his tunnel on the Ross ranch near Newtown.

The eighty-stamp mill of the Empire mine is operating at capacity and producing about $90,000 per month.

William Landigran and Thomas Scadden have found old workings in the Lost Frenchman mine, on Grizzly Hill, which they believe to be the lost tunnel worked in 1869 and presumably closed down while in bonanza gravel.

San Francisco — The suit of George C. Carson against the Afterthought Mining Co. for infringement of patent is being tried before Judge Van Fleet of the U. S. District Court here. Carson claims as his invention the side feeding of ores and fettling in a reverberatory furnace, with a number of subordinate claims. If successful he will probably proceed against the large copper companies next, as side feeding is the customary practice in the large smelters. It is expected that a decision will be rendered by Sept. 1.

French Gulch—The Hazel Gold Mining Co. has given an option on the Gladstone mine to a San Francisco company. The mine was shut down in 1916 on account of high costs. Hamilton Eddie is in charge of the new operations.

Randsburg—The California Rand Silver, Inc., has placed an order for a 200 ton flotation plant with the Joshua Hendy Co. On the Coyote claim, adjoining the Kelly mine, the Randsburg Silver Co. has found 23 ft. of ore, averaging nearly $100 per ton.

Los Angeles—P. A. Simon, president of the Simon Silver-Lead Mines Co., announces that the company has obtained the old Kirk-Simon smelter at Harbor City and expects to remodel it for the production of zinc oxide from the flotation concentrates of the new mill at Mina. Shipment of the flotation machinery from San Francisco will be completed by the last of August, it is reported.

Oroville—J. A. Coutts, a mining engineer of San Francisco, reports the finding of two rich veins of gold quartz in the old Wyandotte mine. A mill has been built and preparations are being made to sink to the 300-level. B. F. Clark and John Wells have discovered good gold-silver ore near Yankee Hill.

Bridgeport—The Perini group of mining claims at Masonic has been sold by S. L. Perini. The purchasers will begin operations at once.

Alturas—The Gooselake Mining Co. is arranging to install a five-stamp mill on its property in Willow Valley.

MICHIGAN

C. & H. Cutting Costs—Channing Impressed With Seneca's Developments

Houghton—Three hundred additional men have been let out by Calumet & Hecla as the result of recent orders to curtail to the utmost possible extent in every department. All costs not absolutely essential to the maintenance of the property have been eliminated. The power plant at Lake Linden will be operated to serve the electric pumps and steam will be maintained at the mine to operate the steam pumps and bailers. Sixty-five men have been retained for work on the pumps.

Calumet & Hecla, Ahmeek, Centennial, Osceola, and Allouez have combined their clerical departments, with John G. Bennetts, of the C. & H., as chief clerk. During the period of the suspension at least this work will be centralized at Calumet. Mr. Bennetts also has been made assistant treasurer of Calumet & Hecla.

J. Parke Channing, of New York, president of the Seneca Copper Corporation, expresses himself as favorably impressed with developments in the Seneca property. He has thoroughly inspected conditions in both the Seneca and Gratiot shafts and is satisfied, he says, that the ground opened is equal to that in any of the adjoining properties on the Kearsarge lode, including Ahmeek and Mohawk. No. [illegible] drift north from the Seneca shaft toward Gratiot, the longest opening in the mine, has reached a length of 1,[illegible] ft. and is in good rock practically all the way. The 4th, 5th and 6th level drifts north, also are in good ground. New hoists must be installed before either the Seneca or Gratiot can be deepened, but in the meantime the mine will be opened extensively by means of laterals.

Calumet & Hecla has added to its already large supply of Danish flint pebbles for its grinding mills at Lake Linden. A cargo of 2,200 tons recently was received from Copenhagen. They are used for grinding of conglomerate.

WASHINGTON

New Hope Starts New Tunnel

Spokane—In a letter to the stockholders of the North Bunker Hill Mining Co. of Kellogg, the directors state that the crosscut from the 500-ft. station in the shaft has been advanced 480 ft. and that the work is now in the casing of the ledge, with every indication of cutting into the vein at any time. The present work is attracting considerable attention, as the crosscut is entering a point directly beneath Haystack peak in a quartzite formation where the mineralized area is said to show a width of 340 ft. in surface and upper workings.

Eugene Thomas reports that a new tunnel has been started on the property of the New Hope Mining Co., of which he is manager. The property is north of Osborn, in the Coeur d'Alenes. The tunnel will have to be 1,800 ft. long to reach the main ledge, but a ledge of considerable importance probably will be cut at about 300 ft. from the portal of the tunnel. The new tunnel will give 350 ft. additional depth.

The Walton Mines Co., operating fourteen miles north of Fairfield, Idaho, expects to finish its mill and begin the shipment of concentrates to Salt Lake about Sept. 20. Three hundred tons of mill feed running $20 to $30 has been stoped for milling.

The directors of the Guelph Mining & Milling Co., near Kellogg, Idaho, plan resumption of development work on the property. The mine has been idle for a year. The last work was in the crosscut from the 225 ft. level of the main shaft. This crosscut had been extended 600 ft. and had just cut the Guelph lead and started toward the Ambergris vein, when the flow of water became too heavy for the pumps, and work was discontinued until additional machinery could be installed. The management expects to cut the Ambergris lead in about 200 ft.

Fifty tons of ore has been shipped by the lessees in the No. 4 tunnel of the Western Union Mining Co., in the Coeur d'Alenes. This is the nineteenth car shipped by them this year, and is said to be about the best ore taken out.

Blewett — The Amalgamated Gold Mines Co., which reopened the old Blewett mine about one year ago, has been operating steadily. The old stamp mill has been overhauled and five stamps are now in operation. The ore is being concentrated on tables and vanners, and experimental tests are working out a method of treatment that will increase the percentage of recovery. C. R. Hesseltine, of Seattle, is manager of the property, and Ernest Riebe is engineer in charge.

OREGON

Opp Mine To Be Reopened

Holland—The Boswell Extension Gold Mining Co., a Nevada corporation capitalized at $1,000,000, has been granted permission by the state corporation commissioner to operate in Oregon, with headquarters at Holland. George S. Barton, of Grants Pass, is secretary-treasurer. The new company holds mining ground containing extension veins of the famous Boswell gold mine six miles out from Holland.

The Norden-Fritz syndicate, which is composed of Seattle, Wash., investors, with headquarters at Holland, Ore., has purchased the Siskron mine.

Jacksonville—The Opp gold mine, less than two miles west of Jacksonville, which has been closed down since 1916, is being reopened by J. W. Opp, of Jacksonville, and associates. The mine was discovered many years ago, but its chief development has taken place within the last sixteen years. It is at an elevation ranging from 1,850 to 2,850 ft. and consists of a total acreage of 373 acres of mining lands. It is opened by eighteen adits disclosing three main veins. The longest crosscut entry is about 850 ft., and the total underground workings amount to over 7,000 ft. The surface equipment consists of about 3,600 ft. of tram line, a six-drill Leyner compressor, a 125-ton cyanide plant, and a twenty-stamp mill, equipped with crushers, a Dorr classifier, one Wilfley and six Johnson concentrators, and four plates.

The mine as a whole is in good condition, and has a large amount of excellent equipment. A considerable additional expenditure is warranted in the further development of orebodies already exposed in the mine and in arranging the mill to treat the same according to the best milling practice.

The California-Oregon Power Co., the local power company of this region, with headquarters at Medford, Ore., has announced that it will extend its power line beyond the Opp mine due west toward the Gold Ridge, Millionaire, Centennial, and Roaring Gimlet mines, now in operation in the Gold Hill district. This will accommodate the new properties soon to be developed between the Opp and Gold Hill mines.

Gold Hill—The National Manganese Ore Co., an Indianapolis, Ind., corporation, with headquarters at Gold Hill, has taken over the old Centennial placer diggings, three miles south of here, which have been idle for years. Several carloads of equipment have arrived from the East for the erection of a drag-line type of dredge. A power line has been rebuilt to the mine, which will be operated by electric power. Water will be pumped from Rogue River at Gold Hill through a 3-in. pipe line to the diggings, to enable operations to continue during the dry season. The former owners of this property were the Electric Dredge Co., an Indianapolis concern, and the extensive electrical driven equipment on the property was dismantled in the early days of the war and shipped to war industry centers.

The Red Ribbon group of gold quartz mines out six miles west of Gold Hill, and owned by M. S. Johnson, of Gold Hill, has been taken over for further development by Dr. A. M. Knapp, interested in the Boswell Extension mine at Holland, Josephine County, Ore. The new owner is preparing to drive 200 ft. from the surface and under the old works on the vein. The vein averages about 2 ft. in width, but produces high-grade ore running into hundreds of dollars per ton on the pay shoots characteristic of the district.

Sumpter—Blowing-in of the rehabilitated Sumpter smelter, originally scheduled to take place about Sept. 1, has had to be postponed because of delay in arrival of electrical machinery.

Baker—Because of revived interest shown in mining in Baker and Grant counties, a marked increase has been shown of late in the volume of travel on the Sumpter Valley Ry.

Virtue—White Swan mill is running on some very good ore, of a grade similar to that found in that famous property in the early days.

Bourne—Satisfactory progress is being made in reconstruction and enlargement of the E. & E. mill.

MINNESOTA

Heavy Flow of Water in Boeing Pit

Hibbing — The Winston-Dear Co., stripping contractors, have encountered an abnormal flow of water in the Boeing pit, a property of the Mesaba Cliffs Iron Mining Co. The water has necessitated the installing of three steam pumps and one electric pump of large capacities, which at present are handling from 1,500 to 1,800 gal. per min. It is now planned, to facilitate the handling of the water, to put down three cased drill holes to the present underground workings and handle the greater volume of the water by the underground pumps. This scheme will do away with the present installation of pumps in the pit and will permit more rapid movement of the shovel due to lack of the congestion of pipes and pumps.

Ely—The Zenith mine, operated by Vermilion Mining Co., a subsidiary of Pickands, Mather Co., has again curtailed its forces but to no marked degree. The curtailment consisted of the laying off of forty or fifty men, but the company is still employing approximately 130 men. Present plans of the company, besides the completion of the construction work on the condensing plant, provide for the development of the 13th level. This development work will necessitate the sinking of the shaft to a greater depth and drifting in rock until the ore is encountered, before the development in ore can take place. There will also be some development work on the other levels in anticipation of a larger production during the 1922 season.

THE MARKET REPORT

Daily Prices of Metals

Aug.	Copper N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
25	11.375@11.50	25.25	25.50	4.375@4.40	4.20@4.25	4.15
26	11.50	25.625	26.125	4.375@4.40	4.20@4.25	4.15
27	11.50	25.375	25.875	4.375@4.40	4.20@4.25	4.125
29	11.50	25.875	26.25	4.40	4.20@4.25	4.125
30	11.625	26.25	26.75	4.40	4.20@4.25	4.10@4.15
31	11.75	26.50	27.00	4.40	4.20@4.25	4.15@4.20

*These prices correspond to the following quotations for copper, "delivered": Aug. 25th, 11.625@11.75; 26th, 27th, 29th, 11.75; 30th, 11.875; and 31st, 12.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Aug	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
25	66¼	66⅞	70½	149	150½	23½	22⅞	24½	25¼
26	67½	68¼	70½	152	154	23⅝	22⅞	24¾	25¼
27									
29	67⅞	68½	70½	153¼	155¼	23¾	22¾	24⅝	25¼
30	67¾	68¼	71½	156½	158¾	23½	22¾	24½	25¼
31	68¼	68¾	71½	157	159¼	23½	22¾	24¾	25½

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb

Silver and Sterling Exchange

Aug.	Sterling Exchange "Checks"	Silver			Aug.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York, Foreign Origin	London
25	368¼	99¼	62½	38⅜	29	369¼	99¼	62⅛	38¼
26	368¼	99¼	62	38	30	370	99¼	62⅛	38⅛
27	368	99¼	62	38	31	372	99¼	62⅛	37⅞

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, Aug. 31, 1921

A much better sentiment has characterized the metal market during the last two days, although no particular reason can be assigned for the changed feeling. The London market has shown a stronger tendency; sterling exchange has improved; business conditions in this country seem to be somewhat better, particularly in the Middle West; and consumers have come to the conclusion that metal prices are not likely to fall much lower: all of these factors have no doubt had an effect.

Copper

Yesterday and today the copper market has taken a marked turn for the better, and we now know of no agency willing to supply September copper for less than 12c., delivered. This is the price which the larger producers have been asking ever since the break came early in the month, and it seems likely that they will now be able to do some business at that level. In the meantime, however, copper has sold down to 11⅞c., delivered, though the quantity on the market was never large. Producers are not disposed to quote for shipment later than October, but last-quarter delivery could probably be obtained today for 12.25c.

Export demand has continued satisfactory, the bulk of the metal being taken by Germany, Japan, China and France at between 11¾ and 12c., f.a.s.

Monthly Average Prices for August

Copper:	
New York Electrolytic	11.634
London Standard	68.614
London Electrolytic	72.705
Lead:	
New York	4.382
St. Louis	4.217
London	23.489
Silver:	
New York, foreign	61.597
New York, domestic	99.250
London	38.096
Sterling Exchange	364.505
Zinc:	
St. Louis	4.186
London	25.068
Tin:	
99 per cent	25.662
Straits	26.301
London	155.318
Antimony	[illegible]
Quicksilver	45.028
Platinum	[illegible]

Lead

The lead market continues practically unchanged, with producers generally well sold up for current production, and, in some cases, asking a premium because of that fact. Demand has not been great, but neither has it been particularly dull. The St. Louis market has been somewhat depressed by the continued offering of reliable brands at 4.20c., as reported last week, but, on the other hand, a prominent producer has been able to do a fair amount of business at 4.25c. Selling for forward delivery is still not in evidence. Opinion is divided whether the next price movement will be up or down.

A feature of the market during the last few weeks has been the foreign demand, chiefly from the European countries. This has taken away a great deal of bonded lead which would otherwise have had a depressing effect on the market. European supplies are evidently not equal to the demand.

Zinc

The market dropped still lower on Saturday, when weak producers made sales at 4.12½c. in the St. Louis market. A day or two later one small producer sold for 4.10c., which is the lowest price reached in the recent decline. The cheap metal was quickly picked up, however, and late yesterday afternoon bids of 4.15c. were turned down. Today most of the producers have not been willing to sell under 4.20c., but consumers have not been willing to meet this figure. Demand has not been great during the week, but there is no doubt that galvanizing interests have been more active in the market than for some time. Brass special is quoted at 10 points premium over Prime Western, and high-grade is bringing 6c., delivered.

Tin

With a stronger market in London and higher sterling rates, tin prices in New York have risen somewhat without much buying. Consumers seem to feel that the present reaction is only a temporary one, and distrust the spirit of the market. Tin-plate business is reported to be improved. Receipt of two small lots of 99 per cent grade has temporarily allayed the shortage of spot supplies of that variety. Forward delivery Straits continues to be quoted at the same price as spot.

Arrivals of tin, in long tons: Aug. 25th, London, 50; 26th, Straits, 465; Rotterdam, 100; 29th, Rotterdam, 25; London, 25.

Gold in London: Aug. 25th, 111s. 4d.; 26th, 111s. 6d.; 29th, 111s. 4d.; 30th, 111s. 1d.; 31st, 110s. 4d.

Foreign Exchange

The foreign exchange market has inclined toward strength during the last week, but has had no outstanding features. Sterling cables were quoted one-half cent higher than the demand prices given on page 393. On Tuesday, Aug. 30th, francs were 7.815c.; lire, 4.36c.; and marks, 1.175c. New York funds in Montreal, 10 13/16 per cent premium.

Silver

The silver market the last week has been steady but dull, with limited business. Supplies have been moderate, with little pressure to sell. The rise in sterling exchange has tended to offset the decline in London price for silver. The market closes dull.

Mexican Dollars — Aug. 25th, 47¾; 26th, 47⅝; 27th, 47⅝; 29th, 47¾; 30th, 47¾; 31st, 47¾.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 19@20c. per lb.; 18½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 4.50@4.60c.; market dull. W.C.C. brand, 5¼@5½c. per lb. Cookson's "C" grade, spot 9@9¼c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 6@6½c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb., 500-b. lots.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb., black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $160@$170 per oz.

[1]**Molybdenum Metal**—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnage spot, 35@40c.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb. f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominally, $55@$60 per oz.

Platinum—Nominally, $75@$78 per oz.

Quicksilver — Nominal, $45@$46 per 75-lb. flask. San Francisco wires $45.50. Dull.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—22c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 27—Zinc blende, per ton, high, $23.55; basis 60 per cent zinc, premium $21; Prime Western, $20@$18; fines and slimes, no sale; average settling price, all grades of zinc, $21.03.

Lead, high, $53.40; basis 80 per cent lead, $50; average settling price, all grades of lead, $51.20 per ton.

Shipments for the week: Blende, 4,180; lead, 1,040 tons. Value, all ores the week, $141,280. Shipment for eight months: Blende, 176,882; calamine, 102; lead, 39,137 tons. Value, all ores, eight months, $5,216,110.

Producers of zinc ore assumed a more liberal aspect toward accepting price offerings a week ago, and buyers again this week found an easy buying market on a lower level of prices. Fewer than 3,000 tons are reported bought at 2 o'clock today, but it is evident at least one purchasing agency is willing to accept all blende offered on the market on an $18 or less basis any time today. Sellers have held firm against a lowering market while the reserve stock has increased from 60,000 to 90,000 tons.

Platteville, Wis., Aug. 27—Lead ore, $51 per ton. Zinc ore, no market. Shipments for the week: Lead ore, 30 tons. Shipments for the year: Blende, 8,461; lead ore, 1,008 tons, correcting error in total heretofore carried forward. Shipped during week to separating plants, 80 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1.500@$2,000; No. 2, $850@$1,250; spinning fibers, $350@$850; magnesia and compressed sheet fibers, $225@$350; shingle stock, $95@$150; paper stock, $55@$70; cement stock, $16@$27.50; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Borax—Granulated, crystals, or powdered in bags, carloads, 5¾c. per lb.; in bbls., 5¾c.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

China Clay (Kaolin)—Crude, $6.50@$8.50; washed, $9@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@

---

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points

Feldspar—No. 1 soap grade, $7@$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, $6@$6.50; No. 2, $5@$5.50. Market dull. Large stocks are available and quotations are nominal. Producers report cancellations of orders. No. 1, Canadian, ground, $26 f.o.b. cars.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $13.50, f.o.b. Lordsburg, N. M. Ground, acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, ¾@2½c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined—Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $45@$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned—$33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, [illegible]@$160 per ton (depending upon quality); ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports, 77 per cent tricalcium phosphate, $11.65; 75 per cent, $10.65; 75@74 per cent, $10.15; 70 per cent, $6.25; 68 per cent, $5.75; 68@66 per cent, $5.50.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 12c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica—Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $7.50@$11 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—6c. per lb.

Sodium Nitrate—$2.10@$2.30 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $12.50 per ton, f.o.b. in bulk, Western mines, spot and six months' contract; $22@$25 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.25 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 12c. per lb. of chromium contained; 4 to 6 per cent carbon, 13c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $65@$67, f.o.b. furnace; resale, $90, delivered; English, $65@$70, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $26@$28, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works. Imported material, $1.70@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $40; 50 per cent, $65; 75 per cent, $135.

Ferrotungsten—Domestic, 70 to 80 per cent W, 40@45c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$4.[illegible]@$4.50 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York [illegible] 13½c.

Lead Sheets—Full lead sheets, 7¾c.; cut lead sheets, 8c. in quantity, mill lots.

Nickel Silver—31½c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal—Dimension sheets, 16¾c.; sheathing, 15½c.; rods, ⅜ to 3 in., 13¾c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina $50 per ton; 76 per cent, $90@$95 f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—$52@[illegible] per net ton.

Fire Brick—First quality, 9-in. shapes $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $65@$70 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98 f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Aug. 30, 1921

There has been a slight further improvement in demand for sheets and tin plates, but other branches of the finished trade show no improvement, and some have probably lost a little ground.

Steel prices show little change except in sheets. Late in July the open market declined to 3c. on black and 4c. on galvanized, and for a time these prices were shaded $1 or $2 a ton on particularly desirable orders. Then one producer came out with a $5 a ton cut, four other independents following, and the Steel Corporation [illegible] prices, making 2.75c. on black and 3.75c. on galvanized the regular market. Merchant bars [illegible] developed a [illegible] plates are hardly quotable at over 1.80c., or $1 a ton below the price as it declined a month ago. [illegible] changed at [illegible] daily newspaper reports last week of a "reduction" to $4.75 having been based on imagination.

Pig Iron—[illegible] Pittsburgh [illegible] $1.96.

Coke

Connellsville—Furnace, [illegible]; foundry, [illegible].

---

[1] [illegible] Mineral Co., Philadelphia, Pa.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York		London		Sterling Exchange	
	1920	1921	1920	1921	1920	1921
January	132 827	65.950	79 846	39.985	367.082	372.650
February	131.295	59 233	85.005	34.745	337.466	385.932
March	125.551	56 023	74.194	32 479	370.870	389.806
April	119 779	59.337	68.848	34 250	392.438	391.784
May	102 585	59 810	60 010	34.165	383.360	396.580
June	90 957	58.510	51 096	34 971	393.663	377.236
July	91.971	60 260	53.736	37 481	385.538	362.565
August	96.168	61 597	59.875	38 096	360.404	364 505
September	93.675	......	59 476	......	350.370	......
October	83.480	......	54.197	......	346.460	......
November	77.734	......	50.952	......	342.333	......
December	64.774	......	41.845	......	348.101	......
Year	100.900	......	61 590	......	364 840	......

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic		London Standard		London Electrolytic	
	1920	1921	1920	1921	1920	1921
January	18.918	12.597	118 095	70.964	123.238	79.119
February	18.569	12.556	120.188	70 925	126.950	75.925
March	18.331	11.976	109.533	67.565	118.348	71.190
April	18.660	12.438	103.025	69.381	111.500	71.786
May	18.484	12.742	96.750	73 196	109 200	74.298
June	18.065	12.697	87.864	71 852	101.909	75.682
July	18.576	12.170	90.148	71 155	106.455	75 286
August	18.346	11 634	93.935	68 614	111.143	72 705
September	18.144	......	96.381	......	111.905	......
October	15.934	......	93 327	......	104.905	......
November	14.257	......	84.807	......	94.614	......
December	13 188	......	75.702	......	85.905	......
Year	17.456	......	97 480	......	108.839	......

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London	
	1920	1921	1920	1921	1920	1921
January	8.561	4.821	8.300	4 747	47.095	23.387
February	8.814	4.373	8.601	4.228	50 256	20.650
March	9.145	4 084	8.894	4 000	46.054	18 911
April	8.902	4.356	8.618	4.272	39.225	20 589
May	8.576	4.952	8.352	4 784	38 488	23.399
June	8.323	4.485	8.169	4.293	34.330	22.563
July	8.338	4.410	8.283	4.260	34.960	23 399
August	8.687	4 382	8 725	4 217	36.304	23 489
September	8.177	......	8.160	......	35.452	......
October	7.070	......	7 018	......	35 238	......
November	6.159	......	6.127	......	32.489	......
December	4.727	......	4.717	......	24 089	......
Year	7.957	......	7 830	......	37 832	......

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York 99%		New York Straits		London	
	1920	1921	1920	1921	1920	1921
January	61.596	36 000	......	36 000	376.512	190.464
February	58.466	28 534	59.932	32.142	395.750	166.250
March	61.037	27.296	61.926	28 806	369.489	156.024
April	61 120	28 990	62 115	30 404	345 450	163.905
May	53.230	31 431	55.100	32 500	294.813	177.411
June	46.125	28 514	48.327	29 423	250.614	167 506
July	45 798	26 755	49.154	27 655	261.886	164.530
August	43 856	25 662	47 620	26 301	274 048	155 318
September	41.940	......	44.465	......	270 120	......
October	39 310	......	40 555		258 190	......
November	35 667	......	36 854		241 080	......
December	31.135	......	34 058	.	212.440	......
Year	48 273	......	49 101		295 866	......

New York quotations, cents per lb London, pounds sterling per long ton

Zinc

	St Louis		London	
	1920	1921	1920	1921
January	9 133	5 413	58 643	25 262
February	8 708	4 928	61.338	24 850
March	8 531	4 737	53 467	25 077
April	8 184	4 747	47 388	25.530
May	7 588	4 848	45 088	26 923
June	7 465	4 421	41.193	26 750
July	7 720	4 239	41 886	26 262
August	7 835	4 186	41 220	25 068
September	7 661		39 690	.
October	7 150		39.756	..
November	6 247		35 028	...
December	5 824		27 762	.....
Year	7 671		44 372	.....

New York and St Louis quotations, cents per pound London, pounds sterling per long ton

Antimony, Quicksilver and Platinum

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1920	1921	1920	1921	1920	1921
January	10.577	5.258	90.192	48.440	154.23	73.400
February	11.588	5.250	84.432	49.545	151.59	70.227
March	11.056	5 282	92 611	46 796	138.56	72.463
April	10.500	5.137	102.192	45 423	127.04	73.404
May	9.655	5.250	89.560	47.000	97.50	73.740
June	8.289	5 087	90.154	46 846	85.19	74.942
July	7.500	4 735	90.333	44.950	83.94	70.440
August	7.177	4 597	83.806	45 028	111.44	73 222
September	7.113	......	75.000	......	115.20	.....
October	6.723	......	67.200	......	101.70	.....
November	6.109	......	58.417	......	84.75	.....
December	5.534	......	49.577	......	79.62	.....
Year	8.485	......	81.123	......	110.90	.....

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer		Basic		No. 2 Foundry	
	1920	1921	1920	1921	1920	1921
January	$40.47	33 96	$39.88	31.96	$39.86	33.88
February	42.95	28.96	42.61	26.96	43.40	30.25
March	43.40	28.16	42.90	26.46	43.40	27.85
April	43.72	26.96	44.22	24.46	43.90	26 77
May	44.00	26.21	44.88	23.84	45.36	25.56
June	44.89	24 96	45 41	22.66	46.40	24 38
July	47.21	22.84	47.42	20.76	46.56	22.36
August	48.90	.....	49.88	.....	49.35	......
September	50.46	.....	50.46	.....	51.96	......
October	49.21	.....	44.38	.....	48.58	......
November	41.26	.....	39.20	.....	42.61	......
December	36.96	.....	34.90	.....	37.73	......
Year	44.45	.....	43.85	.....	44.93	......

In dollars per long ton.

Monthly Crude Copper Production

	1921 April	1921 May	1921 June	1921 July
Alaska shipments	5,615,500	4,216,920	3,234,693	3,019,812
Arizona Copper	2,000,000	2,000,000	(a)	(a)
Calumet & Arizona	2,204,000	(a)	(a)	(a)
Cons. Aris. Smelting	(a)	(a)	(a)	(a)
Inspiration	1,100,000	(a)	(a)	(a)
Magma	378,900	(a)	(a)	(a)
Miami	4,262,625	4,625,000	3,939,000	4,112,000
New Cornelia	1,864,772	1,327,415	1,300,000	1,502,927
Old Dominion	984,000	(a)	(a)	(a)
Phelps Dodge	1,461,000	(a)	(a)	(a)
Shattuck Arizona	(a)	(a)	(a)	(a)
Ray	(a)	(a)	(a)	(a)
United Verde	2,600,000	(a)	(a)	(a)
United Verde Extension	3,092,746	(a)	(a)	(a)
Calumet & Hecla	(a)	(a)	(a)	(a)
Other Lake Superior	5,000,000	4,500,000	4,500,000	4,250,000
Anaconda	2,935,840	(a)	(a)	(a)
East Butte	1,047,140	1,641,176	1,350,000	1,000,000
Nevada Cons	(a)	(a)	(a)	(a)
Chino	(a)	(a)	(a)	(a)
Utah Copper	(a)	(a)	(a)	(a)
Others, estimated	12,400,000	7,000,000	10,300,000	8,150,000
Total United States	46,946,523	25,310,511	24,623,693	22,033,739
Imports: Ore and concentrates, matte, etc	6,539,005	3,072,707	5,129,065	10,924,973
Imports of blister, unrefined	10,109,145	5,171,662	12,531,637	20,749,969
Imports of refined, etc	19,459,418	7,517,134	3,306,349	595,835
Grand total	83,054,091	41,072,014	45,600,744	54,304,516
Granby Cons	2,459,250	2,539,000	2,254,639	2,255,425
Boleo	728,000	727,098	1,433,804	943,740
Cananea	(a)	(a)	(a)	(a)
Phelps Dodge Mexican properties	407,000	(a)	(a)	(a)
Cerro de Pasco	5,344,000	4,444,000	4,012,000	4,346,000
Chile	3,993,802	3,999,016	4,008 000	4,000,000
Katanga	4,862,025	6,275,430	6,032,880	7,031,745
Backus & Johnston	1,400,000	1,600,000	1,506,000	1,310,000
Hampden Cloncurry	(a)	(a)	(a)	(a)
Mount Lyell	983,360	974,400	902 000	892 000
Mount Morgan	(a)	(a)	(a)	(a)
Cons. M. & S. of Canada	338 000	318,000	152,000	284,000
Falcon Mines	544 000	540 000		486,800

(a) No copper produced during this month.

Comparative Annual Copper Production

	1919	1920	1921
January	135,733,511	121,903,744	90,586 597
February	111,649,512	117,450,000	86 632 941
March	102,040,460	120,309,316	91,046,345
April	98,808,998	116,078,871	46,946,523
May	92,652,975	114,964,207	25,310,511
June	95,856,570	116,107,856	24,623,693
July	100,369,247	109,729,510	22,033,739
August	107,994,040	116,460,654	....
September	108,703,075	104,919,262	....
October	115,143,143	105,231,571	....
November	117,289,735	106,700,178	....
December	102,997,633	95,709,009	

COMPANY REPORTS

Utah's Deficit for Second Quarter, $1,256,475

A report of operations of Utah Copper Co. for the second quarter of 1921 states that, owing to the suspension of mining operations on March 31, the gross production of copper contained in concentrates for the quarter was only 1,406,085 lb., as compared with 23,424,502 lb. for the preceding quarter.

The net production of marketable copper derived from concentrates and from the precipitates produced in the clean-up of the leaching plant was 1,480,697 lb., as compared with a net production of 22,726,411 lb. for the first quarter of 1921.

Mining operations and shipments of ore were entirely suspended on March 31, but a small yardage of capping was removed by one steam shovel kept in service a few days in April to complete a new entrance to the "A" level, which was under way when the mines were closed down.

The Arthur concentrator plant was continued in operation for two days in April in the treatment and clean-up of the tonnage of ore in mill bins at March 31, when the mill was also closed down completely.

Only a limited number of employees are retained in service in the various departments of mine, mill, and ore delivery, employed solely in the necessary caretaking and protection of property, improvements, and equipment. All expenses have been cut to the minimum, including a reduction of 20 per cent in salaries of all company officials. The details of the financial outcome for the quarter are shown in the following statement:

Net loss from copper production	$42[illegible]
Plant shutdown expense	47[illegible]
	$[illegible]
Miscellaneous income, including payment for [illegible], etc.	[illegible]
Total loss	$444,[illegible]
Distribution to stockholders	[illegible]
Deficit	$1,2[illegible]

The item of "plant shutdown expense," covered in the profit-and-loss statement above, includes, in addition to the actual and necessary cash outlay, the regular monthly accruals for taxes, insurance and the usual fixed and general overhead charges. The quarterly distribution to stockholders made on June 30 was at the rate of 50c. per share. As there will be no production to report during the period of temporary suspension, the issuing of further quarterly reports will be discontinued until such time as operations are resumed.

Barnes-King Development Co.

The records of the Barnes King Development Co. show the following operating results for the quarter ended June 30, 1921:

Earnings:		
[illegible]		$[illegible]
Interest received		[illegible]
		$[illegible]
Deficit:		
[illegible]	$[illegible]	
[illegible]	2,743.39	
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
Miscellaneous expense	[illegible]	
		[illegible]
[illegible] on operations for quarter ended June 30, 1921		$[illegible]

The above figures include provisions for depreciation on the various plants of the company on the same basis as has been used heretofore.

Ray Consolidated Deficit $370,210 For Second Quarter

A report of operations of Ray Consolidated Copper Co. for the second quarter of 1921 states that as all operations at mine and mill were suspended early in April, gross production of copper in concentrates for the quarter was only 1,605,654 lb., compared with 8,802,186 during the first quarter, 1921. After smelter deductions, net production was 1,546,535 lb. of copper, compared with 8,563,596 for the preceding quarter. No direct smelting ore was shipped. Earnings for the last four quarters compare as follows:

	1921		1920	
	June 30	Mar. 31	[illegible]	[illegible]
[illegible]	$85,61[illegible]	$[illegible]	$[illegible]	$[illegible]
[illegible]	289,774			
[illegible]	5,431	[illegible]	[illegible]	[illegible]
[illegible]	(a)370,21[illegible]	[illegible]	[illegible]	[illegible]
Dividends			[illegible]	[illegible]
Deficit	370,210	[illegible]	[illegible]	[illegible]

(a) Loss.

No underground development work has been done during the quarter, mine operations having been suspended and concentrator shut down as soon as mine and mill could be put in condition for indefinite closing.

Working forces at mine and mill have been reduced to lowest limit consistent with proper care and protection of plant and equipment, all expenses have been reduced to a minimum, and salaries of company officials have been cut 20 per cent.

Current sales of copper have disposed of all the first-quarter output, and made appreciable inroads upon the stock of refined metal carried in inventory at the beginning of the year. Issuance of quarterly reports is suspended until operations are resumed.

Wolverine Copper Mining Co. Shows Operating Loss

Copper, Michigan

A report of the operations of the Wolverine Copper Mining Co., for the year ended June 30, 1921, states that [illegible] lb. of copper was produced, at an operating cost of 16.423c. per lb., to which should be added the cost of smelting, freight, and marketing, 2.480c., the charge for taxes, 0.700c., depletion amounting to 4.249c. and depreciation of 1.154c., giving a total of [illegible] per lb. Operating statement follows:

Sales:		
[illegible] lb. of copper at [illegible]		$[illegible]
Cost of sales:		
Copper on hand July 1, 1920	$[illegible]	
Operating expenses at mine	[illegible]	
Smelting, freight and New York and Boston expenses	[illegible]	
Taxes	[illegible]	
	$[illegible]	
Copper on hand June 30, 1921	[illegible]	[illegible]
Loss on sale of copper		$[illegible]
Income:		
[illegible]	$[illegible]	
[illegible]	[illegible]	
	$[illegible]	
[illegible]	[illegible]	[illegible]
Operating loss for the year		$[illegible]
[illegible]		
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
		$[illegible]
[illegible]		[illegible]
		$[illegible]

Balance July 1, 1920, was $[illegible], plus appreciation of $[illegible], or $[illegible]. Deducting operating loss for the year of $[illegible], depreciation, $[illegible], [illegible], $[illegible], and loss on sale of Liberty Bonds of $[illegible] leaves a balance June 30, 1921, of $[illegible].

MINING STOCKS

Week Ended August 27, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Ahmeek	Boston	42	40	42	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*32	*29	*29		
Allouez	Boston	18	17½	17½	Mar. '19	1.00
Anaconda	New York	34¼	31¾	33½	Nov. '20, Q	1.00
Arcadian Consol.	Boston	†2	†1½	1½		
Ariz. Com'l.	Boston	7½	7½	7½	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*25	*21	*22		
Bingham Mines	Boston	10	†9½	9¾	Sept. '19, Q	.25
Calumet & Arizona	Boston	46	44	45½	June '21, Q	.50
Calumet & Hecla	Boston	224	220	224	June '20, Q	5.00
Canada Copper	N. Y. Curb	*27	*25	*25		
Centennial	Boston	7½	7½	7½	Dec. '18, SA	1.00
Cerro de Pasco	New York	25¾	24	24¼	Mar. '21, Q	.50
Chile Copper	New York	10	9½	9¾		
Chino	New York	21½	20	20¼	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*23	*16	*16½		
Con. Arizona	N. Y. Curb	....	....	*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1	*89	1		
Copper Range	Boston	30¼	30	30½	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*42	*34	*38		
Davis-Daly	Boston	6	5¼	5¾	Mar. '20, Q	.25
East Butte	Boston	7	7½	7¼	Dec. '19, A	.50
First National	Boston Curb	*54	*53	*54	Feb. '19, SA	.15
Franklin	Boston	1¼	1½	1½		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol	New York	15¾	15	15¾	May '19, Q	1.25
Greene-Cananea	New York	20¼	20	20	Nov. '20, Q	.50
Hancock	Boston	†3	†2	2½		
Howe Sound	N. Y. Curb	2¼	2	2	Jan. '21, Q	.05
Inspiration Consol.	New York	31	29¾	30	Oct. '20, Q	1.00
Iron Cap	Boston Curb			5¾	Sept. '20, I	.25
Isle Royale	Boston	†18	†16½	16½	Sept. '19,	.50
Kennecott	New York	18¾	16¼	17¾	Dec. '20	.50
Keweenaw	Boston	†1½	†1	1		
Lake Copper	Boston	†3	†2	2½		
La Salle	Boston	†1¼	†1¾	1½		
Magma Chief	N. Y. Curb	*7	*6	*7		
Magma Copper	N. Y. Curb	17	17	17	Jan. '19, Q	.50
Majestic	Boston Curb	*5	*5	*5		
Mason Valley	Boston	†1½	†1	1½		
Mass Consolidated	Boston	1½	1½	1½	Nov. '17, Q	1.00
Miami Copper	New York	20¼	19	19	Aug. '21, Q	.50
Michigan	Boston	†2	†1½	1½		
Mohawk	Boston	46	44	44	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	4	3¾	3¾		
Nevada Consol	New York	10	9½	9¾	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	*3		
New Cornelia	Boston	12½	12½	12½	Aug. '20, K	.25
North Butte	Boston	9	8¾	8¾	Oct. '18, Q	.25
North Lake	Boston	†*25	†*15	*15		
Ohio Copper	N. Y. Curb	....	....	*6		
Old Dominion	Boston	21	20¼	20½	Dec. '18, Q	1.00
Osceola	Boston	22½	22¾	22½	June '20, Q	.50
Phelps Dodge	Open Mar.	†1.55	†1.40		July '21, Q	1.00
Quincy	Boston	34	33½	34	Mar. '20, Q	1.00
Ray Consolidated	New York	12	11½	11¾	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*21	*17	*17		
St. Mary's Min. Ld.	Boston	31½	31	31	June '20, K	2.00
Seneca Copper	Boston	15	13½	13½		
Shannon	Boston	*90	*90	*90	Nov. '17, Q	.25
Shattuck Arizona	New York	5¾	5½	5½	Jan. '20, Q	.25
South Lake	Boston	*1¼	*50	1		
Superior Copper	Boston	2¾	2¾		Apr. '17	1.00
Superior & Boston	Boston	1¾	1¼	¾		
Tenn. C. & C. cfs.	New York	7¾	6¾	6¾	May '18, I	1.00
Tuolumne	Boston	*42	*36	*36	May '13,	.10
United Verde Ex.	Boston Curb	23	20	22½	May '21, Q	.25
Utah Consol	Boston	3½	3½	3½	Sept. '18,	.25
Utah Copper	New York	44¾	41¾	42¾	June '21, Q	.50
Utah Metal & T.	Boston	1¾	1¾	1¾	Dec. '17,	.30
Victoria	Boston	†1¾	†1¼	1½		
Winona	Boston	*50	*43	*43		
Wolverine	Boston	11	10¼	10¼		
		NICKEL-COPPER				
Internat. Nickel	New York	12½	11½	12	Mar. '19,	.50
Internat. Nickel, pf	New York	†80	†80	80	Aug. '21, Q	1.50
		LEAD				
National Lead	New York	72	68½	72	June '21, Q	1.50
National Lead, pfd	New York	†106	†103	103	June '21, Q	1.75
St. Joseph Lead	New York	10¾	10	10½	June '21, Q	.25
		QUICKSILVER				
New Idria	Boston	†*50		*50		
		ZINC				
Am. Z. L. & S.	New York	7¼	7	7	May '20,	1.00
Am. Z. L. & S. pfd.	New York	23	22½	23	Nov. '20, Q	1.50
Butte C. & Z.	New York	4	3¾	4	June '18,	.50
Butte & Superior	New York	11½	10½	10¾	Sept. '20,	1.25
Callahan Zn-Ld.	New York	4½	3¾	4	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	.		116½	Aug. '21, Q	2.00
Success	N. Y. Curb	..		*2	July '16,	.03
Yellow Pine	Los Angeles	*50	*35	*55	Sept. '20, Q	.03

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	½	½	½		
Alaska Juneau	New York	1¾	1¾	1¾		
Carson Hill	Boston	14½	13½	13½		
Cresson Consol. G.	N. Y. Curb	1 13/16	1 7/16	1½	June '20, Q	$0.10
Dome Extension	Toronto	*65	*62	*62		
Dome Mines	New York	17	16¾	16½	July '21, Q	.25
Florence Goldfield	N.Y. Curb	*39	*34	*37		
Golden Cycle	Colo. Springs	*69¾	*58	*58	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*6	*6	*6	Dec. '19,	.05
Hollinger Consol.	Toronto	7.35	7.20	7.35	Aug. '21, 4 wks.	.05
Homestake Mining	New York	57	57	57	Aug. '21, M	.25
Kirkland Lake	Toronto	*43	*37	*43		
Lake Shore	Toronto	1.24	1.21	1.24	Aug. '21, K	.02
McIntyre-Porcupine	Toronto	2.01	1.97	2.00	May '21, K	.05
Porcupine Crown	Toronto	*15	*14	*15	July '17,	.03
Porcupine V. N. T.	Toronto	19	16½	18		
Portland	Colo. Springs	*42	*40	*40	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	....	....	*4	May '19,	.05
Schumacher	Toronto	*24	*20	*24		
Silver Pick	N. Y. Curb	*11	*9	*11		
Teck Hughes	Toronto	*17	*14½	*17		
Tom Reed	Los Angeles	....	†*65	*71	Dec. '19,	.02
United Eastern	N. Y. Curb	2 3/16	2 1/16	2½	July '21, Q	.15
Vindicator Consol.	Colo. Springs	....	....	*27	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*4	*4	*4		
Yukon Gold	N. Y. Curb	*94	*85	*94	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*20	*17	*17	Apr. '20, M	.03
Batopilas Mining	New York	½	½	½	Dec. '07, I	.12½
Beaver Consol.	Toronto	*28½	*27	*28	May '20, K	.03
Coniagas	Toronto	1.60	1.60	1.60	May '21, Q	.12½
Crown Reserve	Toronto	*10	*8	*10	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3¾	3¾	3¾	July '21, Q	.12½
La Rose	Toronto	*22	*18	*22	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*17	*14	*17	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.14	1.05	1.14	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4¾	4½	4¾	July '21, Q	.15
Ontario Silver	New York	3½	3½	3½	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	*13	*13	*13	Jan. '12,	.10
Temiskaming	Toronto	28	22	22	Jan. '20, K	.04
Trethewey	Toronto	*14	*9½	*11	Jan. '19,	.05
		GOLD AND SILVER				
Barnes-King	Butte	*75	*65	*60	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*69	*65	*68		
Cash Boy	N. Y. Curb	*6	*4	*4		
Consol. Virginia	San Francisco	†*27	*16	*21		
Dolores Esperanza	N. Y. Curb	1¾	1¾	1¾		
El Salvador	N. Y. Curb	*18	*11	*14		
Jim Butler	N. Y. Curb	....	....	*7½	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	....	....	*4	June '16,	.05
Louisiana Con	N. Y. Curb	....	....	½		
MacNamara M.& M.	N. Y. Curb	*17	*15	*15	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	....	....	4	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 1/16	1½	1 1/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*74	*67	*67		
Tonopah-Extension	N. Y. Curb	1½	1 7/16	1½	July '21, Q	.05
Tonopah Mining	N. Y. Curb	1¾	1¼	1 1/16	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	*80	*77	*77	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N. Y. Curb	*9	*8	*8	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	†1.20	†1.05	...	Dec. '21,	.15
Chief Consol.	Boston Curb	2½	2 7/16	2¼	Aug. '21, Q	.05
Consol. M. & S.	Montreal	15	15	15	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†2.50	†1.30	...	July '20, Q	.10
Daly-West	Boston	†3	†2	2½	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	....	....	2	Apr. '21, K	.05
Electric Point	Spokane	*6½	*5	*5	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*35	*28	*32		
Federal M. & S.	New York	†9	†5½	7	Jan. '09,	1.50
Federal M. & S., pfd	New York	22½	22¼	22½	June '21, Q	1.00
Florence Silver	Spokane	*11½	*11	*11½	Apr. '19,	.01½
Grand Central	Salt Lake	†*65	†22	..	June '20, K	.03
Hecla Mining	N. Y. Curb	4	3 15/16	4	June '21, Q	.08
Iron Blossom Con.	N. Y. Curb	*18	*18	*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†3.00	†2.00	...	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*3	*3	*3	June '21, I	.02
Prince Consol.	Salt Lake	*23	*17	*17	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*3	*2½	*3	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*8	*6	*8		
South Hecla	Salt Lake	*35	*35	*35	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*12	*10	*12	Oct. '17,	.05
Stewart Mining	N. Y. Curb	*4	*3	*4	Dec. '15	.05
Tamarack-Custer	Spokane	1.75	1.75	1.75	Jan. '21, K	.04
Tintic Standard	Salt Lake	2.20	2.05	2.05	July '21, Q	.05
Utah Apex	Boston	2	2	2	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	....	..	*2	Nov. '17,	.01
		VANADIUM				
Vanadium Corp.	New York	27¾	25¼	27	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	40¾	38¼	39	July '21, Q	1.50
Asbestos Corp., pfd.	Montreal	70	67	68	July '21, Q	1.75
		MINING, SMELTING, AND REFINING				
Amer. Sm. & Ref.	New York	34½	29¾	31½	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	69½	63½	63½	June '21, Q	1.75
Am. Sm. pf. A	New York	†66	†61	67½	July '21, Q	1.50
U. S. Sm. R. & M.	Boston	28½	27½	27½	Jan. '21, Q	.50
U. S. Sm. R. & M. pf	Boston	38½	37½	37½	July '21, Q	.87½

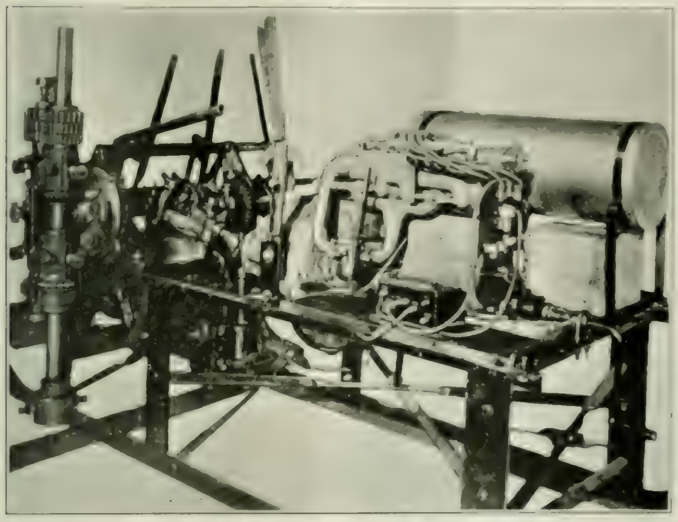
INDUSTRIAL NOTES

Gasoline Driven Diamond Drill Portable and Efficient

A compact, self-contained diamond drill, operated by a gasoline engine, has been placed upon the market by the Diamond Drill Contracting Co. of Spokane, Wash. The drill is mounted on a steel frame provided with steel skids. It contains the drilling head and feed arrangements, a rope drum one foot in diameter by one foot long, for hoisting the drill rods, a pump, and the gasoline engine. The engine is of the gasoline automobile pattern. The rig complete weighs 1,650 lb. By means of the steel skids and the rope drum it can haul itself into many difficult positions, and after leveling up is ready to operate. With a crew of three and the aid of its own power a distance of four miles over comparatively rough country has been made in two days. The outfit is made particularly for use in prospecting in rough, mountainous country.

In one instance a machine of this kind was moved a distance of thirty five miles under its own power and our views show stages in this journey. For the first three and one half miles the machine was placed upon a cedar pole raft, together with all tools and supplies, including 600 gal. of gasoline. The swivel-head of the drill was inclined at a suitable angle and a screw propeller attached to the end of a section of drill rod. This arrangement enabled a speed of two and one half miles an hour to be attained and about half this speed when the raft was sent upstream on a river discharging into the lake. The machine was next moved under its own power eight miles over a mountain trail by means of a cable attached to trees and the hoisting drum. A sled loaded with supplies and gasoline was "snaked" behind the drill. It was transferred to another lake, and then three and one-half miles over a steep mountain trail to the drilling site at an elevation of 2,500 ft. above the lake.

With the ordinary arrangements a steam boiler and engine are required. This greatly increases the weight and difficulty of getting a drill outfit into position. The gasoline rig is a light weight unit compared with the ordinary rig, and its operating cost is such that it is cheaper to operate under gasoline power than by cutting and using wood in a steam boiler at the drill site. The unit presents many advantageous points for prospecting purposes.



PORTABLE POWER DRILL ON SKIDS

The Hercules Powder Co. has announced a reduction in price of twenty-five cents per hundred pounds on all Hercules high explosives, effective August 20.

RAFT CARRYING DRILL OUTFIT PROPELLED BY DRILL ENGINE

Special Fabric Used as Covering for Concentrating Tables

"Minefab," a new covering for concentrating tables, is described in a folder issued recently by E. I. du Pont de Nemours & Co.

The development of a large number of special fabrics by this company for varied industrial uses has led to the production of "Minefab," which is described as a specially treated fabric of great tensile strength made permanently impervious and flexible by the thorough impregnation of both its surfaces with a non-deteriorating waterproof compound, highly resistant to chemical action and to abrasion.

It is stated to be the only material ever made for the specific purpose of covering concentrator tables. A long period of service tests which gave the most satisfactory results have led the du Pont company to recommend it as thoroughly satisfactory for the treatment of all ores.

Self-Cleaning Attachment for Burners of Carbide Lamps

A self-cleaning attachment for burners of carbide lamps has been invented by two Michigan copper country men, John Emil Turja and Jacob W. Jacobson, both of Hancock, Mich.

The invention, for which patent was allowed May 10, 1921, relates to carbide lamps and especially to a means for cleaning the burners without having to extinguish the light or to remove the lamp from its position or provide other means of light while cleaning the burner opening. The invention is of such nature that dirt may be discharged from the burner outwardly and not forced inwardly into the gas conduit as the present cleaning method does.

The present method of cleaning burners of carbide lamps, especially of miners' carbide lamps, is for the wearer to carry upon his person a cleaning wire which he inserts from the outside through the burner opening, pushing the foreign matter in the opening into the base of the burner tube, where the dirt repeatedly arises with the gas flow and causes continuous clogging of the burner. This method of cleaning demands that the light be first extin-

DRILL [illegible] ON SKIDS MOVING [illegible] guished and other means of light be provided while inserting the wire into the burner opening. In many instances carbide lamps are used for igniting dynamite charges; when the fuse ignites it spits powder and this powder clogs the burner opening. When this occurs, the miner is subjected to hazard unless he has provided other means of light.

The invention overcomes all the above objections and makes the cleaning of the burners of carbide lamps a momentary one which may be accomplished by simply pressing a button on the outside of the lamp and without having to remove the lamp from its position or extinguish the light. Furthermore, any possible clogging in the gas conduit is eliminated.

The inventors of this attachment can be addressed at 735 Elm Street, Hancock, Mich., for full particulars.

Motor Trucks Demonstrate Worth in Great Emergency

During the memorable "Outlaw Strike" some months ago, not a few of the country's very large shippers turned to the motor truck as a solution of their freight problems. Among them perhaps none was in a better position to meet the emergency than the Linde Air Products and Prest-O-Lite companies. The accompanying photograph shows that the trucking alternative is not always a bed of roses. The trucks shown are loaded with Linde Oxygen, and much of their way they had to fight a passage through mud up to the hubs, but they got through, delivered their cargoes where the oxygen was urgently needed, and brought back their burden of empties for refilling.

The Linde company and the Prest-O-Lite company are now operating several fleets of motor trucks. Other large companies that have not the advantage of picking up return loads of their own are, in some instances, carrying return freight for other shippers, thus making their trips pay both ways.

MOTOR TRUCKS IN EMERGENCY SERVICE

Campaign Launched in Southwest To Boost Copper Sales

The El Paso office of the Mine & Smelter Supply Co., of which J. L. Harman is manager, is launching a campaign for every one in the Southwest to "Buy Something Made of Copper." Every one in that section of the country, says Mr. Harman, is directly or indirectly dependent upon the copper industry for prosperity and should aid in the movement. Some of the ideas suggested are as follows:

Stamp outgoing letters "Buy Something Made of Copper."

Insert the same slogan in advertisements and in window cards. "No matter whether you are a milliner or an undertaker, put the window card in action just the same. The lady who buys a new fall hat may be a miner's wife. Also, they make copper coffins nowadays."

Display copper wares in store windows.

Have a copper week, the same as California has her Orange Day and Pennsylvania her Apple Day.

Hauling Gold Ore in Alaska

Until recently, the transportation of the ore was one of the most serious problems confronting the Guggenheims' Premier Gold Mining Co. The "Caterpillar" Tractor solved the problem, and two of the five-ton models are now engaged in the work. It is expected that during the winter the tractors will have no difficulty in bringing to the wharf all the ore that is mined—a total estimated at 3,000 tons. A short haul out of the mine, over trails so winding that trailers cannot follow the tractors, is handled by teams. The balance of the haul to the wharf is handled by the "Caterpillar" Tractors, which make one round trip daily, each pulling three trailers. A minimum of 20 tons of ore is delivered to the wharf daily.

In the spring, when the roads become soft, it is planned to use trailers equipped with "Caterpillar" tracks.

The Redwood Manufacturers Co. of San Francisco, manufacturers of "Remco" continuous and machine bound redwood pipe and tanks, has just been awarded a contract by the City of Norfolk, Va., for a 10-mile pipe line from Lake Prince to the City of Norfolk. The contract is for 39,600 ft. of 36-in. pipe and 12,700 ft. of 30-in. pipe. When constructed the pipe line will carry water at pressures of 70 ft. to 250 ft. head.

TRADE CATALOGS

Hoisting Equipment—National Hoisting Engine Co., Harrison, N. J., have issued the sixth edition of their catalog, "Improved Hoisting Equipment." The publication gives illustrations and specifications of an extensive line of electric hoists, gas and gasolene engine hoists, belt-operated hoists, derricks and derrick fittings, trench cableways and pile drivers.

Hoisting Equipment—S. Flory Manufacturing Co., Bangor, Pa., have recently issued their catalog No. 26, "Flory Hoists." This issue includes illustrations and data covering the company's standard special types of hoists and hoisting machinery.

Steam Tables—The Wheeler Condenser & Engineering Co., Carteret, N. J., has issued a sixth edition of the company's "Steam Tables for Condenser Work." The calculations for these tables, which range from pressures of $\frac{1}{10}$ to 214 lb., are specially made for this work by Prof. Marks, on the basis of the latest Marks & Davis tables for saturated steam. The convenient, pocket-size book and the legible well-arranged tabulations will appeal to all users. A section on correction of readings is a necessary and useful portion of the work.

Rotary Pumps — The Connersville Blower Co., Connersville, Ind., have recently issued Bulletin 196, "Valveless Rotary Pumps," which describes the design and construction and refers to some of the applications of Connersville pumps. These are used extensively in mining operations, in handling liquids as well as serving as vacuum pressures in vacuum filtrations.

Damper Regulator—The Atlas Valve Co., Newark, N. J., has just issued, as Bulletin No. 5, a description of the company's Victor damper regulator No. 3, for boiler pressures up to 250 lb. The damper-actuating piston is moved by hydraulic pressure, and has a compensating attachment which permits the damper to be fully opened or closed only on extreme boiler pressure variations.

Magnetic Clutches — Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has recently issued a pamphlet, entitled "C-H Magnetic Clutches," describing the use of magnetic clutches in connection with synchronous motors for heavy work. Several installations are illustrated and considerable valuable data are included in the bulletin.

Hoists—Bulletin No. 1819 of the Allis-Chalmers Manufacturing Co., Milwaukee, Wis., is issued by the mining machinery department and is entitled "Electric Hoists." Photographs and general descriptions of the various types now installed in the mining field are given, together with such supplementary information as will be of value to the mine executive.

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, September 10, 1921 Number 11

Support the Institute

A CORRESPONDENT raises the question whether it is worth the price to belong to the American Institute of Mining and Metallurgical Engineers. If our opinion is of value to him, it is to the effect that this society is the one organization to which he cannot afford not to belong. We believe that every engineer who is eligible should become a member. The society has been wonderfully active and virile, and that character still continues. What it has done in the way of developing knowledge of mining technology and in the advancement of it cannot be overestimated.

We are weighing our words. No small part of the prominence of the American Mining Engineer has been due to the exchange of knowledge, the instructions of the technical papers, and the general feeling of solidarity and good-fellowship which has been brought about by the Institute. We urge most sincerely every engineer who can qualify to join; and to all who are in it we represent that it is a benefit, and not only that but a duty, to remain.

You owe something—probably a great deal—to your profession, and you can express this debt most simply by being a member of the Institute and supporting it.

The Rôle of Criticism

WE WRITE this explicitly because it is our creed, and also lest our friendly criticism or friendly joking concerning *Mining and Metallurgy*, or any other detail of the Institute's activities, should be misunderstood for lack of belief in the necessity of loyalty and support for the society.

A sure sign of a good citizen is when he takes enough interest in the affairs of government to applaud and censure; and the same principle applies to the members of a great society. A great, virile organization like the Institute can never escape adverse criticism: it will never desire to, for the only man, and the only society, that never makes mistakes is a dead one. And besides mistakes, there is a difference of opinion, and both sides should express their opposing views; and out of this discussion we shall get enlightenment, and finally a course of action shaped by the feeling of the majority.

The Institute is an organization, not an individual; and if we make suggestions and criticisms we are only one of thousands of members who do so. Such differing points of view will be heard in its meetings, on its committees, in its directors' meetings, in conversation among its officers. It is organized like any well-ordered society, toward that end. No Lenine-Trotzky regime dictates; there is no head to attack; no prince to assassinate; no one but members, directors, and officers, who all have their ears to the ground to find out what the great body of the Institute wants and how its interests (which means the interests of the profession of mining engineering), can be advanced.

The Necessity of Taking Part

WE HAVE A LOT of suggestions and further criticisms to make to the Institute, but we do not want to spoil what we have, in a genuinely appreciative spirit, written above. We know the Institute will be thankful for them, as its members and officers have been in the past, and have so generously and courteously expressed themselves to that effect. Wherefore, brother members, go thou and do likewise. It is your society, and the temporary management of the society is keen to know what you are thinking about it, and chiefly solicitous that you should do some kind of careful thinking about it.

The solidarity of mining engineers is a mental economic and spiritual safeguard for the profession; and the Institute is the only society which symbolizes and makes coherent that solidarity.

The Sensitiveness of the Modern Economic System

THE MODERN ECONOMIC SYSTEM is a highly organized and exceedingly complex arrangement. It is a gradual development from the primitive custom in which each family group produced enough for its own particular requirements, to the complicated modern order in which we are all more or less highly specialized cogs in the great machine that keeps the world moving and improving. Under this scheme the rancher, to take a homely example, raises cattle, the hides of which are used by the shoe manufacturer to make shoes for the rancher or any one else demanding them. The miner in his turn produces copper for use in electrical machinery necessary to the economical production of shoes and other commodities. And so on. Through an exchange of commodities or services we are able to satisfy our wants to a certain degree. In normal times this arrangement brings about a fairly stable relation between the various producing groups, and prices are evolved that represent an adequate return for any particular branch of production or service. Every unit is closely knit together, nationally and internationally, and mutually dependent.

When some economic upheaval such as war or a financial panic and period of depression affects one or more of these commodities the others are also disturbed, the economic system is disorganized, and the complaint is made that conditions are highly unsatisfactory. The fact that the modern economic system is so sensitive to sudden change and slow in readjusting itself largely accounts for the maladjustment in which many branches of commerce now find themselves, as price relations are still abnormal, raw material prices being far below those of manufactured products. This situation must ultimately correct itself.

In the meantime the mining industry, as one of the great raw-material producing industries, finds itself in the short space of two years plunged from the heights of prosperity, fat dividends, [illegible] and the [illegible] symptoms of the times—to the most depressed period in many a year. The feeling is not enjoyable, but it has already deeply affected other units of trade. The shutdown of the copper and zinc mines of the country first shook labor, both skilled and unskilled, which was forced to seek employment in other activities, but under the unfortunate circumstance that other industries were also feeling the depression. Railroads lose heavily in revenue. In a period noted for its exceptionally high rates made to help them out of financial difficulties, the roads are unable to take the fullest advantage of this increase, because of a serious loss of traffic. Mine supply companies are hit, dynamite sales fall off, and machinery manufacturers push sales on a basis of replacement and the introduction of more efficient methods rather than greater production. Incidentally, the metal-producing states find their revenue cut severely, and are hardpressed to meet some political program decided upon at a more opportune time.

The fact that mining industries are depressed and that this is bound to have an effect upon others will ultimately result in some general readjustment of prices bringing them to a more normal relation, and though the process is tedious and nerveracking in its suspense, the mining industries can rest assured that sooner or later their period of inactivity will help to bring a correction among other commodities and services which will start the wheels of the mines turning again.

A German Example of a Technical Society Publication

GERMANY BECAME FAMOUS, among other things, for that efficiency which brushes aside morality and decency. Just as the Germans, however, are not wasting time on singing their hymns of hate these days, but are busy picking up the fragments, and with very good result and very efficiently, as reports go, so in this country we have since the armistice given over the exposal of the moral destruction back of such efficiency as Germany's. Therefore, we survey with renewed interest some account of an engineering journal published in Germany, as communicated to us from trustworthy private sources. This journal is published in German under the name of *Industrie und Technik*, in English under the name of *Engineering Progress*, also in Russian and Spanish. Our informant states:

"As far as *Engineering Progress* is concerned, it is a pure propaganda paper. In the heading of this paper, the publishers are stated to be the Society of German Engineers, the Association of German Steel Manufacturers, and the Society of German Electrical Engineers. The editor is one of the directors of the Society of German Engineers. These societies, however, have no financial interest in the matter, the real publisher being the Auslandsverlag C. m. b. H., which is an organization formed for industrial propaganda in foreign countries, and which is strongly backed by what is called here the 'heavy industry,' by which is chiefly understood the Rhenish iron and steel industry. The Auslandsverlag is a part of a large organization, initiated during the war for the purpose of export propaganda for the German industry.

"The first enterprise started was a company formed for the purpose of centralizing the placing of advertisements in foreign journals, with the aim to secure in that way an influence in foreign publications, and by that an amount of favorable publicity. This company has representatives and agencies in most foreign countries. It is conducted not so much as a commercial enterprise as a propaganda institution. Large funds are at the disposal of the company. The activity of this company has caused rather unfavorable comments not only abroad, but also in Germany; in the latter country for the reason that it plays an important part in the movement of bringing the German press under the influence of the iron and steel industry. Already a section of the press has been bought up by this industry, and a large number of papers are financially dependent on it, on account of the large influence the company has gained in the financial field."

Reverting to *Engineering Progress* in its different language-editions, our correspondent informs us, "The methods by which these publications have been financed is peculiar. Industrial firms have been solicited, with some pressure used, by the industrial organizations to subscribe to a number of copies, and to pay the subscription fee for several years in advance. A large amount of money was in that way received. Krupps, for instance, are said to have subscribed to several hundred copies for four years."

We have quoted liberally from this fascinating description, as we are much interested in the various types of technical journals, including those published as independent enterprises and those published by the technical societies, but as commercial ventures. In a recent address before the Philosophical Society in Washington, Dr. Robert B. Sosman analyzed the field, classifying the journals published by societies as altruistic, as opposed to the independent journals, or those published for profit. In a letter to him, however, we pointed out that the technical journals published by the societies were frankly, and according to their own statements, published for profit, and that the whole matter required closer analysis. We may thank heaven pharasaically that "they do these things more efficiently in Germany" when we learn of the frank union of the German engineering societies with a venal and prostituted technical press. May we be saved from this kind of efficiency! Individualism and the simple life were the original basis of Americanism; and we should cling as tenaciously as may be to whatever shreds of those ideals the times allow us to retain.

Labor's Stake in Industry

THE LARGEST TWO mining properties in the Grass Valley district in California, the North Star and the Empire, have been again beset by labor difficulties, which had their immediate origin in an attempt to equalize wages in relation to living costs. The prevailing wages had been increased during the last few years until neither of the mines mentioned was making a profit. According to Charles G. Yale, the cost of producing an ounce of gold has reached $19.35 per oz. in the Grass Valley district. It was definitely stated that neither mine could operate under the prevailing wage. Thus the continuous employment of 600 or more miners is threatened.

Recently the Alaska Gastineau Mining Co. closed its Juneau property after a gallant fight to continue. During 1920, 478 men were continuously employed at an average wage of $5.12 per day. The Mother Lode mines of California several months ago succeeded in reducing the prevailing wage scale without a strike. The difficulties of the copper miners are too well known to render recounting them necessary. It is apparent to even the casual observer that the mining industry is facing a hard struggle to maintain itself and bridge the wide gap intervening between the present stagnation and prosperous times.

Labor is most benefited by continuity of employment and stability in both wages and living costs. Necessarily there must be hope of advancement or promotion. Interest of the employer and the industry generally in the hopes, aspirations, and welfare of its workers is just as essential as the interest of the worker in his particular job. Although it is true that in individual instances labor has been exploited, it is also equally true that labor has had its share in the exploitation of the public and individual employers as well. Exploitation of one kind or another by various groups is inevitable in our civilization. The great proportion of leaders in an industry are essentially fair-minded and solicitous for the continuation of that industry along sound economic lines and with the least possible exploitation of any interest involved, whether labor or the purchaser of its product. Were labor equally solicitous for the economic soundness of the industry from which it derives its living, there would be a whole-souled joining of interests and team work that would be of great benefit to the individual worker and therefore to all.

Efficient management and sound financing are as important to the worker as to the industry. Wages are important, but more important is the return made for the wages. Continuity of industry cannot be maintained without a substantial return in production, whether in tons broken per drill shift or saucepans made per labor shift. Collective bargaining carries with it collective responsibility and individual responsibility as well. If labor makes collective bargaining its tenet, then it must secure a thorough understanding of the economics of an industry, the peculiar difficulties that beset it and its relation to the common weal. Its responsibility is such that an industry cannot be allowed to wither and die, for this means a profound disturbance to the workers in that industry. In assuming the burden of collective bargaining, labor has taken a huge task upon its hands. To carry it out successfully it must secure the best executives and most comprehensive knowledge. Without this, collective bargaining may be disastrous both to the industry and the worker.

The present state of the mining industry is due to the limited demand for the metals despite the low prices prevailing. Were it possible for the mines to market a considerable proportion of the metals produced, operation for a limited time might be practicable, but with low prices and inability to market a considerable proportion of production at such prices, operation would speedily absorb available capital. In gold mining, many operations have been sustained largely out of a desire to retain working organizations and to prevent unemployment as much as possible. In other kinds of mining employment has been given to as many as possible in new development and plant improvements.

Labor has a stake in industry. It is as important a one as the other fellow's. There has been too much discussion of individual rights, too much bickering among workers' organizations, and not enough of labor's interest in continuous productive industry. There has been too much complaint of exploitation and not enough appreciation of the persistent effort to keep the wheels going. There is not enough faith in disinterested efforts. We feel, however, that a majority of the skilled and semi-skilled workers in the mining industry are sound and have at heart pride in their industry. We bespeak a larger participation in the control of labor policies by them. We believe that a change is taking place that will cause a more decided pulling together than has hitherto been evident. In the specific instance given in the beginning of this editorial we have been informed that the Grass Valley miners are getting together with the operators. Their common interests would indicate a speedy and satisfactory adjustment of existing difficulties. The prevalence of this spirit now and in the future is indicative of the continuance of mining operations in such a way as to be remunerative to both employer and worker, without which industry cannot prosper.

From Beans to Bonus

THERE ARE WILDCATS and wildcats when drilling for oil is considered, as every one knows. There are wildcats that ought to be encouraged in their efforts to be good, and there are other wildcats that ought to be spanked. Spanking a wildcat is something like belling a tame cat. First you have to catch him and make sure that you have him.

Out in Fallon, Nev., a district renowned for its production of siliceous oil beans, the wildcats have been busy many, many moons. For over two years there have been frequent attempts at well drilling in this locality, some of which died a-borning and others of which died before they were born. Not one has resulted in anything except a slender hole in the ground. But the ground out at Fallon looks as if oil ought to be there, the wildcatters say. On the other hand, knockers say that geological conditions there are unfavorable. But are not oil beans produced locally, and is this not a doubt-removing argument-clinching fact? How could you have oil beans, if there was no oil? Tell us that, ye doubters and knockers.

Anyhow, the government of the State of Nevada has offered $25,000 as a bonus for the first producing oil well, and the wildcatters are about to go at it harder than ever.

Words, Words

"LEASER," meaning "lessee," is frequently heard in mining camps from East to West and from Canada to Mexico. Fay, in his "Glossary," defines it when thus used, as a colloquialism of lessee in the West. Webster calls such use of the word rare, obsolete or dialectic, but defines it as "one who leases." "Leaser," thus used, is not rare and certainly not obsolete. Possibly it is dialectic, though a word familiar to several million widely scattered inhabitants of this country can hardly be termed dialect or slang.

Apparently the dictionary here is merely lagging behind the development of our tongue. One who quarrels with a dictionary, however, may not expect to have the last word. Another definition given by Webster for "leaser" is "liar." This is really obsolete, but some having Mark Twain's famous definition of a mine owner in mind will be apt to confuse it with "lessor" rather than "lessee."

WHAT OTHERS THINK

"Science, Journalism, and Hypocrisy" Recast, In Accord With the Mark Diagram

The editorial in *Engineering and Mining Journal* of July 9 on the above test strikes such a sympathetic chord in my breast that I am tempted to try you out along the strike, but at greater depth. I wonder if your thoughts were limited by the National Geographic Society. Was it not possible that the same formula could be applied to societies a little nearer home? To be more concrete, does not much that you say apply to the old A. I. M. E.?

In the issue of the *Journal* of Nov. 16, 1912, you published a diagram got up by our friend Mark Lamb, aiming to aid the beginner in locating his standing as a mining engineer. In this diagram, if you will take a straight-edge and draw a line from "Member A. I. M. E.," through "Envied," you will find "Hand to Mouth." If you instead draw the line through "Mining Geologist," it strikes "Visiting Wife's Folks." To this point I can vouch for the truth of the diagram.

One more trial. Draw the line from "Contributes to the *Journal*" through "Mining Geologist," and it hits "Check Book." My dear Mr. Editor, you might tell us if that part is true—I can't; but if you will look over on the next line you will note that the last line runs through "Common Sense"; so I am still a believer in the diagram.

Now let's mud out and put in a longer steel. Do you think that the average member of the A. I. M. E. gets his money's worth? If you think he does, please tell us why and how. Of course he can tack the "Member A. I. M. E." to his "Member N. G. S.," which may look nice in his obituary, but will it increase extraction any? You agree that the National Geographic gives you your $3.50 worth in magazine, but how do you come out with the A. I. M. E.? I confess to belonging to the two societies, and I think that I get the most for my time and money in the N. G. Society. Did the membership committee of the A. I. M. E. ever send back the initiation fee because the applicant was not far enough advanced in the requirements for membership?

Judging by a perusal of the year book, I should judge that in many cases they gave the candidate the benefit of the doubt. Maybe they did so in my case too, but I am in now, and my wife has gone to the expense to buy me one of the nice little badges of the two crossed hammers. I fear every moment that she will find out that they are not official badges, and that she will have another reason why no young lady should ever marry a mining engineer.

I proposed some of the foregoing notions to an old member of the society, and his answer was, "But think how much the A. I. M. E. does for the general good of the mining engineer"; and I have thought and still am thinking. The average mining engineer can stand quite a bit more of this "good" without having his coffers overflowing.

As Zach Sweeney used to say, "Don't just be good; be good for something."

How much does the A. I. M. E. assay in "good for something"? "The question ain't who, but why."

New York City. "TOMMY KNOCKER."

The Theory of Special Pleading

Principles terminate in precipices. If it is your principle, as expressed in a recent editorial, to support the mining industry "finely and honestly," do not flinch at the precipice. To trace the original finely etched chiaroscuro on some palimpsest were simple compared to determining just how you support the mining industry in displaying the anti-tariff pen of Marc Pawl on minerals and supporting this policy editorially.

Nascent mining industries need the protection of tariff if we expect them to thrive in this country. The readers of the *Engineering & Mining Journal* who make their livelihood by mining expect to read a brief FOR a tariff on minerals, and not to find in your columns print which would make them think you have become some puisne advocate of the manufacturer, who is anxious to have foreign minerals imported duty free, which will permit him to make large profits on account of tariff protection he enjoys on his finished product.

Let the mining papers support the miners, and not enshroud their principles with a caliginous vapor, which might conceal the principles they print they are anxious to support.

Those whose finances will be adversely effected by a minerals tariff will quickly enough find objections to protection on minerals, and it will then be time enough to see what is "the greatest good for the greatest number."

We have read how the Almond Growers' Association work for a duty on almonds—the dye manufacturers asked protection on dyes—surely mining publications can support a tariff on minerals.

The United States is perhaps the richest country in the world in minerals. The virgin resources of Alaska are immense. Congress will do well to stimulate prospecting by favoring a tariff on minerals. A mining journal should be proud to support such a measure. Chromite, magnesite, asbestos, tungsten and many other important minerals need the tariff to allow operations of the mines in this country. To help such operations should be your endeavor. C. S. MALTBY.

San Francisco.

Should Copper Blast Furnaces Be Bricked Up to the Tuyéres?

I am much interested in the results published by Julius H. Gillis in *Engineering and Mining Journal* of Aug. 13. I have noticed, in my work, that a furnace will speed up in a damp climate and handle a greater tonnage than when the air is clear and dry. However, I do not think that Mr. Gillis or any of the other metallurgists have mentioned what to my mind is the greatest factor in obtaining a maximum tonnage per square foot of hearth area.

Several years ago I was in charge of a blast-furnace plant consisting of one 20-ft. and two 30-ft. furnaces, and in this plant we treated a magnetite ore which produced sows. When one of these furnaces was rebuilt and newly bottomed, with the tuyères 20 in. from the bottom, it ran much slower than the other furnace that was filled with the sow. As the sow built up in the new furnace the tonnage gradually increased, until it reached its maximum, when the sow was on a level with the tuyères and the connection was almost closed. This plant had to suspend operations at the outbreak of the World War, and I did not have a chance to experiment further with the different conditions, although I made a record of 8.7 tons per square foot of hearth area.

Several years later I took charge of a plant in the Southwest, where the blast-furnace work had been very unsatisfactory, and, remembering about the sow in the other plant, I bricked the furnace up to the tuyères when I overhauled it. This furnace gave an average of 10.2 tons per square foot of hearth area when put in operation, which leads me to believe that a crucible is a detriment to a copper blast furnace producing matte.

I would be glad to hear from any other metallurgists who have been experimenting along this line. Below are a few tables showing tonnages handled under various conditions:

TWO BLAST FURNACES [illegible]

Month	Average Daily Tonnage	
May	921	[illegible]
June	1,206	[illegible]
July	1,262	[illegible]
August	1,400	[illegible]
September	1,641	[illegible]
October	1,683	[illegible]
November	[illegible]	[illegible]
December	2,240	up

OPERATION OF SMALLER FURNACE IN SOUTHWEST WITH AND WITHOUT A HEARTH
Furnace 42 x 168 In.

	Tons
[illegible], with a hearth	724
[illegible], with a hearth	5,828
[illegible], without a hearth	[illegible]
March, without a hearth	[illegible]
April, without a hearth	[illegible]
May, without a hearth	[illegible]

The improvement, as the crucible is eliminated, is evident. F. K. BRUNTON.

Venice, Cal.

Radium Ore Supply Not Limited

The editorial in *Engineering and Mining Journal* of June 25, quoting a Baltimore physician, a "radiologist," suggesting the exhaustion of the available radium ores in the world in possibly fifteen years, was lately brought to my attention as a quasi-radiologist. Having visited most of the carnotite mining fields of Colorado-Utah and the more recently known fields of the Carrizo Mountains, in New Mexico and Arizona, and having observed the rate of production of carnotite and its associated minerals, I venture to predict the availability of radio-active ores from these fields alone for a much longer period than the fifteen years referred to by the "radiologist."

At present there is little production of these ores; the industry is passing through a period of depression. Sacked ore is stored in many places, awaiting shipment. Production of ore, of concentrates, of radium sulphates, of the refined product, as well as the byproducts of vanadium, are awaiting better days. Some unsold radium menaces the market for those who are not sufficiently large and influential to control the situation. At the same time the miner is again being "shaken out." The history of mining and milling of radio-active ores in Colorado and Utah is marked by a series of shutdowns and revivals that appear arbitrary and designed to keep the small producer in his place. At the present rate of production the Colorado ores will last several centuries.

Figures giving ore reserves of irregular orebodies lying unexposed or partly exposed in sedimentary beds in an area containing nearly 100,000 square miles, part of which is not yet explored save by the manufacturer of "white mule," are likely to be uncertain.

An addition to the known area that is mineralized is that region lying on all but the north side of the Carrizo Mountains in Arizona, where rich vanadium ores, associated with medium grade radio-active ores, have lately been discovered. From several trips into that region it appears probable there are many years' supply of both vanadium and radium for the United States in these new and almost unexplored fields.

Farther to the west and also to the southwest are still other fields. There will be plenty of material for vanadium steel automobile axles and radium applicators for an increased use for an uncertain and unguessable number of years. There is work for an army of diamond drillers, and it will be easy work, as the overburden is rarely 50 ft. and often only 20 ft. thick.

To the north, in Utah, are unworked deposits in the Henry Mountains. Big field parties have explored some, in an incomplete way. Tales come from there of workable deposits awaiting the railroad and the caprice of the makers of markets.

I trust the shortage of radium-bearing ores will not worry you, nor your readers, nor any "radiologist" of our acquaintance. W. H. STAVER.

Idaho Springs, Col.

An Advertiser's Opinion

Permit me to congratulate you for having included, and Harry J. Wolf for having written, the article "Judged From an Advertising Viewpoint," which appeared in *Engineering and Mining Journal* of July 16.

I am glad to be on record as saying that there isn't anything for which I will "go to the mat" quicker than a chance to battle against "Proceedings" of engineering societies and other societies or their official organs, soliciting advertising in those fields which are already represented by the legitimate trade and technical press. I have been in numerous skirmishes on this point and I have some very hard and fast opinions on the subject. These are best brought out in an article printed in the Dec. 30, 1920, and Jan. 6, 1921, issues of *Printers' Ink*. I admit having some interest in the preparation of this material, as I had talked this over with friend Murphy some months previous and had told him that this article would be of more real benefit to this phase of advertising than anything he could do, and I am glad to be able to refer Mr. Wolf to these articles, which contain the viewpoint of not only the writer and Mr. Murphy, but of a good many other advertising men.

Whenever you see the need for defending the legitimate trade and technical papers against the encroachments of these so-called official organs and "Proceedings," let me know, and I am here to serve you.

New York City. S. W. L.

The Reclamation of Mexican Mining Titles

Legal Process Outlined for Regaining Possession of Valuable Properties Forfeited During Revolution for Non-Payment of Taxes—General Conditions Leading to Forfeiture Described

By Paul W. Meyers
Written for *Engineering and Mining Journal*

TEN YEARS of Mexican turmoil discouraged most American mine owners. It was but natural that many should have ceased the struggle to keep up payments on their taxes when the revolutions continued year after year. While the State Department at Washington served notice that receipts for payments made locally under protest to *de facto* authorities having military control would be held as legal and valid, the practical difficulties and dangers attending such payments at local offices caused many owners, forced from the districts by the perilous conditions, to arrange for payment of taxes to the Central Office in Mexico City.

This alternative was not always easy. The Mexican government accepts nothing but actual cash in payment of taxes, and trustworthy agents are not always available in revolutionary times. At a period when doubt existed as to the legality of any faction in temporary control of the capital, when banks had closed their doors, when Americans had been ordered to leave Mexico by their Government, many American owners were obliged to suspend tax payments.

Carranza Forfeited Many Charters

The Mexican government officially takes the position that order has existed in the capital since August, 1915, or soon after Carranza forces under General Pablo González occupied the city and General Carranza returned from Vera Cruz. But the reputed anti-American attitude of Carranza and his limited control of the country caused American owners of mining properties to hesitate. The result was that many properties before long were declared *caduca* (forfeited) by the Carranza government. The provisions of the mining law of pre-revolutionary times had imposed a fine of 50 per cent for default of payment during the first month following, then 100 per cent for the second month, and then *ipso facto* forfeiture. This practice was now suspended and the policy adopted of letting the taxes accumulate except where the forfeiture of a title was specially applied for (naturally by parties interested in acquiring such properties by relocation), when special orders of forfeiture were issued.

This policy enabled speculators and parties in position to take advantage of the general situation to look up the records at the Central Office in the capital, learn of valuable properties in arrears in their tax payments, obtain their forfeiture, and, in the disturbed conditions prevailing in many districts, relocate without serious opposition or competition, thus acquiring such properties at a certain amount of personal risk but at nominal cost.

The Law Pertaining to Forfeited Properties

Realizing this situation, on March 31, 1917, Carranza, as Chief Executive, promulgated a decree, the preamble of which set forth the fact that it was neither equitable nor just that it should continue. The following is a translation of the three articles of the decree itself:

> Art. 1. The right to exploit minerals in virgin ground or in properties which may not have been exploited, is granted in the terms established by the Mining Law in force and its Regulations.
>
> Art. 2. Such mining properties whose concessions may have been declared forfeited, whether by omission of the payment of the mining tax, or because of idleness in the terms of the Decree of Sept. 14, 1916, and which, in the judgment of the Department of Fomento, Colonization and Industry, represent a value of consideration through the actual state of their development, will be granted to exploitation by means of a special contract whose clauses will be established by the said department, and without being subject to the legal process established by the Mining Law and its Regulations in force.
>
> Art. 3. In case of simultaneous applications, the right to the concession of a property will be put to public bids and the best bid will be accepted, after the Department of Fomento has studied the conditions presented by the applicants.

The decree of Sept. 14, 1916, alluded to, had required the operation of mining properties under penalty of forfeiture. It was afterward not enforced, its injustice and impracticability being recognized.

On March 15, 1918, the Department of Industry, Commerce and Labor (which had succeeded the Department of Fomento, Colonization and Industry) issued a circular to local mining agents prescribing the terms and conditions for the special contracts alluded to in the decree. These terms were onerous and impracticable. I have inquired and been informed that only two special contracts were ever applied for and executed, which were soon forfeited. It is safe to say that practically all those who relocated mining properties of developed value did so by simple location in violation of the decree.

Impracticability of Decree of May 29, 1918, Demonstrated

Therefore, on May 29, 1918, the Department of Industry, Commerce and Labor issued another circular to local mining agents beginning: "This department having observed certain irregularities on the part of the mining agents in applying the proceedings which should be followed in conformity with the decree of March 31, 1917. . . ." The instructions which followed described how virgin ground or properties having comparatively slight development could be relocated under the old Mining Law, but decreed that properties containing important developments which could be considered of industrial value could be acquired only by special contract, and in doubtful cases the agent might accept an application for simple relocation but should forward it with reports and information, based on which the department would either approve or reject the application.

However, the impracticability of this decree and its two regulations, so far as the result desired by the government was concerned, has been fully demonstrated. Local mining agents are usually not informed upon the state of development of the various mines of their respective districts or are not qualified to pass upon the question of "industrial value." Quite naturally they have continued to accept without question simple relocations and ignore the decree of March 31, 1917, and its regulations.

Therefore, the Mexican government, realizing that agents have forwarded to the capital many illegal applications for titles to valuable mining properties, has been unusually slow in issuing new titles. It is now a common thing for an application to be over two years in process without title having been granted. I have been reliably informed that the present administration, fully recognizing the unworkable character of the law, has been contemplating its cancellation, but has hesitated to act until the whole question of relocations made during revolution can be decided upon at one time.

CARRANZA CONSTITUTION STILL OPERATIVE

The authority of the law cited appears to be unquestioned. On Oct. 19, 1915, the United States officially recognized Carranza as the Chief Executive of the *de facto* government of Mexico, and in February, 1917, full recognition was accorded. In the following month Carranza was elected President of Mexico, and he was inaugurated May 1, 1917. In the ensuing three years, while probably the greater portion of the country for the major part of the time was under control of opposing factions, the capital was securely held by the Carranza Administration. Then came the sudden overturn of May of last year, and by the time General Obregón was inaugurated on Dec. 1, 1920, organized opposition had ceased throughout the republic. The so-called Carranza Constitution of 1917 has been adhered to by the Obregón Administration, and the various decrees, laws, and regulations of the Carranza Administration are given full force and effect.

The Carranza decree of June 19, 1915, admitting the legality of the payment of mining taxes on properties in regions controlled by opposing factions, is well known and has served for the reclamation of numbers of properties. The recognition of the Carranza government by the United States and Carranza's continued control of the capital encouraged numbers of Americans to seek connections in Mexico City and pay up their taxes, even though in the districts in which their mines were situated there were conditions of insecurity to life and property. Moreover, prospects and properties of unknown value with taxes in arrears remained largely undisturbed, and many owners were able to take advantage of a period opened by the Carranza government and later extended by President de la Huerta in the latter part of last year for resuming payments and covering the payment of accrued taxes in installments without penalties.

OPPORTUNITIES THAT STILL REMAIN

Even now it is possible to resume payment of taxes by paying to the Treasury Department the accumulation in a lump sum with certain penalties added, provided the properties in question had not been declared forfeited, as many still have not. Even if forfeiture has been declared, if it so happens that the forfeiture was bona fide and not obtained by relocations, it is still possible to petition the Department of Industry, Commerce and Labor and secure the revocation of the forfeiture upon payment of the accumulated taxes with penalties to the Treasury Department, thus restoring the validity of the title.

This privilege, of course, cannot remain open indefinitely, and I understand that the Mexican government is contemplating fixing another period expiring Nov. 1 for the payment of accumulated taxes, after which a general order for forfeiture will be made covering all titles which may remain unredeemed.

There remains, therefore, the case of owners of valuable properties who became completely discouraged by the general conditions in Mexico, but who perhaps clung to the hope that eventually they would be permitted to reclaim under conditions of entire peace and security, and so, after dropping the struggle to meet taxes every four months, did nothing further in the matter. Such owners, probably reading of disturbed conditions and conflicts between Federals and rebels in the general region of their properties, cherished the hope that the Carranza government would take such general conditions into consideration and not insist upon collecting taxes where operations would be dangerous, or, at least, unattractive from a business viewpoint. But the Carranza government re-established its mining agencies as fast as possible in regions of sporadic disturbances, adopted a stern attitude toward the mining industry, endeavored to force the operation of properties, and freely imposed the penalty of forfeiture for non-payment of taxes, so that speculators and relocators, risking the trips to the district agencies in periods of calm, effected the formal publications of forfeiture and relocated valuable properties at nominal expense.

Having studied the subject carefully, I am convinced that there is only one road still open to the recovery of such valuable, developed mining properties, and that is the application of the law of March 31, 1917, in cases in which title may not yet have been formally issued to new claimants.

ONLY ONE PRECEDENT EXISTS

There is only one really complete precedent of such application of the said law to my knowledge. In 1916 the old San Rafael mine of Zacatecas was declared forfeited for non-payment of taxes, and the central portion, embracing the main shaft, was relocated by former employees. Upon the promulgation of the decree in 1917, the American company which had owned the mine sought to have the law applied retroactively, and secured this result by executive order; that is to say, after the industrial value of the mine had been proved, the application of the relocators was rejected. These latter promptly brought suit in the State Court of Zacatecas and won, but lost when the case was appealed to the Supreme Court of Mexico in Mexico City, the latter deciding that ownership is born with the issuance of title, up to which point the government can accept or reject any application for reasons which in its judgment are proper.

The question then arose of the requirements of the law for opening the property to public bids for a special contract. But, as it happened, the San Rafael had suffered damage through Villistas, and the owners submitted a proposition to the Treasury Department taking the position that the property could not be put to public bids unless security was deposited for that damage, and offering to renounce any claim for such damage in lieu of a special contract, provided they were permitted to pay the accumulated taxes in consideration of the annulment of the forfeiture of the title. This proposition was then accepted by the Treasury Department, but not sanctioned by the Department of Industry, Commerce and Labor until recently. However, this case has now been closed and the title fully restored to the American owners.

The value of this precedent is lessened by the retroactive application of the law and the renunciation of the damage claim. Probably a number of valuable properties may be in similar position of having suffered damage to equipment and would cheerfully renounce any claim in consideration of getting their properties returned to them, but others may have no such proposition to offer.

THE DIPLOMATIC SITUATION

The news regarding Mexico, American interests and terms for recognition is dominated by the difficulties of the oil companies. American mining interests, once dominating a great industry in Mexico, are now singularly quiescent. But, while Article 27 of the Constitution of 1917 appears to confiscate legitimate subsoil rights, if interpreted retroactively, is there not some ground for the contention that the application of the mining law regarding forfeiture, whose stringency may not have worked undue hardship upon mine owners in the peaceful times before 1910, has been confiscatory in effect when applied in the troublous period which, it is to be hoped, is now closed?

Broadly speaking, it seems to me peculiarly unfair that mine operators—driven from the peaceful operation and physical possession of their properties by revolutionary conditions, and leaving the country because of the impracticability of resuming their businesses under recurring danger to life and property; then subjected to uncertainties and difficulties in the payment of their taxes, when one faction threatened to repudiate all payments to another, and no one could foretell who would emerge a winner or when the revolution would end—should have been subjected to the extreme penalty of forfeiture of their titles as a climax to their misfortunes; especially in the discriminatory manner practiced during the Carranza administration, when speculators were able to secure special forfeiture and pick the hearts out of valuable properties representing large investments of capital. It may be alleged in defense that ample time was usually allowed before declaring forfeiture, but it is an open question whether this time elapsed during actual conditions of security, using the word in a broad sense.

STATUS OF MEXICAN MINING TITLES

This question of security and protection of American interests is one which, in my opinion, can only be properly and effectively debated between the two governments. It is well known that Mexican mining titles are simply mineral rights which are granted by the Mexican government only for the period in which taxes are met, and are revocable upon the failure to pay such taxes. And so long as a mining property is in the prospective stage, one may perhaps look upon its loss through revolution as the fortune of war. But when a considerable sum has been invested, either through purchase or development, and the property has come to represent a real value in ore developed, equipment, and the collateral expenses which form so large a portion of the cost of bringing a mining property to the point of production, then its ownership becomes a vested right which should, in equity, be protected by a responsible government in time of revolution and civil strife, instead of being subjected to the extreme penalty of forfeiture as a climax to whatever injuries may already have been inflicted upon its business and equipment.

In other words, the Carranza government, finding itself unable to control the country or to give the mining business anything like the condition of peace and security in which it had been developed, in justice should have protected titles from speculators, as this was within its power. Itself in arrears in its financial obligations, it might fairly have given greater consideration to others in misfortune, especially as declarations of forfeiture yielded it little profit.

The Mexican government is, no doubt properly, sensitive of the use of the word "confiscation." It insists upon the legal interpretation that confiscation is the forcible appropriation of property without due process of law. But where law can be made overnight by executive decree, and revolutionary conditions may make observance either difficult or impracticable, the question of whether or not mining titles should be irrevocably lost becomes essentially a matter of justice and fairness on the part of the Mexican government.

What is known technically as "equity" in the courts of the United States does not exist in Mexico jurisprudence, where all is written law, and in order to make any reclamation of mining titles, in my opinion, it will be necessary to take the law as it is to begin with, and also to attempt to persuade the Mexican government to make such further regulations as may seem practical and just. I have submitted a plan for diplomatic negotiations on this point between the United States and Mexico which I believe to be not only just to Americans but of positive practical advantage to Mexico, as it would perhaps bring back numerous American mining men to reclaim and resume operations, and thereby stimulate the mining industry of Mexico, which is suffering such great depression.

METHOD OF RECLAIMING FORFEITED TITLES PROPOSED

It must first be stated that, in my opinion, retroactive action will be difficult, and, in the case of properties which have been duly forfeited, relocated and the *titles to which have been issued*, the Mexican government can only refer any reclamation to the courts. It is true that mining titles are issued "without prejudice to the rights of third parties," and Art. 116, Chap. VIII, of the Mining Law extends a term of three years from the issuance of a title in which an action might be brought in the courts with the object of securing annulment of the title by the government. But the way of the courts is tedious. I recommend that, as a first step, original owners should learn if their properties have been formally forfeited, and if so, second, whether they have been relocated, and then, third, whether title has been issued to the relocator.

If it proves that a relocation has been made but title not yet issued, an opposition should be filed at once at the Department of Industry, Commerce and Labor, in which the circumstances relating to the forfeiture of the title are clearly set forth, ending with a request that the department grant a reasonable term for proving the industrial value of the property under the law of March 31, 1917.

When this is granted, a Mexican "titled" or graduate mining engineer must be employed to examine the mine, take check samples, and verify as fully as possible the data of ore developed which have been submitted by the owner.

Should the report of this engineer confirm the industrial value claimed for the property, the Department of Industry, Commerce and Labor may require other more specific information of the circumstances surrounding the forfeiture and relocation, and will doubtless also require the owner or his representative to prove legal authority to act by submission of deeds or powers-of-attorney.

The second regulation of the law of March 31, 1917, states that even though the mine workings may be under water or in ruins, if industrial value can be shown, the property is not subject to simple relocation, so it may be possible to convince an engineer by full data and collateral evidence, and so prove industrial value, despite the probable condition of a mine after years of idleness. Of course, the relocator may in turn contend the property to be without industrial value and ask for a period for proving same, but in the case of a property actually developed and with ore in sight, the relocator will obviously be at a disadvantage in attempting to prove a negative contention.

The case should eventually proceed to a decision upon the score of industrial value, and, if proved satisfactorily, the application of the relocator will be rejected.

At present, the Department of Industry, Commerce and Labor, despite the precedent of the San Rafael case, holds the opinion that the property should thereupon be put to public bidding for a special contract for its operation; but, as it is the custom to revoke forfeiture in favor of former owners who apply for the privilege of paying accumulated taxes, when no rights of a third party exist, and as such rights will have been removed by the rejection of the illegal relocation, it would obviously be unfair to insist on putting the property up at auction in disregard of the just rights of the original owner whose labor or investment gave the industrial value he has proved.

I have strong hopes that diplomatic conversations on this point may result in an interpretative regulation being issued by the Department of Industry, Commerce and Labor defining this question in favor of the reinstatement of the titles of the original owners upon their payment to the Treasury Department of their accumulated taxes.

This is the only legal recourse which is now open for those in the position outlined who would like to attempt the reclamation of their properties. I think it may be of interest to many of the former mine owners and operators in Mexico.

Accidents in Utah Ore-Dressing Plants

During 1920 there operated in Utah eighteen mills and ore-dressing plants, employing 1,534 men and milling 6,132,386 tons of ore (not including ore put through sampling mills), which represents about half the capacity of the mills in question. There were produced 421,864 tons of concentrates. These figures are taken from reports made to the Utah Industrial Commission by the plants themselves. Labor and accident data from the plants, as compiled by the Federal mine inspector in connection with the commission, are as follows:

[illegible]

	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]		[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	[illegible]

A Blast Furnace for Zinc?

Experiments in Smelting of Ores Under Pressure Suggested Which Might Result in Economies Over Present Methods

By EVANS W. BUSKETT

[illegible]

MANY ATTEMPTS have been made to smelt zinc ores in a blast furnace, and some of these have been successful so far as the smelting operations were concerned. The zinc was extracted from the ore, but on account of the large admixture of air and gases it was found impossible to condense the zinc to metal. It came off as a blue powder, or zinc dust, mixed with zinc oxide.

The advantages of smelting zinc ores in a blast furnace are many. First there is the cost of installation. The cost of erection of a blast-furnace plant would not be more than 25 per cent of the cost of a retort plant of the same capacity. The cost of operation is less, especially the labor cost, which would be less than one-half that of a retort plant. Again, in a blast furnace the process is not so much at the mercy of the laborers as in the retort plant, nor is blast-furnace work as hard on men as the work around a retort furnace. A man does not have to face a fiery furnace all the time, as in a retort furnace. But the most important point of all is still in doubt—the recovery of the metal from the ore.

Schnabel says, in his "Handbook of Metallurgy," "In the present condition of science and technology, all attempts at the production of zinc in shaft furnaces must therefore be looked upon as presenting no probability of success." But science and technology are constantly changing. What was impossible yesterday is in common use today.

PRESENT METHODS OF ZINC RECOVERY FOLLOW BELGIAN PRACTICE

A close inspection of processes now employed in the metallurgy of zinc does not reveal anything revolutionary but rather only an improvement in the Belgian method. There are the large gas-fired furnaces with tiers of retorts four and five high; there are the larger regenerative furnaces fired by producer gas; and now metal shields protect the men. These details and a close attention to the furnace operations have reduced the losses from 25 to 15 per cent and in many operations to 10 per cent. But these savings are still accompanied by high costs—the cost of smelting in some plants being $28 per ton.

I propose a set of experiments that in my opinion will lead to a commercially successful process of smelting ores in a blast furnace or at least in a modified form of blast furnace.

In the retort furnace the charge of coal and [illegible] ore is about 50–50. The excess of coal produces [illegible] and CO gases, thus keeping up a reducing atmosphere without which the zinc would be reoxidized and lost. It also plays the mechanical part of holding up the charge, allowing the CO gas to circulate freely and preventing the slag-forming constituents of the ore and coal from uniting with each other.

A series of experiments should be made using coal in slight excess of what is needed for the actual reduction of the zinc from the ore. These experiments can be made by filling a short piece of iron pipe with the mixture and sealing the ends with caps or plugs. These pipes should be placed in a furnace and heated for several hours. In my opinion the pressure produced by the gases in the pipe will not be sufficiently strong to break it. The pipe should be removed from the furnace, set on end, and allowed to cool, after which it should be opened and examined. If the experiment is successful the zinc will be found in a metallic button at the bottom of the pipe with a layer of slag above it. The zinc and slag should be weighed and the slag assayed for zinc, iron, lime, and silica.

Should this first experiment prove successful, a second one should be made in which the pipe should be cooled below red heat, then opened and its contents poured into a mold. This will demonstrate the fluidity of the slag.

POSSIBILITIES OF UPRIGHT IRON RETORTS

Analyses should then be made of the ore and coal to determine the slag-forming constituents—iron, lime, and silica, and the necessary additions of fluxes made to produce a fluid slag. The success of these experiments will indicate that a process is feasible wherein upright iron retorts can be used. These retorts could be 12 to 18 in. in diameter and 10 ft. high. A 12 in. retort would have three and one-half times the capacity of an ordinary retort.

The fact that 75 per cent of the coal has been eliminated would make one of the iron retorts about five times the smelting capacity of a clay retort of the Belgian process. These retorts should be set in two rows, twenty retorts to the block. On the outer side a tap hole would be provided, opened and closed by a stop cock. The opening from the stop cock would be closed by a piece of charcoal before charging, to avoid difficulty in opening after the charge is melted. Charging would be done from above, and the charge rammed in tightly, either by hand or by machinery, and the top sealed by a clamp and wedge. After the charge is smelted, it will be necessary to allow it to cool before tapping, so as to prevent the volatilization and oxidation of the zinc. The tap hole will then be opened and the whole charge tapped into a large forehearth for the separation of the metal and slag. One forehearth will serve ten retorts.

EMPLOYING BLAST-FURNACE UNDER PRESSURE

From this sealed retort process it is but one step further to my proposed blast-furnace process. I propose to smelt roasted zinc ores in a blast furnace under pressure. Later it may develop that zinc sulphide can be smelted raw, as I believe it will be. To smelt zinc ore in this furnace it will be necessary to determine the slag-forming constituents contained in the ore and fuel and add such fluxes as will produce an easily fusible slag. It will probably be necessary to briquet the ore and fuel.

The furnace will consist of a shaft furnace, either brick or water jacketed. A brick furnace would be inclosed in boiler plate to enable it to withstand the pressure. A tap provided with a stop cock will serve to run the charge from the furnace. A swinging valve balanced by weight in the flue of the furnace will regulate the pressure.

In operation, the pressure will be removed for charging. Fuel will be charged first, and when the furnace is sufficiently heated the briquetted ore will be charged until the furnace is filled, after which it will be sealed. The high-pressure air will then be turned on and the pressure regulated by means of a valve in the discharge flue. When the smelting is complete (this will have to be determined by experience), the blast is shut down and the furnace allowed to cool. When sufficiently cooled, the charge will be tapped into a forehearth for the separation of the metal and slag.

ASSURING CONTINUOUS OPERATION

It will be seen that this is an intermittent process. Owing to the volatile nature of zinc, it is not feasible to tap the furnace at a high temperature, although it may develop in practice that this can be done. If it does, it will only be necessary to shut off the blast for a few minutes, to introduce a new charge, thus making the process practically continuous.

The pressure necessary for this process is undetermined. It will be well, however, to provide a compressor capable of furnishing air at 100 pounds' pressure. The theory is that the zinc will not volatilize under pressure,[1] but will behave the same as lead does under atmospheric pressure. There will be some danger in trying out this process, as explosive gases may develop in such a furnace under heavy pressure. I am, however, convinced that if anything is ever done in the smelting of zinc ores in a blast furnace it will have to be by some such method as that here suggested.

Large Production of Fuller's Earth in 1920

The production of fuller's earth in 1920, according to the U. S. Geological Survey, was 128,487 short tons, valued at $2,506,189, or $19.51 per ton. These amounts represent the largest output, the largest value, and the largest average price ever recorded. The output was 21 per cent greater than in 1919; it was more than three times as great as in 1913 and nearly nineteen times as great as in 1895, the first year of production. The value in 1920 was 25 per cent greater than that in 1919.

Fuller's earth was produced in eight states in 1920; named in the order of their rank in output they were Florida, Georgia, Texas, Alabama, Nevada, Arkansas, California, and Massachusetts. Promising deposits of fuller's earth have been discovered also in Pennsylvania and Virginia. The Southern States reported 99 per cent of the output, Florida alone reporting about 85 per cent of the total.

The imports of fuller's earth, which for many years constituted the entire source of supply, also increased in quantity and value in 1920. During the war these imports naturally decreased in quantity, and with the cessation of hostilities they just as naturally increased. The imports in 1918 were about 50 per cent of the maximum (24,977 short tons in 1914); in 1920 they were 77 per cent of the maximum. During the war some refiners of edible oils and fats—by whom the imported fuller's earth is probably used exclusively—were unable to obtain a sufficient supply of foreign earth and were compelled to adapt domestic earth to their needs, and it may be that imports of this material will never again be so essential to the American industry.

The imports of fuller's earth in 1920 were 19,235 short tons, valued at $221,893, or $11.54 a ton. These amounts represent an increase of 39 per cent in quantity and of 17 per cent in value over the figures for the previous year.

---

[1] This is not a new idea, zinc smelting under pressure in a blast furnace was proposed many years ago.—EDITOR.

Preliminary Roughing Concentration by Sorting, Jigging and Tabling—Part III*

Experiments With a Test Jig and With a Specially Designed Close-Sizing Device—The Wilfley Table as a Rougher, and The Results Secured by the Use of Deflectors and Baffles

By Edward S. Wiard
Written for Engineering and Mining Journal

SOME OF THE EXPERIMENTS to be described in the following pages were failures, in that the procedure described was never adopted on a commercial scale. Other tests are given which should have been carried further if practical conclusions were to be drawn from them. The aim is, however, to present those tests which are suggestive or illuminative, as well as those of immediate practical value. Some of the former kind I consider of more real value than the practical kind.

In the test jig, shown in Fig. 1, arrangements were made to convert the jig into one of any number of compartments up to five, by having false partitions between the compartments. By removing any one of the inclined boards between compartments, the material flowing from the upper of the pair could be caused to flow down the inclined spout between the boards of the false partition and through a slot cut through the posts into a suitable catching receptacle. This arrangement also made the placing of the top discharges at the end of the compartments very easy. This is the position for them generally favored by millmen.

When the jig was used on the roughing principle, making tailings and middlings, the inclined partition boards between compartments were removed and fine-mesh screens were substituted. By this means the water coming from one compartment could be largely removed, only a small part of it passing to the next. Water was introduced under each plunger by pipes from a header which ran along the top of the framework. Any desired amount could be introduced into a compartment without affecting the settling and sep-

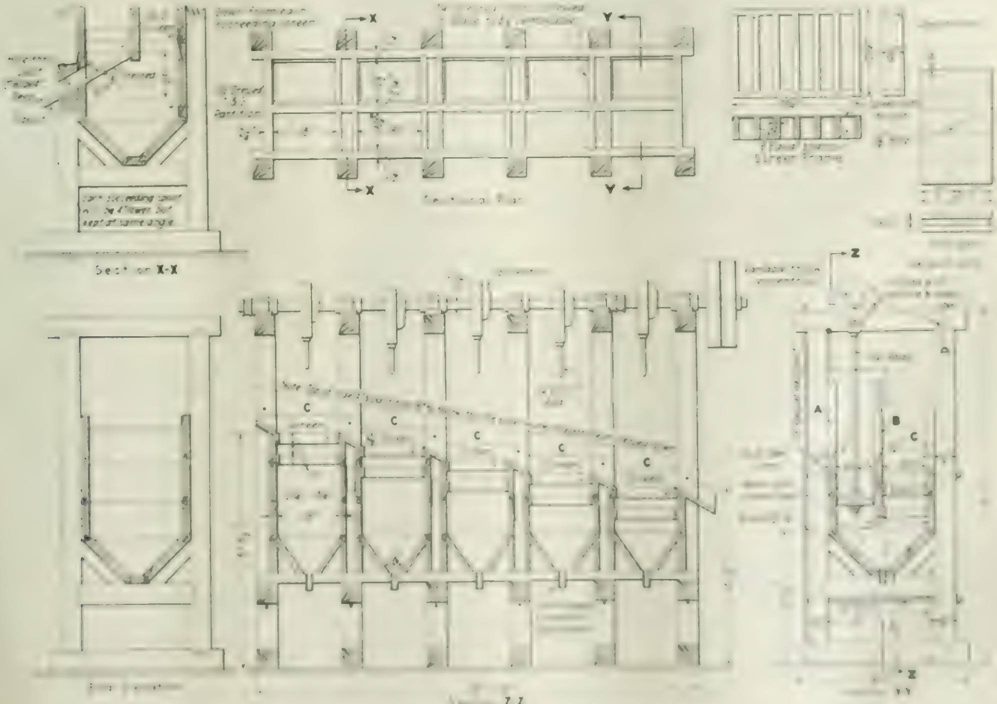


FIG. 1. DETAILS OF EXPERIMENTAL JIG

---

*Continued from Sept. 3 issue.

arative work of the respective compartments below.

The material which was fed assayed: silver, 2.24 to 3.12 oz.; lead, 0.04 to 0.31 per cent; and zinc, 0.22 to 0.54 per cent. This material was jigged for the silver content. The low content in lead and zinc will be noted. It averaged less than 0.50 per cent of metal. The silver makes no appreciable increase in the total metallic content of the ore. As there are 29,166 troy ounces in a ton avoirdupois, an assay of 291.66 oz. equals 1 per cent of metallic silver, and other amounts in proportion.

The material to be tested consisted of a quartz, gneiss, and granite gangue, with small amounts of galena and zinc as very pure "resin jack" (sphalerite). Some of the silver occurred as a close associate of the galena, and the mineral form is either argentite or gray copper. Another portion of the silver occurred as isolated patches and grains of the several forms of silver which are commonly denominated gray copper. All of these sulphides are antimonial rather than arsenical. There was occasionally some dark-red ruby silver.

The material for the tests was drawn from a mine dump. Occasionally rich pieces of galena were found, but most of the metallic contents was thinly disseminated through a relatively small bulk of the dump material. The favorable factor for jigging was the large proportion of waste; the unfavorable one was the lightness of the average mineralized piece of dump material.

The material fed in the first series of tests had passed a 1-in. round-holed screen and was held on ¼-in. screen.

The adjustments of the jig were as follows:

	Comp 1	Comp 2	Comp 3	Comp 4	Comp 5
Depth of bed	6 in	5 in	4¾ in	4¼ in	4¼ in
Stroke	1¼ in	1 in	1¼ in	1¼ in	1 in
No. strokes per min	175	175	175	175	175
Height of discharge above screen	1 in. throughout.				
Screen cloth	10 mesh throughout.				

The first series of tests were four in number, each of twenty minutes' duration. The rate of feeding varied from 0.975 ton per hour to 1.001 tons per hour. The compartments were skimmed at the end of each twenty-minute period; the portion of the bed one and one-half inches deep, resting on the screen, being removed in each case. Skimming began with the first or uppermost compartment, the upper layers of the bed of material in the compartment being thrown into the second compartment, from which the material was raked back after the skimming was completed.

A similar method was used in the next three compartments. In the last the upper layers were raked into the fourth and were raked back again after the lower layers were removed. Following each skimming period, the jig was again put in operation, and feeding was resumed. Automatic discharges were used in all the compartments in this first series of tests, and in the summary the figures connected with the caption "All middlings" refer to the combined weights, average assays, and other like data of the four separate tests, as do the other figures.

FIRST SERIES JIG TESTS

Material	Dry Lb.	Weight, Per Cent	Average Assays: Ag Oz.	Pb Per Cent	Zn Per Cent	Percentage Recovery: Ag	Pb	Zn
Feed	2,395	100.00	2.52	0.181	0.32	100	100	100
All beds	320¼	13.37	6.21	0.819	0.761	32.92	60.51	31.81
Middlings	939¼	39.22	2.83	0.064	0.183	43.97	15.86	22.43
Bed tops	125	5.22	2.32	0.180	0.230	4.80	5.31	3.78
Hutches	118¼	4.94	2.52	1.55	1.66	4.93	42.26	25.55
Tailings	698	29.14	1.88	0.055	0.138	21.70	8.78	12.52
Unaccounted for	194							3.91
Total	2,395					108.32	130.72	100.00
Assay of feed computed from products			2.95	0.211	0.345			

Attention is called to the figures accompanying the caption "Unaccounted for"; also the totals for the percentages of each metal recovered at the bottom and to the right. Some slime is bound to be lost in jigging experimentation, and owing to the low grade of the material treated and of the products made, the percentage error in assaying is great. For comparison the assay of the feed computed from the weights and assays of the products made is given at the bottom of the tabulations.

In the second series of tests, five in number, the results of which, in tabulated form, are given below, all automatic discharges were removed except that of the last compartment. As before, the aim was to keep the feeding, which was done by hand, as close to the rate of one ton per hour as possible, and the other constants of the test were also the same as in the first series. The average rate of feeding for the five tests was 0.946 ton per hour.

SECOND SERIES JIG TESTS

Material	Dry Lb.	Weight, Per Cent	Average Assays: Ag. Oz.	Pb. Per Cent	Zn. Per Cent	Percentage Recovery: Ag	Pb	Zn
Feed	3,069	100.0	3.12	0.151	0.234	100.0	100.0	100.0
All beds	492¼	46.0	7.65	0.701	0.696	39.32	74.51	47.7
Middlings discharge No. 5	366½	11.9	2.15	0.019	0.154	8.22	1.92	7.93
Bed tops	104	3.4	2.40	0.060	0.180	2.61	1.30	2.64
Hutches	87¼	2.8	2.88	0.630	1.000	2.62	11.88	12.10
Tailings	1,833	59.7	2.00	0.034	0.118	38.29	13.61	30.04
Unaccounted for	186	6.2	....	.....	.....	8.94	....	.....
Total	3,069	100.0				100.00	103.24	100.28
Assay of feed computed from products			3.03	0.166	0.250			

In the first series of tests 60.51 per cent of the lead was recovered in the beds, which formed 13.37 per cent of the weight of material fed, and the feed was graded up from 0.181 to 0.819 per cent lead, the tailings assaying 0.055 per cent lead. The percentage recovery and the percentage weight given in the tabulation is based on the assay and weight of the ore fed. Based on the weights and assays of the products made, the recovery of lead in the bed was 46.29 per cent and the beds were 14.6 per cent, by weight, of the products made and recovered and weighed. Attention should be directed to the large lead recovery made in the first series tests in the form of hutches. Based on the feed, the recovery of lead in the hutches was 42.26 per cent. The recovery, on this basis, in the beds and hutches was over 100 per cent. The error was apparently in sampling the hutches. Based on the weights and assays of the products recovered, the percentage of lead recovered in the hutches was 32.34 per cent. The combined saving of the beds and hutches was 78.63 per cent.

In the second series of tests, which are freer from error, 74.51 per cent of the lead was recovered in the beds, based on the figures of the feed, and 72.17 per cent based on the products. The respective recovery figures for the hutches, computed by these two methods, were 11.88 and 11.51. The combined savings of the beds and hutches were 86.39 and 83.68 per cent respectively. Attention is directed to the middlings, which, in the first series tests, is the product which came out of the automatic discharges placed in all five compartments. In the second series, the only middlings made were from the automatic discharge of the last compartment. It will be noted that the metallic content of the middlings is less than the feed. The great discrepancy between the lead in the middlings and the feed is particularly striking and bears out the statement made in discussing the theory of jigging that it is impossible to remove "final middlings" by automatic discharges and that these devices on this class of material draw from all the layers of the bed in the immediate vicinity of the discharge and fail to draw out the enriched product of the lower layers. Compare the assays of the middlings discharge No. 5 product of the second series tests with those of the tailings of the same test and it will be seen that there was practically no difference between the material leaving the last compartment through the automatic discharge and the overflow or tailings from this compartment and the jig.

An analysis of the assays of the beds and middlings of each test of the first series is furnished by the accompanying table. The figures under the last column, "Compartment 5," should particularly be compared with one another.

These tests form only a small portion of some exhaustive experimentation done about five years ago. The rate of feeding was fixed by testing. A higher rate of feeding gave a lower recovery. Increasing the time of the periods of jigging increased the richness of the beds but lowered the saving. The dump material was experimented with to determine the best practical silver extraction. In a later series of tests than the ones given, and without changing the constants of the second series tests, much better silver recovery was obtained.

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]										
[illegible]	[illegible]	2.00	[illegible]	[illegible]	4.4[illegible]	1.44	[illegible]	2.80	3.84	[illegible]
[illegible]	[illegible]	0.03	[illegible]	[illegible]	[illegible]	0.03	[illegible]	[illegible]	0.54	0.02
Z[illegible]	[illegible]	0.22	[illegible]	0.28	[illegible]	0.26	1.03	0.32	0.48	[illegible]
[illegible]										
[illegible]	3.52	[illegible]	[illegible]	1.76	7.20	1.60	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.47	0.07	[illegible]	0.09	[illegible]	[illegible]
Z[illegible]	[illegible]	[illegible]	[illegible]	0.28	0.42	[illegible]	[illegible]	[illegible]	0.78	0.15
[illegible]										
[illegible]	[illegible]	1.20	[illegible]	2.40	9.00	[illegible]	3.68	2.56	[illegible]	[illegible]
[illegible]	0.40	[illegible]	[illegible]	0.10	1.80	0.20	[illegible]	0.01	0.27	[illegible]
Z[illegible]	0.28	0.22	[illegible]	0.25	1.60	[illegible]	0.28	0.12	[illegible]	[illegible]
[illegible]										
Silver, oz	[illegible]	[illegible]	[illegible]	2.40	8.00	1.84	1.80	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.76	0.06	[illegible]	0.02	[illegible]	[illegible]
Z[illegible]	[illegible]	[illegible]	[illegible]	0.22	1.38	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The first and second series tests are what may be denominated "key tests." In these tests, in order to obtain all possible information on the jigging problem, every separate product was dried, weighed, sampled, and assayed. Each separate product was also subjected to a [illegible] centage of the weight calculated, sampled and assayed for silver, lead, and zinc. Other tests along similar lines were not so complete. The first and second series tests are consequently better adapted to a general discussion of jigs in the roughing field. The lead figures throughout the tabulations will be found best suited for making [illegible]

It may be thought that occasional particles of pure [illegible] obtained. To be sure, the beds from the first compartment [illegible]

unlocking of the "inch to quarter-inch" material fed in the tests would fail to give any yield of concentrate or even of rich middling, as was demonstrated by test. Beyond the second compartment the material of the beds consisted entirely of grains which would require fine grinding to unlock the sulphides.

A hand-sorting test of tailings from a jig run gave the following results:

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	4.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	34.00	2.56	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1.28	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]			
Computed feed			[illegible]	[illegible]	[illegible]

The field of middlings' saving that these tests illuminate is beyond that of the operations in the ordinary jigging mill. They show the possibilities of the Harz jig for extracting the last modicum of mineral. The argument against the use of jigs to effect this by hand skimming may or may not have weight, depending on the individual ore. With the material under consideration, as only 20 per cent of the original ore is between one-inch and quarter-inch size, and as the ratio of concentration of the feed to the beds averages about 6, the rate of handling of bed material per hunderd tons of original ore will be only 3½ tons.

The net area of the jig screens is 10½ x 16 in. To the ton rate of feed per hour there is consequently a total area of 940 sq.in. for the five compartments. As the jigs have to be skimmed at definite periods, two jigs, or twice this area, would be required if feeding is to be continuous, or a total area of 1,880 sq.in.

The argument that roughing methods will require too [illegible] whichever term the reader prefers, from these jigs over Harz jigs with automatic discharges, using automatic discharges down to the point where a bed cannot be formed, a point which can be determined by making comparisons of the assays of the beds and discharges; and finally to pass the overflow from the automatic discharge jigs over skimming jigs.

The number, kind and spread of the jigs required in the application of jigging on the roughing principle can only be determined accurately by experimentation.

Tailings such as those made in the two series given were, at a later time in the experimental work, again subjected to jigging. The rate of feeding was 0.25 to 0.30 tons per hour, the other constants of the tests being the same as in the second series already given. The richest single bed removed during the progress of four single tests made assayed: Ag, 4.16 oz.; Pb, 0.21 per cent, and Zn, 0.18 per cent.

REJIGGING JIG TAILINGS

Material	Dry Weight, Lb.	per Cent	—Average Assays— Ag, Oz.	Pb, —Per Cent—	Zn,	Percentage Recovery Ag	Pb	Zn
Feed	1,438	100 00	1 84	0 077	0 131	100 00	100 00	100 00
All beds	390¾	27 7	2 76	0 154	0 163	40 74	54 05	34 04
Middlings ..	243	16 90	1 63	0 113	0 118	15 00	24 32	15 43
Bed tops..........	110	7.65	2.40	0 010	0.130	9.98	0.90	7.45
Hutches..........	58	4.03	1.76	0 020	0 200	3.85	0.90	6.38
Tailings..........	559¾	38.93	1.56	0.091	0 113	32.92	45.95	33.51
Unaccounted for	76½	5 32	. .			. .		3.19
Totals..........	1,438	100 00	.....	.....	.....	102 50	126 30	100.00

RESULT OBTAINED FROM A CLOSE-SIZING APPARATUS

While the jig experimentation was being done on the wide range of size from 1 in. to ¼ in., collateral experimental work was performed with the close-sizing device shown by Fig. 2. It was assumed that if satisfactory roughing could be done with a wide range of size, better results would be obtained in actual milling if a practical method of close sizing could be devised and employed.

Feed enters the device of Fig. 2 at the point marked "feed end." The compartment at that point is merely for receiving and disintegrating purposes. The screens or grids which dip down midway in the compartments are strips of hard wood in which are inserted stout wires which can be spaced to give any desired width of opening. The grids are adjustable as to the depth to which they dip in the compartments. They are supported on cleats at either end, pierced with rows of vertical holes through which are passed adjusting and supporting pins. This detail is shown in the main plan and section of the drawing at the middle compartment position. At the forward end of each compartment is an adjustable dam. The detail of these dams is shown at the forward end of the first or uppermost compartments, and the mode of adjustment will readily be understood by an inspection of the drawing.

The apparatus is mounted on 3-in. I-beams or slides, which rest in track angles, not shown, and is shaken in a direction at right angles to the travel of the material down through the machine. The apparatus is shaken by an eccentric, and the center of the shaft driving the eccentric is shown in the drawing.

The material entering the first, or disintegrating, compartment passes into the second. Here the material which could not pass the first grid would overflow into the inclined trough between the first and second compartments, where, as the water entering with the feed tends to flow down through the apparatus, leaving the portion of feed back of the grid dry, spray water would have to be used to transport the oversize in the trough to any desired destination. Spray water must for a similar reason be used with the other oversizes.

This sizing device was planned for use with the test jig. It was to be mounted above the cap timbers of the jig, the five different sizes made by the sizing apparatus being separately fed to the upper ends of the five compartments of the test jig, the tailings from each separate compartment being taken away from the jig by way of the spouts between compartments.

In this sizing apparatus it was the intent to take advantage as much as possible of the way grains will arrange themselves when a loose mass of them is vigorously shaken. Such shaking tends to bring the largest grains to the top of the mass and to send the finest to the bottom, with a gradation of size between. It was believed that when material was fed into the machine in motion, the finer parts would work down through the interstices of the larger grains and pass down and through the first grid, and that the coarser particles, which would tend to come to the top of the bed, would discharge into the oversize spout, and that a similar mode of arrangement and disposal of grains would be effected in the other compartments.

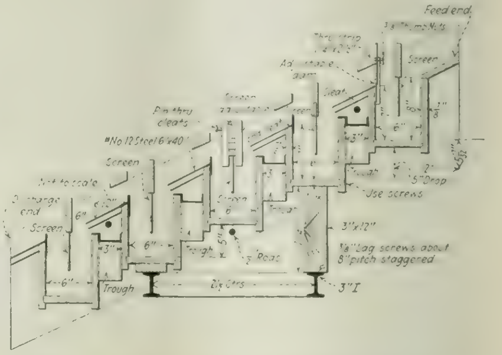


FIG. 2. CROSS-SECTION OF CLOSE-SIZING DEVICE

When the device was given a trial it was found that the square ends of the compartments and the lack of a differential motion to the shaking caused the beds in the compartments to pack, and as the grains did not move freely across the grids they quickly became blinded. The press of other more important work prevented tests and changes on this device to overcome the defects revealed by operating. As it is presented it is merely suggestive. The device, and the suggestions which follow, are freely offered to anyone who wishes to work further with it.

By introducing sprays in the bottom of the compartments, greater mobility was secured and the device would work after a fashion. To obtain vigorous rapid stratification and a rapid movement of the grains back and forth over the grids, both forward and return movement of the stroke must be accelerated; and to secure the best effect from the differential movement the square ends of the compartment would have to be modified so as not to kill the movements of the grains in the corners of the compartments. Possibly each compartment would have to be built separately and be actuated by separate eccentrics with varying length of stroke. It was noticed during the course of the experimentation that with any given length of stroke and rate of rotation of the eccentric shaft one compartment worked very much better than the others.

The question as to the proper dimensioning of the compartments for capacity and best effect received no attention, as the experimentation was too brief to enter into questions of this sort. For the same reason, no experiments were undertaken to determine the proper positions of the upper edges of the dams and whether or not the grids should be carried partly or all the way to the bottom of the compartments. If there were perfect interstitial stratification it would be unnecessary to carry the grid wires to the bottom of the compartments, but on practical grounds this course would probably be necessary.

During the duration of the tests the strokes of the machine ranged from 1 in. to 1½ in., and the number of strokes from 175 to 270.

EXPERIMENTS WITH THE WILFLEY TABLE AS A ROUGHER

One of the earliest uses of the Wilfley table as a rougher was in the Utah Copper Co.'s mills, the modified table being known as the Garfield table. This was not strictly a roughing device in the sense used in these articles, for the whole feed of the plant crushed to about 12 mesh was fed to a battery of tables, and two classes of *middlings* were made. At the time of the installation of the Garfield tables the material which discharged from the side of the deck was ground fine and passed to vanners for a finishing treatment. The rest of the material discharging from the deck, or the richer of the two classes of middlings made, was lightly ground and further concentrated on ordinary Wilfley tables with re-treatment of the "tailings" from these machines on vanners.

The capacity of the Garfield tables on Utah Copper ore was about 100 tons per day per deck. The deck was of the standard type, and the whole surface was riffled. The riffles were spaced 1½ in. apart, were ⅜ in. deep at the head-motion end and tapered to ⅛ in. at a diagonal line drawn from the water-box side of the deck to the lower corner. From this line to the end of the table the riffles were uniformly of ⅛-in. depth. The transverse inclination of the deck was very great. To make the front sides of the riffles as nearly vertical as possible the lower surface of the riffles, or their contact surface with the deck, was cut with a bevel. The wear and tear on these decks even with so comparatively finely ground roughing feed as 12 mesh was great. To prolong the life of the riffles hard wood was substituted for soft wood.

RESUMÉ OF THEORY OF ACTION OF A WILFLEY TABLE

In treating coarse material on tables of the Wilfley type, riffles are a necessary "evil." The chief function of riffles is to stabilize the paths of the various layers stratified out by the shaking action. The riffles keep the bed of material on the deck spread out to a uniform depth. They protect the lower layers so that the course of these down the deck is nearly or very nearly in the line of the head motion. The upper layers, which are more nearly waste or tailing layers, not being so well protected by the riffles, are more under the influence of the transverse inclination of the deck and the wash water and tend to follow a diagonal path down the table, discharging at some point on the long or tailing side of the machine. If no riffles were on the deck, the material fed would take a diagonal course down the table, the richer layers, as before, being those nearest to the deck. The sand or waste would tend to shift to some extent during this diagonal movement, reporting largely at the tailing side of the deck, and the concentrate would tend to report at the concentrate end, but variations in the rate of flow of the wash water and the speed of the table would make the paths of the grains more variable than they are when it is riffled. With all shaking tables, the head-motion component of the force acting on the particles has a much greater effect than the transverse component produced by the inclination of the deck and the wash water.

Let the reader lay a sheet of paper on a table to represent the deck of a Wilfley table. The upper right-hand corner of the sheet will be the feeding point; the lower edge, the concentrate discharge end, or, in roughing problems, the middling discharge portion, in part. The left-hand side of the sheet will be the tailing discharge side. Now, if the right hand be placed on the paper with the long axis of the hand corresponding with the diagonal line from the upper right-hand to the lower left, and the left hand be placed over the right, then there will be a representation, by the finger tips, of the stratification which ensues soon after the feed reaches the deck. Roughly speaking, the finger tips of the lower or right hand will represent the heavier portions of the feed and those of the left hand will represent waste or middling.

If, now, the two hands be slowly shifted past one another with the finger tips as a pivot, a representation will be obtained of the shifting or separation of the waste and concentrate bands from one another as the feed travels down the table deck. The shifting of the hands must not be carried to the point where there is an opening between the hands, because that would indicate a perfection of separation which it is impossible to obtain on a shaking table.

As is well known, the overlapping of the bands of material fed to a Wilfley or similar deck at the lower or discharge points, preventing sharp lines of demarcation and clean cutting of discharging products, constitutes the chief theoretical objection to the use of decks of this kind for concentration purposes. It would be expected that if the deck were increased in length over the present existing standard lengths, and in the direction of the diagonal resultant line of the motion of the particles fed, a much better separation of the various grades of material fed would result. The various bands tend to become wedge-shaped as they proceed down the table, but the spreading-out action of the individual band is less in amount than its shifting or divergence with respect to the others. This mode of overcoming the overlap of the bands has been tried with some degree of success.

It might also be expected that, by the use of deflectors and the rearrangement of the riffling, the bands might be made to pursue axes more nearly transverse than longitudinal, and that the same effect that may be secured theoretically by a deck very long on the diagonal line—viz., reduction of the overlap—could be obtained. It was with this thought in mind that I worked in attempting to get better separation and greater capacity from the Wilfley table. It may be stated at once that the experimentation which involved using deflectors and rearranging the riffling did not result in a practical increase in the saving. The reason seems to be that though the axes of the bands are more widely separated by the use of deflectors, the individual bands become more widely spread out and form more obtuse wedges.

and this action largely overcomes the good effect which is obtained by greater divergence of the axes of the bands.

By the use of deflectors much greater capacity was obtained than could be had with the Wilfley deck riffled in the ordinary way. The tendency of material fed to the ordinary shaking deck is to follow the diagonal line from the feed corner to the opposite or lower corner. As the rate of feeding increases, the tendency to build up and pack and dry out on this line becomes marked. If very coarse feed, say up to a maximum of ¼ in., is fed to a Wilfley riffled in ordinary ways, very shallow riffles will be found to give the greatest capacity and all-round best effect. The shallow riffles allow the feed to spread out, which deeper ones do not. The objection to shallow riffles is that they do not allow of good stratification, and, theoretically, the coarser the feed the deeper the riffles should be.

My present trend of thought regarding roughing decks is toward a highly inclined deck, with deep riffles arranged parallel to the head motion of the machine, and a long sharp stroke. Judging by experience with the McKesson-Rice screenless sizer, the wear and tear would be much less with highly inclined decks than with gently sloping ones.

SPREADING OF THE FEED ON A WILFLEY DECK BY DEFLECTORS

The material fed in the experimentation ranged down from ¼ in. The Wilfley roughing table as first received was completely riffled over its whole surface. At the beginning of the tests with this table, the concentrate end was raised ⅝ in. higher than the head-motion end. Before the riffles with which the table was originally provided were removed, the difference in the two points was increased to 1⅝ in. This increase in longitudinal slope did not have a favorable effect on the tailing bands, which failed to shift transversely to any marked degree, so the experiment was not continued.

The deck was then cleared of the original riffling and forty-four new riffles were nailed on. The longest riffle on the tailing side of the machine was ¾ in. at the upper end, tapering to ⅛ in. at the lower end; the shortest riffle at the feed-box side of the deck was 72¾ in. long and was placed parallel to the line of the head motion, 3 in. from the inside edge of the deck. A baffle 23¾ in. long was secured to the deck in front of the feed box and parallel to it. A series of deflectors, radiating from the feed box, were secured to the top of the riffles. These deflectors were more nearly athwart the line of the head motion at that end of the deck than were those starting at points nearer the lower end of the feed box. The inclination of the line of deflectors to the line of the head motion decreased going down the deck. Naturally, the deflectors were closest together at the feed box and most widely spread at their ends on the tailing and concentrate side and end.

After the deflector blocks were put on they were sawed out between adjacent pairs of riffles, skipping every other pair. This left pieces of deflector blocks spanning two riffles, alternated by open spaces. A grain, passing through the open space between two riffles, would, in its passage down the deck between this pair of riffles, encounter the next deflector, where it would bridge the two riffles.

The first line of deflector blocks began 21 in. from the motion end of the deck and reached the tailing side 56 in. from the lower end of the deck. The next line began 3 in. lower down on the feed side, and at the tailing end the first and second lines of blocks were 16 in. apart.

Difficulties were encountered. The deflector system did not increase the divergence of the axes of the various bands, but it did increase the sharpness of the gradation from coarse material, discharging at the tailing side, to the finest material leaving the machine at the concentrate end of the deck. An additional baffle had been placed at the end of the feed box, attached to the deck at right angles to the line of the head motion, on the supposition that it would help throw the feed transversely out on the deck. The actual effect of this baffle was to crowd the feed up against the first line of deflector blocks. Eventually, owing to this action, all the space in front of the lower half of the feed box was filled up solidly with grains. In the deflector space immediately outside of the choked area there was also more or less chokage during the progress of the tests with these wooden block deflectors. Chokage would begin under one or more deflector blocks, and when a relatively large area had filled up the feed would ride over the blocks and proceed down the table in masses. There was also much choking and "drying out" in other parts of the deflector system. Large grains would lodge under deflector blocks and dam up other grains back of them.

In later tests with these wooden deflector blocks the whole area occupied by the deflector system was sprayed from a battery of spray pipes suspended above the deck. The spraying system consisted of a header from which, at intervals, ran stub pipes which were carried parallel to one another across the table. Spray pipes with very small openings were screwed into the stub pipes at right angles to them and with regular spacing. A relatively small amount of water, evenly distributed in the form of rain or mist, was found more effective in overcoming "drying out" than a larger amount of water issuing in distinct streams. It is merely necessary to keep the grains moist with a thin coat of water running over them to prevent them from adhering. The spray water did not overcome the chokages. In later tests, when the problem of overcoming chokages around deflector systems was solved, the sprays were found to be unnecessary and were removed.

In the next series of tests the radiating deflector block system was replaced by continuous deflectors placed athwart the line of the head motion. These continuous deflectors were placed parallel to one another, and all ended at the tailing side of the table. The continuous deflectors were made of strips of wood ⅜ in. deep and ¼ in. wide and the various deflectors were spaced 2½ in., center to center. To overcome crowding and packing at points near the feed box, the riffles in that vicinity were reduced in depth. The reduction in depth was carried in the area immediately facing the feed box and for the same length. The riffle nearest the feed box was cut down to a uniform depth of ⅛ in. Going toward the tailing side of the deck the succeeding riffles were also cut down in depth, but there was increasing reduction in the cut removed until riffle No. 17 was reached, which, for the length of the feed box, was ½ in. throughout. The rest of the riffling system was allowed to remain unchanged.

The deflector system was carried over the deck at a uniform height from it. When crossing the riffles, little filling-in pieces of wood were used to support the deflectors and maintain their height above the deck.

In later tests which followed those employing the arrangements recited, and in order to deflect the feed out on to the table as quickly as possible, a system of baffles was installed. These ranged in depth from ½ in. at the head-motion end of the deck to ⅛ in. at the feed-box end, and with lengths ranging from 9 in. at the head-motion end to 15 in. at the feed-box end, and with spacings of 3 in. from center to center of baffles. These baffles were secured to the deck under the feed box and were placed at right angles to the line of the head motion. Where they crossed the riffles the latter were cut out to receive them.

The first four baffles were ¼ in. wide, the next four ⅜ in. wide, and the last nine were ½ in. wide. The baffles were found to have a beneficial effect in classifying the feed preparatory to entering the deflector system, but the cleats, as placed on the deck with the spacing given, were found to be too obstructive, and their depths and number were gradually reduced. In the final arrangement, the first cleat was placed under the feed box 14½ in. from the motion end. The rest of the cleats comprising the baffle system, eight in number, were spaced 6 in. apart. The first cleat, which was 9 in. long, tapered from a depth of ⅛ in. at the feed-box side to 1/16 in. at the other end. At the lower end the baffle cleat was 13½ in. long, and 3/16 in. deep at the feed end, tapering to 1/16 in. The intervening cleats varied as to depth and length between these two extremes.

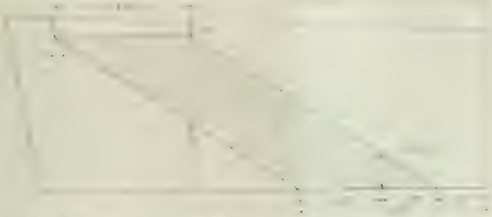


FIG. 3. ARRANGEMENT OF WIRE DEFLECTORS ON DECK OF RIFFLER

[illegible]

In the final arrangement of baffles and deflectors the baffle arrangements remained as just described, but the wooden cleats were replaced by wires. The arrangement and size of the wires is shown in Fig. 3. The baffling arrangement is not shown.

The feed which was available at the time these roughing-table tests were made did not exceed 70 tons per day. At this rate of feeding the table was underloaded with ¼-in. material. The table would have taken 100 to 125 tons per day or possibly more. On material of the grade of that used in the jig testing, and containing about 0.25 per cent lead, a 75 per cent recovery was obtainable, with a concentrate running about 1 per cent, and a ratio of concentration around 6. Recovery of the associated silver and zinc was somewhat less. Practically similar results were obtained with the Empire table but with not as heavy a rate of feeding.

With the wire deflectors there was practically no stoppage. It had been planned as a safeguard on this point, if the experiments had been continued further, to mount the deflector wires in a hinged frame which could be raised up by the attendant from time to time to [illegible] from an incipient stoppage. No observations were made of the wear and tear on the deflector wires, none developed, but the amount put over the deck was too small to have given any information on this point. The possibility of wear and tear of the deflector wires, of stoppages caused by them, and the failure to obtain a better recovery than could be obtained on the Empire roughing table caused me to adopt an Empire machine in the plant for which the roughing experiments were made. Had the Empire table been available at the beginning, the deflector experiments would not have been made.

EMPIRE TABLE

A general view of this machine is shown in Fig. 4. This table has less capacity than the rougher which was developed by experimentation. The deck shown in the illustration is 4 ft. wide by 10 ft. long. In the experimental work strokes up to 6 in. were tried. When the inventor later began to manufacture the machine, he recommended a length of stroke from 2 to 4 in. The number of strokes per minute varies from 140 to 160. The general action of the machines, except the greater length of stroke, is similar to the ordinary shaking table, but this great length of stroke gives great mobility. Very slight changes in the transverse slope of the deck make great differences in the positions at which the bands discharge at the side and end of the deck.

On ¼-in. material the capacity of the machine is about 60 tons per day. The serious objection to this and other shaking tables when coarse material is being fed is the tremendous wear and tear. Ordinary linoleum and wooden cleats will be completely worn away in a week or two of use. The linoleum stands up better than the riffles, the latter becoming shreds and scraps in half the time that the linoleum takes to wear out. This makes the cost of upkeep unduly high.

Suggested improvements in the riffles extend all the way from replacing softwood with hardwood riffles to brass, steel and special cast-steel riffles. It has been suggested that iron or steel decks be used, or cast-iron

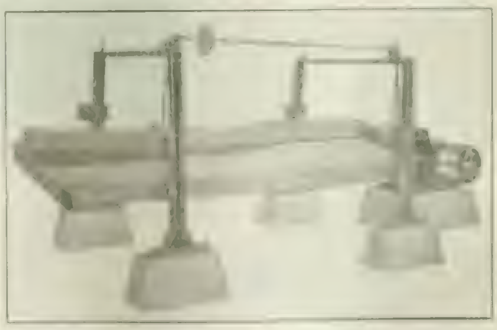


FIG. 4. THE EMPIRE [illegible] TABLE

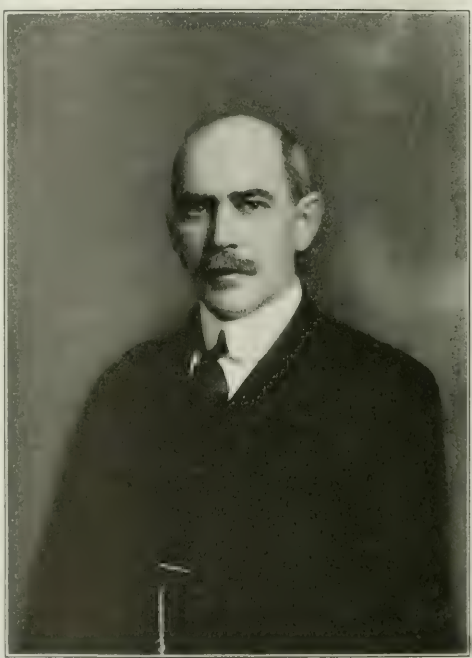
decks in which is embodied [illegible] material as is found in patented stair treads. A deck made of material of this sort might resist wear well, but it would offer the great hindrance of [illegible]. A [illegible] deck has recently been patented.

The Empire table of the rougher type is no longer manufactured. It has been improved mechanically and is now being sold [illegible] with standard concentrating tables. If the problem of wear had been solved, a long-stroke machine would be successful in the roughing of many concentrating processes.

Mining Engineers of Note

F. F. Sharpless

FREDERICK FRALEY SHARPLESS, the newly elected secretary of the American Institute of Mining and Metallurgical Engineers, enters upon his new duties after two years of experience in a similar position with the Mining and Metallurgical Society of America. Mr. Sharpless became a member of the Institute in 1889, soon after completing his college course, and since then he has been intimately connected in varying capacity with the mining industry, his work as an engineer taking him into many parts of the world. Born in Chester County, Pa., which is known for the great variety of its minerals, his father a mineralogist, Sharpless became a collector of minerals at the age of fourteen, and by the time he was ready for college had an interesting collection. At the Normal School in West Chester, his home town, he developed a taste for chemistry, and, following his inclination, went to Ann Arbor, where he took his bachelor's degree in 1888. In his senior year at Michigan he became interested in metallurgy, mining, and geology, which he attributes to his studying under Prescott, Cheever, Pettee, and Alexander Winchell.


F. F. SHARPLESS

Upon his graduation he went to Houghton as instructor, and later became professor of metallurgy, ore dressing, and assaying. Leaving there in 1894, he went to Minneapolis and opened a chemical laboratory in association with Horace Winchell. The work of the laboratory was entirely on ores, and Sharpless says he soon discovered that he lacked practical experience in mining and metallurgy. So, treating the defect in drastic fashion, he gave up the laboratory in 1897 and went to California, where he worked in various mines and mills on the Mother Lode under the management of R. A. Parker and W. L. Honnold. Finally he became manager of the California Copper Co., which had a mine at Daulton and a 150-ton smelter at Madera. Here he remained until the mine was worked out and the furnaces could secure no more ore on which to work.

Following his California experience, Sharpless made several trips into Mexico on examination work. In 1900 he became connected with the Consolidated Mines Selection Co., Ltd., of London, and for twelve years acted as that company's American representative. In this capacity he traveled not only throughout the West, but into British Columbia, the Yukon, Alaska, Mexico, and Central and South America. The work consisted in making examinations and reports upon mining properties in all stages from prospect to abandonment, some of which were occasionally taken under development or operated by him. The fund of information gathered on these trips was often of exceeding interest and sometimes of much commercial value to his principals. In particular, a year in Colombia was especially valuable, and Sharpless was able to send back to England much data regarding the mineral resources of that country. Soon after this, English capital began to come into Colombia rather freely, and it is said that returns have been very satisfactory. Following his visit to Colombia, Sharpless went to Asia Minor to examine and report on mercury mines. Two of them, one at Koniah and one at Karabournou, were taken up and developed, and Scott furnaces were installed. The venture at Karabournou was a success. Later, opportunity presented itself for Sharpless to spend a season on the Gold Coast of Africa, examining mines and prospects, in both of which his principals secured an interest with satisfactory results. During the last eight years Mr. Sharpless has been engaged in independent consultation, his work covering the United States, Canada, and Mexico.

Mr. Sharpless comes of Quaker stock, and is a member of the Quarterly Meeting at Westbury, Long Island, where he makes his home. He was married in 1892, and it is set down in the *Transactions* that he and his bride attended the Plattsburg meeting of the Institute that year, as a wedding trip, and were given a reception on Lake Champlain, at which Dr. Raymond officiated. He was also among the members that went abroad in 1889 as guests of European mining engineers. He became a charter member of the Mining and Metallurgical Society upon its organization, and in addition to serving twice as secretary, as already stated, has also been vice-president of that society.

HANDY KNOWLEDGE

Shaft Surveying at the North Star Mine, California

By G. S.

Written for Engineering and Mining Journal

A detail of the general method of carrying an azimuth into mine workings through a vertical shaft was used at the Central shaft of the North Star Mines Co. at Grass Valley, Cal., between 1900 and 1903, and I believe it to be of general application. The line was carried down by the two-wire method, using piano wires strained to about two-thirds of their safe strength. The shaft was 1,600 ft. deep. Any error in the method employed will arise principally from the difficulty of locating a line through the wires.

It is customary to set the transit up on a line through the wires and at the same time on line with permanent survey points underground so as to read the angle between them, or, by prolonging the line, set two underground points on the same azimuth as that on the surface. The former method is preferable and of more general application. The arrangement of points and position of the transit in the sketch was made to avoid the necessity of putting the transit on both lines at once and so, by avoiding this difficulty, increase the speed of reading the angles.

The wires are *a* and *b*. The permanent survey points are *c* and *d*. The transit is set up approximately at the point *x*, the intersection of the two. As the point *x* lies on the intersection of the two lines, it is for the time indeterminate. The line *cd* may be located and drawn on a stationary flat surface so that the line through the wires will fall on it. The transit is then set up on this line and nearly enough on line with the wires so that any movement necessary to bring it accurately in line with them is within the limits of the movable head. The base of the instrument should be as nearly level as may be to facilitate shifting and releveling between observations.

As in deep shafts the wires are never still, the limits of their swing are measured by reading on draftsman's scales set as close behind the wires as possible without touching them. Both wires and scales are illuminated by shaded lights set a little to one side but shining away from the observer. It is most convenient to have the transit so close to the wires that only one is in focus at once. It will avoid confusing the wires when watching the swing.

The necessity of putting the instrument on the line *cd* is avoided by fastening a scale behind the plumb line hung from the point *d*. If the instrument is set up at *y* instead of *x*, the angle *ayz* may be measured by the instrument and the angle *zcd* calculated by measuring the distances *cd* and *zd*. The distance *cd* should not be less than 50 ft. At that distance the arc subtended by one minute is approximately 0.0145 of a foot, and may be easily estimated by reading the scale.

The observer, by noting the limits of swing, determines their centers on the scales by averaging, and puts the instrument on line with points on the scales instead of the moving wires. The angle *ayz* is then measured and the distance *zd* determined by observation. The scales at *a* and *b* are then moved slightly endwise, the instrument is shifted on the sliding head, again brought into line, and the operation repeated. The observer is, therefore, not influenced by his former readings. As the alignment of the instrument with the wires is the least accurate part of the process, as many shifts of the instrument and new determinations as possible should be made. It may be desirable to repeat the angle once. In the case cited, because of a peculiar defect in the transit, the angle was read once and repeated, and the instrument was then reversed and the angle read again and repeated.

The accuracy of measurement increases with the number of observations if they are independent and there is no constant error.

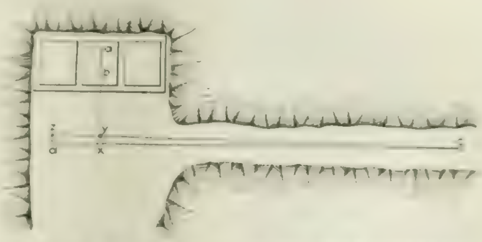


DIAGRAM SHOWING METHOD OF SHAFT SURVEYING

The wires must be set on the surface with great care and checked afterward, or, preferably, watched by an instrument man during the observations. A draft of air from a connection with the shaft on a level above may push the wires more or less constantly out of position, but in this event the azimuth need not be carried down from the surface but only from the lowest level on which there are connections with the surface. Compressed air pumps or drills may be shut down while the survey is being made.

The usual precautions to see that the wires hang free must be taken. It is naturally best to use wires hung in different compartments as far from each other as possible, as this increases the base and the probable accuracy of an individual measurement. The wires swing slowly and a series of measurements takes a considerable time.

It is well to make the observer as comfortable as possible, because doing so probably will be reflected in more rapid and accurate results. A stool or chair may be provided for him while he is watching the swing of the wires, as he may be looking continuously at times through the instrument for some hours.

After wires, lines, and instrument are set, the observer's assistant has nothing to do but watch the lights and occasionally move the scales behind the wires. He will save time for the observer by acting as recorder for scale and angle readings.

A Review of Drilling—Part III*

BY GEORGE J. YOUNG

Western Editor, *Engineering and Mining Journal*

DRILL SHANKS AND REMOVAL OF CUTTINGS

Properly shaped and accurately dimensioned drill shanks play their part in the drilling program. Undersizes and oversizes cause trouble with chucks and result in unnecessary delays. Overlength shanks decrease the efficiency of the drill. Worn chucks are also a source of trouble.

The use of hollow steel with an internal jet of air and water has resulted in a marked improvement in drilling rates for horizontal and down holes. The cushioning effect produced by a thick mass of sludge in the drill hole has been reduced and the need for pumping or blowing out down holes avoided. The net result has been a gain in effective drilling rate. Water tubes cause some trouble, but if the blacksmithing work has been carefully done, both breakages of water tubes and stoppages due to clogged steel are minimized. Some trouble is encountered in soft rocks by the hole in the steel plugging up, due to the forcing of a core into the hole. Where trouble of this kind persists, the remedy appears to be to use a side hole instead of the usual arrangement.

With lower drilling rates, the removal of cuttings is not difficult, but with drilling rates of a foot or more per minute in down holes, holes have frequently to be blown out with an air tube. Piston drills using hollow steel have operated advantageously under these conditions.[1]

BLACKSMITHING

Good drill sharpening and hardening are essential factors in securing efficient drilling. Accurate sizing of bits and shanks must be attained, or lost time results in drilling operations. The use of power sharpeners, oil furnaces in which pyrometric control is possible, and complete shop equipment has removed to a large extent the personal factor in drill sharpening, and it is entirely possible for an intelligent blacksmith to turn out drills which will meet the most exacting requirements of the mine. Gilman advocates inspection of drill steel before it is sent to the mine, and lists the following requirements:

> "That the drill steel is straight and the bit and shank are formed in alignment with the steel body; that the shank is of the proper length and shape; that the lugs or collar at the base of the shank are of the proper diameter and length; that the hole throughout the steel is of the proper size and free from obstruction; that the striking end of the shank is flat and square, with the inner and outer edges slightly rounded; that the bit is of the proper shape, with the cutting and reaming edges formed full and to the required size; that the gage of the bit is of the correct size for the length of the steel; that the reaming edges of the bit are concentric with the axis of the steel; that the angle of the reaming side corresponds to the standard that may be established for the existing conditions; that there are no sharp corners at the shoulder where the bit blends into the steel body; that the steel is free from cracks and other imperfections which might result in breakage when put into service; that the steels are of the proper length to correspond to the established length of steel change."

DRILLING RATE

Without specification of diameter of drill hole, air pressure and type of machine, as well as direction of drill hole and method of removing cuttings and nature of rock drilled, the drilling rate is not significant. Hard, tough rocks have been drilled at as high a rate as 12 in. per minute and rocks of intermediate class have been drilled at 18 in. per minute and upward. Up holes are drilled faster than down holes. As long as a drill bit retains its cutting edge it will maintain its initial drilling rate. In piston drills the drilling rate diminished as the depth of the drill hole increased, but with hammer drills the driller rate does not greatly diminish except when drill bits become dulled. Theoretically, as follower drills are of smaller diameter, the drilling rate should increase in inverse proportion to the square of the diameter of the drill hole. The last part of a drill hole should drill at a faster rate than the first. This is probably true to a limited degree, but other factors enter (the tightness of the smaller diameter holes and the sludging of the drill hole, for example) and the drilling rate approximately remains constant or does not greatly increase for the depth of the drill hole. In Fig. 1, relative drilling rates, calculated on a theoretical basis, are given for holes of different diameters. For a given mine, drilling rates for different rocks and types of drills should be determined for a drill hole of given diameter and the working air pressure. These results are valuable as a basis of comparison.

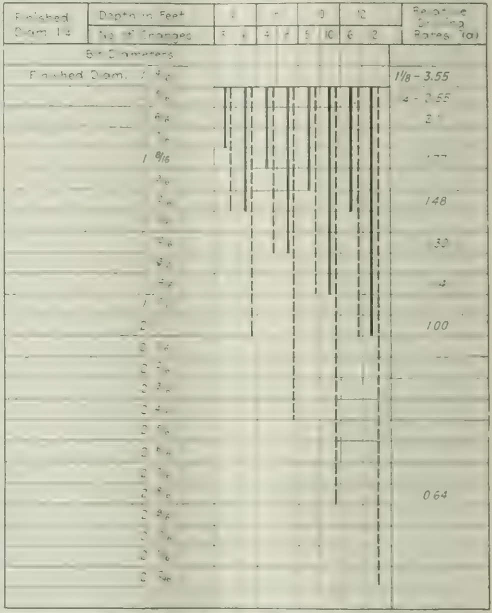


FIG. 1. RELATIVE DRILLING RATES

Dotted lines show range in drill diameters for holes of given depth for ⅛-in. change in diameter for follower drills; solid lines are for ¼-in. change in diameter. (a) Relative drilling rates. The drilling rate for a 2-in. drill hole is assumed to be 1.00. Drilling rate is inversely proportional to the square of the diameter of drill hole, according to theoretical considerations, but is not practically so.

To be continued.

---

*[illegible]

[1] [illegible]

THE PETROLEUM INDUSTRY

The Fossil Oil Field*

The Fossil oil field is in Lincoln County, Wyo., about six miles west of Kemmerer and about four miles east of Fossil. Generally speaking it lies in the eastern part of T. 21N., R. 117 W., but future development may extend it north into the southeastern portion of T. 22N., R. 117 W. The field, as developed so far, occupies a portion of Sec. 11, 14 and 23, T. 21N., R. 117 W.

The geology of the southwestern portion of the state is somewhat different from that of the remainder of the state, especially in the matter of terminology. The particular difference lies in the fact that the oil-bearing sands are apparently found at much higher horizons in the Cretaceous system in southwestern Wyoming than in other parts of the state, notably central Wyoming or the Salt Creek district, and the Big Horn Basin.

In the Fossil field and also in the Dry Piney-La Barage districts, oil has been found in the Evanston, Adaville, and Hilliard formations, which correspond roughly to the Mesaverde and Pierre formations in other parts of the state. So far, no oil has been found in the Mesaverde formation in central or northern Wyoming, and only little oil has been found in the Shannon sand of the Pierre formation. On the other hand, the principal oil-producing sands of central, northern, and eastern Wyoming are found in the Frontier, and lower formations of Colorado age, and in the Cloverly or Dakota sands of lower Cretaceous age. This condition indicates a change in the character of the upper Cretaceous formations going west and southwest from central Wyoming. It has also been noted that the Frontier formation, which contains the famous Wall Creek sands of the Salt Creek oil field, tends to become likewise less productive as one goes west from central Wyoming, and the oil appears to have collected above the Frontier formation and below it.

In the Fossil field the Evanston formation, which is the upper member of the Cretaceous system, is exposed in a small area in Secs. 14 and 23. Underlying this will be found the Adaville and Hilliard formations, both of which are likely to carry oil in commercial quantities. In and surrounding the field are escarpments composed of Tertiary deposits, such as the Green River, Knight, and Almy formations. Structurally, there is an anticline running in almost a north and south direction through Secs. 2, 11, 14, and 23 of this township. The north and south extensions of the anticline are covered and concealed by the Tertiary formations, which are unconformable with the underlying Cretaceous.

Judging from the development that has taken place, it is believed that the axis of the anticline extends from about the northeast corner of Sec. 35, T. 21N., R. 117 W., to the southeast corner of Sec. 34, T. 22N., R. 117 W. There appear to be two oil horizons and one gas horizon so far developed. A number of shallow wells have been drilled in this field, and in these the first sand has been found at depths ranging from 100 to 250 ft. and the second sand at depths ranging from 250 to 450 ft. The first sand is a thin sand containing a heavy black oil, which is reported to be a high-grade lubricating oil of about 24 deg. Bé. The wells in this sand are pumped, and the production is only a few barrels per day per well. The second sand produces a high-grade oil of paraffine base, having a greenish-brown color and containing a high percentage of gasoline. The wells in this sand are pumped and will produce from 5 to 25 bbl. per day.

There are also a number of oil seeps in this small area, especially in Sec. 23. These seeps probably come mostly from the upper or black oil sand. In Sec. 35 of this township are several gas wells reported to be about 800 ft. deep. These wells are now flowing gas and sulphur water. Without knowledge of the logs, it is impossible to state from what sand the gas is derived. Little practical and systematic development has taken place in the field so far.

---

*Abstract of Press Bulletin No. 11, by [illegible] Morgan, State Geologist, Cheyenne, Wyo.

Rumanian Petroleum Production

SPECIAL CORRESPONDENCE

The following official figures, just published, show the petroleum production of the principal companies operating in Rumania during the months of May and June, 1921:

Name of Company	Production in Tons, 1921	
	May	June
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	2,022	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1,730
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

The production of the other companies operating in the country is so trivial that it is of no account. The total production during the month of June amounted to 78,000 tons, and during the month of July the production has even more decreased, amounting to not more than about 2,000 tons per day.

Pierce Junction Field Active

SPECIAL CORRESPONDENCE

Pierce Junction, eight miles southwest of Houston, is rapidly developing into an oil field of prominence. Recently the Brooks well, on the Reed lease, [illegible] ft. from the Snowden & McSweeney No. 1 Cole well, came in at 1,840 ft., flowing [illegible] bbl. It was later pinched down and is flowing 2,000 bbl. through a [illegible] choke. The Snowden & McSweeney well is also flowing this amount. The Gulf Production Co. will drill seven wells; [illegible] & Co., two; Atlantic Oil & Refining Co., one, and the Humble Oil & Refining Co., one.

It is expected that before the end of the year Pierce Junction will be one of the largest producing oil fields on the Gulf Coast.

Technical Papers

Nickel Refining—In *The Mining Journal* for July 23 and 30 (15 George St., London, E.C.4, England; price, 8d. each) is an article describing the Haglund electrolytic nickel refining process. This process has been demonstrated at the Bamle smelting works, in Norway, but has not been operated on a commercial basis. In the Haglund process an almost neutral copper-free nickel sulphate solution is electrolyzed between sheet-iron cathodes and lead anodes, the latter, the insoluble anodes, being surrounded by diaphragms in which acid is liberated. The anolyte is neutralized by granulated copper-nickel matte in the presence of air, dissolving nickel and some copper, which latter is removed by cementation. Enriched in nickel, the solution returns to the catholyte, which is circulated independently at a speed several times as great as that of the anolyte. Many advantages over the Hybinette process are claimed.

Mineral Resources—Recent publications of the "Mineral Resources of the United States" series include: "Gold, Silver, Copper, Lead, and Zinc in the Eastern States in 1920," eight pages; "Gold, Silver, Copper, Lead, and Zinc in Idaho and Washington in 1919," forty-five pages; "Gold, Silver, Copper, Lead, and Zinc in Utah in 1919," thirty-two pages; "Salt, Bromine, and Calcium Chlorides in 1920," eight pages; "Mineral Resources of the United States in 1918," introduction and summary, 138 pages; "Gold, Silver, Copper, Lead and Zinc in Arizona in 1919," forty pages; "Gold, Silver, Copper, Lead, and Zinc in Montana in 1919," thirty-eight pages; "Chromite in 1920," seven pages; and "Gold, Silver, Copper, Lead, and Zinc in Nevada in 1919," forty-three pages. Any of these may be obtained on request to the U. S. Geological Survey, Washington, D. C.

Flotation Testing—Pamphlet No. 3 of the Bureau of Mines and Geology, Moscow, Idaho, twenty-two pages, obtainable on request, describes the various classes of testing machines on the market, with critical notes thereon, and outlines the principal things to be observed in test work.

Alaskan Mineral Resources—Bulletin 714, now complete, is obtainable on request from the U. S. Geological Survey, Washington, D. C. The various sections of this bulletin on the mineral resources of Alaska in 1920 have been previously reviewed in these columns as they appeared. The complete book contains 244 pages, and an excellent up-to-date map of Alaska, showing the mineral deposits of that territory, is included.

Iodide Method for Copper—The procedure for an iodide method for determining copper, for which great accuracy is claimed, is given in the *Alumni Magazine* of the Colorado School of Mines for July, 1921. (Golden, Col.; price, 25c.)

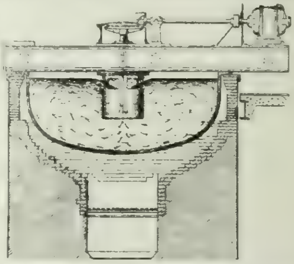
Mineral Resources of New York—The mineral resources of the State of New York form the subject of New York State Museum Bulletin, Nos. 223, 224, which may be obtained from the University of the State of New York, Albany, N. Y., on request. The bulletin contains 315 pages, paper bound. The principal products of the state are portland cement, pottery, salt, iron ore, natural gas, and limestone.

Air-Compressor Operation — In the *Iron Trade Review* for Aug. 25 (Cleveland; price, 25c.) is a four-page article entitled "Avoiding Compressor Troubles." Proper lubrication and occasional cleaning are the principal points to be observed.

Recent Patents

Patent specifications may be obtained from the Commissioner of Patents, Washington, D. C., for 10c. each. Postage stamps not accepted.

Lead Refining—No. 1,386,503. G. P. Hulst, Hammond, Ill., and M. W. Krejci, Chicago, Ill. A method of agitating a bath of molten lead while feeding thereto, without oxidation, suitable reagents for removing impurities in the form of dross. The type of apparatus is shown in the illustration.



Chloridizing—No. 1,384,465. Harry Hey, Melbourne, Victoria, Australia. A process which embraces mixing lead-silver sulphide ores with hydrochloric acid and heating the mixture at a temperature substantially above 100 deg. C. to effect a preferential chloridizing of the lead and silver present.

Concentrating Table—No. 1,385,693. E. T. Lednum, Denver, Col., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del. An ore concentrating table with a surface of pyroxylin-coated fabric.

Jaw Crusher—No. 1,385,244. C. M. Conder and G. T. Vivian, Camborne, England. A new design of jaw crusher.

Shale-Distillation Furnace — No. 1,384,878. J. N. Wingett, Denver, Co., assignor to the American Shale Refining Co., Denver, Col. A design of furnace for distilling the volatile products from oil shale, which comprises superposed vaporizing and combustion chambers.

Book Reviews

Compressed Air. By Theodore Simons, Professor of Mining, University of Montana, School of Mines. Second edition; cloth; pp. 173; illustrated. McGraw-Hill Book Co., New York. Price, $2.

This book has been prepared especially to provide the student with the groundwork that will enable him to solve the several problems connected with compressed air and its uses, and no attempt has been made to go into extensive descriptions of the different types of compressors or other pneumatic appliances. The greater part of the chapter on transmission has been rewritten, and modern formulæ are introduced, with examples of their application. The revision of the original text and the addition of new material brings this second edition abreast of modern theory and practice.

Oil Land Development and Valuation. By R. P. McLaughlin. Flexible cloth; 7½ x 5¼; pp. 196; illustrated. McGraw-Hill Book Co., New York. Price, $3.

This handbook aims to outline only the steps necessary for the full and proper development of lands which have already been determined to be oil bearing. It will be found to be a valuable aid to all who are concerned in or responsible for oil-field operations. The chapters cover the following subjects: Development program; drilling of wells; assembling information relative to underground conditions; production of oil; repairing, deepening, and abandoning wells, and the value of oil land.

Iron and Steel in Sweden. Board cover; 7¾ x 9¾; pp. 183; illustrated. Edited and published under control of and in co-operation with Jernkontoret by Aktiebolaget Svenska Teknologföreningens Förlag, Stockholm, Sweden.

The printing and binding of this publication deserves special mention, and the general appearance of the book is a decided credit to the Iron Masters' Association (Jernkontoret) which has undertaken its publication and distribution. The book is intended to give necessary information to buyers of Swedish iron and steel, but its use will not be entirely limited to this purpose, for the work contains so much of general information that it serves as a fairly complete history of the iron and steel industry in Sweden.

The Engineering Index (1920 Edition). Cloth; 6⅞ x 9½; pp. 586. Published by the American Society of Mechanical Engineers, 29 West 39th St., New York. Price, $6.

This volume contains nearly 14,000 references to articles that have appeared in various domestic and foreign technical publications. The subjects are alphabetically arranged, and the book will be found invaluable for reference purposes.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

A. I. M. E. Meeting Will Include Three Tours

Automobile Trips Arranged by Committee Will Afford Excellent Opportunity for Visitors To View Northern and Lehigh Regions—Itinerary Covers Many Points of Interest to the Engineer and Miner

R. V. NORRIS

General Chairman of the Wilkes-Barre Meeting

THE program of the Semi-Centennial Meeting of the A. I. M. E. has already appeared in *Engineering and Mining Journal* of Aug. 20, although, as announced at that time, it was subject to change. The changes, however, are so slight that it is not regarded as necessary to make any corrections in this issue.

Through the courtesy of *Coal Age* we are able to give the details concerning the three motor trips which will be made as a part of the program arranged by the committee of which R. V. Norris is general chairman.

On Sept. 13 automobiles leaving headquarters at Irem Temple, Wilkes-Barre, will tour past the Dorrance, Prospect and Henry collieries, No. 14 colliery of the Pennsylvania Coal Co., the Hoyt shaft, and the Ewing breaker by Fort Griffiths to Pittston. The Pittston shaft of the Seneca colliery, where mining is being done under the Susquehanna River and its extensive flats, will then be visited. The Twin shaft of the same colliery, the breaker of the Barnum colliery, the washery of the Phoenix Mining Co. will be passed on the road to Duryea. The road then runs beyond the Hallstead breaker and the William A. colliery to Old Forge, where the No. 2 shaft of the Old Forge colliery, the breaker where the coal from that colliery is prepared, and the Jermyn colliery are located. Reaching Taylor, the party will pass the breaker of the Scranton Anthracite Co., the Greenwood colliery and a public school which was started but never finished because the caves stopped the builders. The concrete breaker of the Taylor colliery is the first breaker that the visitors will pass that has been shut down to avoid the payments of the Kohler Act that makes the damaging of houses by mine caves a penal offense.

The Pyne colliery follows, and then the National and Dodge collieries, which have also closed down as a result of the Kohler law. The latter colliery is working by a semi-longwall method and using electric undercutting machines and belt conveyors along the working face.

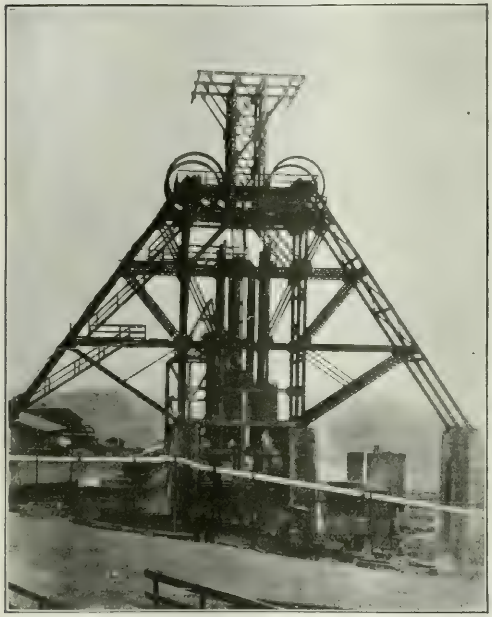
The automobiles will also pass the Hyde Park section of Scranton, where the caves have occurred of which so much has been printed in the newspapers. At the Oxford breaker of the People's Coal Co. the mine has been closed down and the company has passed out of existence. Some of the officials of the company have been tried and found guilty of a violation of an injunction of the court, but the case has been appealed.

Passing over the cave area, Mount Pleasant, the Diamond, and the Tripp collieries will be reached. Then the old breaker of the Bulls Head Coal Co., the West Ridge, Van Storch, Richmond and Legitts Creek collieries will be visited. Arriving at No. 1 shaft of the Marvine colliery, a Hudson Coal Co. plant, the party will leave the cars, inspect the plant, and reembark at No. 2 shaft. The Price-Pancoast shaft, at Throop, and the Richmond shaft on the outskirts of Scranton will be passed on the way to North Park, a section of Scranton, where the top bed, twenty to thirty feet below the surface, must be unrecovered because the mining of

GREENWOOD BREAKER OF LEHIGH COAL & NAVIGATION CO., NEAR LANSFORD, PA.

this bed has been forbidden by permanent injunction.

The party will then lunch at the International Correspondence Schools and hold a technical session in the same building, returning to Wilkes-Barre thereafter by the Pine Brook, Dodge, National, and other shafts visited in the morning. The road taken will be different, and No. 9 colliery of the Pennsylvania Coal Co., No. 4 shaft of the Ewing colliery, and Nos. 6, 5 and 11 collieries of the Pennsylvania Coal Co., also the Laflin colliery, the Delaware shaft, and a breaker of the Wilkes-Barre Anthracite Coal Co., will be on the itinerary.


HEADFRAME OF WATER SHAFT AT TAMAQUA COLLIERY

Other points of interest will be the Pine Ridge colliery of the Hudson Coal Co., the beautiful Mineral Spring colliery of the Lehigh Valley Coal Co., the substantial buildings of the Peach Orchard colliery of the Glen Alden Coal Co., and the ill-fated Baltimore No. 5 colliery, where nearly 100 men were killed by an explosion of powder as the trip was being taken into the mine. No. 2 shaft of the Hudson Coal Co. is the last coal-operating point to be passed on the way to the starting point. The whole trip is short, covering only forty-six miles, but, as may be noted, it is well supplied with coal-producing equipment.

A shorter trip will be made on Sept. 14, when the plants on the road not already visited will be the Pettebone, Haddock, Harry E., Forty Fort, Mount Lookout, and Maltby collieries and the Cortright slope. The visitors will be entertained by the Wyoming Shovel Co. at luncheon.

Starting at 9:30 a.m. on Sept. 15 the various parties will tour by way of Ashley and the Ashley Planes to White Haven, passing the Stanton, Buttonwood, Inman, and Maxwell collieries. Entering the Lehigh region at White Haven, the visitors will proceed to the Drifton breaker, passing the ruins of the old Pond Creek breaker, which was begun in 1879, the breaker of the East Point Coal Co., Highland No. 2 colliery, and that of the Upper Lehigh Coal Co.; also Markle No. 5 and Highland Breaker No. 2. Skirting Freeland, the party will pass Highland No. 5 and the celebrated Eckley breaker and arrive at Jeddo and Japan Village, where coal is reclaimed from the piles by passing it through boreholes into the mines and loading it into mine cars which bring it to the surface. Passing Jeddo No. 4, some "Mammoth Vein" strippings, the Basin shaft, the Jeddo drainage canal, (built to protect the mines from the creek), and the G. B. Markle & Co. strippings will in turn be reached; also Harleigh No. 7 and the Hazleton shaft. Beaver Meadow and the breaker named after it, Coleraine, and the Evans Colliery Coal Co.'s plant will next be passed on the way to the Hudsondale storage plant of the Lehigh Valley Coal Co.

ONE VIEW OF THE ASHLEY PLANES OPERATED BY THE CENTRAL R.R. OF NEW JERSEY

Standard-gage equipment is used. This plane is 3,000 ft long and 422 ft high, and at this point the grade is 14.65 per cent.

The visitors will reach Nesquehoning, passing the breaker named after that village and the Hauto washery and power plant. Luncheon will be served at Greenwood Park. Returning, the party will pass the Lansford colliery and the Coaldale breaker now being built to take the place of the one recently burned. They will then enter Coaldale and travel by way of the Greenwood, Rahn, and Tamaqua breakers, passing, on the way, an 800-ft. water shaft having one of the largest reduction-motor hoists in the world.

The motor is a 1,200-hp. machine. It hoists twenty-seven tons at each trip. Crossing the Schuylkill River, the automobiles take the road to Silver Brook washery, Audenreid, and the Beaver Brook breaker of Charles M. Dodson & Co. Other points of interest will be the Spring Brook washery, Cranberry colliery, Harwood colliery and electric plant. Hazleton will then be reached. Harleigh No. 7 and Lattimer collieries will next be passed. The Pardee headframe, which discharges the coal at right angles to the direction of hoisting, and the old Milnesville strippings, with their interesting rock folds, will next be noted, and then the party will make for home by Fairview and Ashley, a total run by the speedometer, from the start to the finish of the trip of 117 miles.

Utah School of Mines Appointees Begin Work at Bureau of Mines Station

Research work has been started by fellowship appointees of the Utah School of Mines at the Salt Lake station of the Bureau of Mines, under the direction of Thomas R. Varley. Each year the University of Utah sets aside five fellowships for the research work related to mining. The following men have been appointed for the fiscal year 1921-1922, and have already taken up their work at the Bureau of Mines station: Charles G. Maier, a graduate of the Massachusetts Institute of Technology, has been assigned problems dealing directly with the hydrometallurgy of zinc and assisting in problems in physical chemistry directly concerning the application of chloride volatilization process.

Morris Badt, University of Nevada, assigned to work on problems directly connected with ore-dressing research.

C. G. Wurtzbaugh, South Dakota Schools of Mines, assigned to problems dealing with the chemistry of the volatilization process.

Douglas Gould, Tufts College, assigned to work on oil-shale investigations.

In addition, Dr. W. D. Bonner, professor of chemistry at the University of Utah, is doing important work with regard to the possibility of manufacturing hydrochloric acid on a commercial scale in Salt Lake.

George L. Oldright, a hydrometallurgist of many years' experience, has been appointed to work in volatilization problems in the place of E. P. Barrett, who was recently transferred to the Seattle Bureau of Mines station. Mr. Oldright was formerly research hydrometallurgist for the American Smelting & Refining Co., at Perth Amboy, N. J. Later, he directed the construction of the pilot mill of the Chile Copper Co. at Chuquicamata and afterward was general superintendent of the leaching plant.

It is the ambition of the staff of the local station to make the work of organization of the highest possible efficiency. In line with this ideal, many problems, the solution of which are of vital importance to the mining industry, are being studied. With the arrival of a new Leitz photomicroscope, the metallurgical laboratory becomes one of the best equipped in the United States.

Interest in the microscopic analysis of ore is growing rapidly, according to information received at the station. Operators have suddenly awakened to a realization of the need of knowing the physical structure of ores as well as their chemical composition, in order that the best methods of milling may be economically determined.

International Geological Congress Announced for 1922 in Belgium

The following is a translation of a letter recently received from the committee of organization of the International Geological Congress, of which Armand Renier, chief of the Geologic Service of Belgium, is secretary, and Jean Lebacqz, director general of mines and president of the Geologic Council of Belgium, is president:

"The honor of organizing the next International Geological Congress has been reserved to Belgium from 1913. The brutal invasion of our soil in spite of all agreements, the ruins which have accumulated in the course of the war, the distress of the entire country, have, as a necessary consequence, prolonged adjournment of this reunion. But sympathetic requests coming from all parts have incited us to wait no longer.

"In the name of the Committee of Organization, we have the honor to bring to your attention that an International Geological Congress will be held in Belgium the latter part of the month of August, 1922, and to invite you to take part.

"Excursions will be organized before, during, and after the session; they will cover our whole country, whose varied geology has already been studied in great detail. The study of questions of general character will be included. The later circulars will specify the details of arrangement.

"We are convinced that you will lend your valued assistance, and we thank you in advance.

"The addressed lists which are available to us being old, you would do us a great service in forwarding us lists of persons to whom we could profitably send the final circulars. Address all communications to the secretary's office, Geological Service of Belgium, Palais du Cinquantenaire, Brussels."

San Francisco Section, A. I. M. E., Approves Survey of Earthquake Fault

The San Francisco Section of the A. I. M. E. held its regular meeting on the evening of Aug. 23. F. L. Sizer presided. Edward Higgins gave a short talk. The finances of the local section were discussed, the plan of voluntary subscription resulting successfully. Communications favoring Prof. A. C. Lawson's resolution, introduced in the May meeting, were read. The resolution advocated a survey of the changes in geographic position produced by the earthquake fault. Herbert Hoover, Secretary of Commerce; E. Lester Jones, Director U. S. Coast and Geodetic Survey, the San Francisco Chamber of Commerce, and Congressmen from California approved the project. Letters from F. F. Sharpless and President Ludlow to Chairman Sizer were discussed, and a membership committee consisting of H. M. Wolflin, C. A. Grabill, R. P. McLaughlin, H. R. Plate, and R. H. Bedford was appointed.

A request from A. F. Parsons for a historical sketch of the section for the San Francisco Chamber of Commerce was referred to the secretary, and the members were requested to collaborate with him in preparing a suitable résumé. Participation of the section in the affairs of the San Francisco Engineering Council were discussed, and a committee consisting of Wilbur H. Grant, A. A. Hanks, and C. G. Dennis was appointed to investigate and report at the next meeting.

Society of Chemical Industry of Great Britain Holds Montreal Meeting

The fortieth annual convention of the Society of Chemical Industry of Great Britain was held at McGill University, Montreal, Aug. 29-31. About 300 members were in attendance, including many prominent British and American chemists. Sir Charles Fitzpatrick, Lieutenant-Governor of Quebec, extended a welcome to the society on behalf of the province. Sir William Pope, F.R.S., president of the society, emphasized the imperial character of the organization, extending throughout the British dominions and having a large branch in the United States. He predicted that the present generation would see an immense development in the application of organic chemistry to industry, especially in the advanced use of petroleum along the same lines as had been applied to coal-tar products. The following officers were elected: President, Dr. R. F. Ruttan, of Montreal; vice-presidents, J. L. Baker, C. S. Garland, and Sir William Pope; councillors, F. Armstrong, J. W. Hinckley, D. J. Wilcock and E. V. Evans, foreign secretary, Prof. Henry Louis. The annual banquet was held the evening of Aug. 30, the principal speaker being [illegible]. W. H. Nicholls, who represented the American section; Henry Holgate; Harold J. Roast, secretary of the Canadian Institute of Chemistry, and Professor Partington of [illegible].

British, French and American Engineers To Promote Unity

American engineers will meet representatives of the principal engineering societies of Great Britain and France at a dinner to be given at the Engineers Club, New York, on the evening of Oct. 10. The event, though formally celebrating the homecoming of the mission of distinguished American engineers who went abroad to confer the John Fritz Medal upon Sir Robert Hadfield, of London, and Eugene Schneider, of Paris, will mark the launching of a world movement of engineers to promote unity among the English-speaking peoples and among peoples who aided in the war against Germany.

Adjustment of Wage Scales To Be Studied

The U. S. Department of Labor, through the Bureau of Labor Statistics, is making an investigation to determine the manner in which cost of living figures are used in the adjustment of wages. The Commissioner of Labor Statistics has written the *Engineering and Mining Journal* as follows:

"The Department of Labor, through the Bureau of Labor Statistics, is making a study of the methods of adjusting wage scales and concluding collective wage agreements where cost of living figures enter into the wage adjustment. To that end, the Bureau of Labor Statistics wishes to communicate with the various companies, members of arbitration boards, labor managers, or others who are using cost of living figures in the determination of wage awards.

"If any reader of *Engineering and Mining Journal* who has not already communicated with the Bureau is using cost of living figures in the adjustment of wages, it will be appreciated by the Bureau if he will write to the Commissioner of Labor Statistics, Washington, D. C., and inform him of that fact."

Geologists To Visit in Tennessee

The Association of American State Geologists is planning a field trip through Tennessee during the early part of October. Visits to the following points will be included: Oct. 7, [illegible] plant at Nashville; Pleistocene [illegible] deposits, and Silurian fossil locality at Newsom Station; Oct. 8, Mount Pleasant phosphate field; Oct. 9, dam and power plant on Tennessee River near Chattanooga; Oct. 10, industrial plants at Chattanooga; Oct. 11, Ducktown copper district; Oct. 12, Knoxville marble quarries; Oct. 13, Mascot zinc field; Oct. 14, [illegible] deposits, and Oct. 15, Cranberry magnetite iron ore deposits.

MEN YOU SHOULD KNOW ABOUT

Henry C. Morris, of Washington, D. C., has been definitely chosen to head the new petroleum commodity division of the Department of Commerce. In addition to his public-school education, Mr. Morris attended a military academy and the Massachusetts Institute of Technology. He was graduated from the latter institution in 1901 with the degree of B.S. in mining engineering. He was part owner and manager of the Blue Bull mining property, at Goldfield; the Nevada Hills lease, at Fairview, Nev., and the Reno Reduction Works. Most of his experience has been in the business department of mining, rather than in consulting engineering work. He has been in personal charge of oil-drilling operations and has made a specialized study of petroleum economics since May of 1918. Early in the war, Mr. Morris served with the Fuel Administration on a dollar a year basis. In May, 1918, he joined the staff of the U. S. Bureau of Mines and was made a member of the Capital Issues Advisory Committee. Later, he became the Bureau's representative on the Economic Liaison Committee. In that position, he made a special study of the international petroleum situation and has come to be regarded as authority on those matters.

HENRY C. MORRIS

C. W. Purrington sailed from England for Boston on Sept. 7.

Walter H. Aldridge announces the removal of his office to 41 East 42d St., New York City.

F. E. Calkins has recently completed an examination of the Lincoln gold mine near Crown King, Ariz.

C. M. Frantz, of Denver, is making examinations of the fluorspar resources of New Mexico and Arizona.

Horace V. Winchell is transferring his headquarters and residence from Minneapolis, Minn., to Los Angeles, Cal.

J. W. Bell, of the North Crown mine, in Porcupine, has joined the staff of the Gutta Percha Rubber Co., Toronto.

Albert G. Wolf, mining engineer to the Texas Gulf Sulphur Co., was in New York last week on a brief professional visit.

J. R. Mougin has been engaged as mill manager for the Ore Chimney Mining Co., Northbrook, Ont., and will take charge Oct. 1.

J. F. Callbreath, secretary of the American Mining Congress, addressed the members of the Engineers' Club of San Francisco on Aug. 24.

John F. Sleeper, author and chemist, will leave Tenafly, N. J., the middle of September and take up a permanent residence in Santa Barbara, Cal.

G. T. Hansen has resigned as district manager of Allis-Chalmers Manufacturing Co. in Salt Lake, and will give his attention to personal mining and oil enterprises.

Frederick Lyon, formerly a member of the engineering department of the United States Smelting Co., and later vice-president of the company, has been visiting in Salt Lake City.

H. E. Nyberg, formerly assistant general manager of the Cía. Minera "Las Dos Estrellas," S. A., of El Oro, Mexico, has recently been appointed general manager of the same company.

F. G. Cottrell, who has been in Europe during the summer investigating industrial conditions of interest to the mining and chemical industries, will sail from Cherbourg for New York on Oct. 11.

B. A. Middlemiss, former assistant general manager for the Chile Exploration Co., at Chuquicamata, Chile, has completed a three-year contract with this company and intends to enter business in this country.

George H. Kilburn, of the Consolidated Mining & Smelting Co., of Canada, Ltd., is making a mineral survey of the Esquimelt & Nanaimo railway belt lands on Vancouver Island for the Canadian Pacific Ry.

E. R. Rice, formerly manager of the Van Dyke Copper Co., Miami, Ariz., has entered into a partnership with **L. H. Foster**, of Kingman, Ariz. The firm will be known as Foster & Rice, mining and civil engineers.

E. A. Holbrook, acting director of the U. S. Bureau of Mines during the absence of Director Bain, will represent the Bureau of Mines at the Wilkes-Barre meeting of the American Institute of Mining and Metallurgical Engineers.

David White, chief geologist of the U. S. Geological Survey, left Washington on Sept. 4 for an extended field trip, during which he will examine reported oil-shale deposits in the northern Appalachian region and will make several stratagraphic studies in the Pennsylvanian system.

F. W. Bradley, president of Olaska Treadwell and associated companies, and president of Bunker Hill Mining & Concentrating Co., after a visit to the Bunker Hill operations in August, is making an annual inspection of the Alaska mining enterprises.

Howard S. Gilman, for the last three years with the Ingersoll-Rand Co., at Los Angeles, has been transferred to Lima, Peru, as local manager. He is accompanied by **E. P. Cleary**, who has been the company's representative in Mexico City for several years.

Mining engineers recently in New York City included: **L. S. Twomey**, Cleveland, Ohio; **S. D. Bridge**, San Antonio, Tex., and **W. B. Donoghue**, Casapalca, Peru.

G. St. J. Perrott, associate physical chemist of the Bureau of Mines Experiment Station, Pittsburgh, Pa., has been sent to Birmingham, Ala., to study the physical properties of coke in relation to its production and use in the blast furnace. Blast-furnace operators declare that there is a decided lack of knowledge regarding the physical and chemical properties of coke in producing iron ore. In the stress of war time they found it necessary to use almost anything in the way of coke material that was offered, and, it is said, they found they could use materials that before had been regarded as impossible of utilization. It is believed, therefore, that the investigation proposed offers a fertile field for obtaining important information. Conditions are favorable for the conducting of the these investigations at the Tuscaloosa Experiment Station of the Bureau of Mines, where there are a number of small blast-furnace plants and by-product plants.

G. ST. J. PERROTT

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

Missouri Charcoal Iron Industry Passing

Sligo Furnace Co. Makes Last Cast—One Furnace Left in Southeast Missouri

The Sligo charcoal furnace, in Dent County, in central Missouri, has just made its last cast and will permanently go out of business. This furnace has been in almost continuous operation for over forty years, and was built at a time when there were about ten charcoal furnaces in Missouri, all of which have gone out of business and most of them, especially in the Iron Mountain district, over thirty years ago. Though the Ozark hills are timbered mainly with oak, which makes an excellent, strong charcoal, the yield per acre is very moderate, or only about ten cords, so that the timber is rapidly exhausted, which is the cause of the practical extinction of this industry in Missouri. By building a railroad, the Sligo Furnace Co. was able to extend its life to this date by pushing farther and farther away from the furnace for its supply of charcoal, but it has now gone beyond the profitable stage and passes into history. The Sligo furnace relied mainly on local pocket deposits of hematite and limonite, and though these are very uncertain as to tonnage, the company was in a district that has been able to supply a good grade of iron ore to date, although a few shipments of special ore were drawn from mines of the Lake Superior district.

There still remains one charcoal furnace in southeast Missouri, that was built during the recent war mainly to secure the byproducts, as it is equipped with an expensive byproduct oven plant. As this furnace is in a district that has not been cut over, it may continue several years longer, although it is not favorably situated for a reliable supply of iron ore.

Czecho-Slovakia To Stimulate Production of Radium

(Cabled by Reuters to Engineering and Mining Journal)

Prague, Aug. 30—In order to increase the production of radium, the government of Czecho-Slovakia has granted 12,000,000 crowns for the technical improvement and development of the mines. The annual output is expected to reach four grams as a result of this aid.

WEEKLY RÉSUMÉ

The last week has been barren of important events. At Washington protests continue to be made one way or the other against provisions of the metal schedule of the Tariff bill. The Bureau of Mines and the Bureau of Standards are preparing to study the reasons for breakage of drill steel.

In California the suit of Carson against the Afterthought Copper Co. resulted in a verdict of $1 damages for the plaintiff. In Utah the Utah-Sodium company has been taken over by the Western Chemical & Dye Co. In Nevada conditions are rapidly becoming normal at Tonopah and Divide. In the Joplin-Miami district the High Five mine, near Waco, Mo., has been acquired by the American Zinc Lead & Smelting Co. In Ontario the mineral output during the first half of 1921 is estimated at much less than in the same period last year.

Day-Smith Interests Seeking To Control Hecla?

Injunction Obtained Against Star Deal Looked Upon as Move in Fight To Gain Control of Mining Company

The order issued by Judge Blake, of the superior court of Spokane, temporarily restraining the officers and directors of the Hecla Mining Co. of Wallace, Idaho, from taking any steps toward the ratification of the agreement to join the Bunker Hill & Sullivan in the purchase and operation of the Star mine, is popularly regarded in the Coeur d'Alene district as a move by Eugene R. Day, manager of the Hercules mine and a Hecla stockholder, and Mrs. Sarah E. Smith, a director of the Hecla Mining Co., in their fight to gain control of the Hecla company. The order was issued upon their application and the hearing set for Sept. 9. The agreement between the Hecla and Bunker Hill to develop the Star is looked upon as the most important enterprise that has been undertaken in the district for several years, and this move on the part of the Day-Smith combination to block it is regarded by some as a scheme to harass the Hecla management, with the purpose of gaining control of the Hecla.

The Hecla mine has continued in full operation in spite of unfavorable metal conditions, and in joining the Bunker Hill the company will be instrumental in adding a new mine to the list of producers.

Carson Gets Nominal Damages In Afterthought Suit

Jury Awards Him $1 for Infringement of Patent Covering Feeding of Reverberatories—Defendant Calls No Witnesses

The suit brought by George C. Carson against the Afterthought Mining Co. for the infringement of his patent covering the feeding of ore and fettling material through holes along the respective sides of the arch adjacent to the side walls of the reverberatory furnace was recently tried before a jury in the United States District Court, sitting in San Francisco. Plaintiff called a number of witnesses, but the defendant's attorney, W. K. White, did not put any on the stand. At the conclusion of the trial, which occupied about five days, the jury retired, and, after deliberating for eight hours, arrived at what might be deemed a compromise verdict, by awarding the plaintiff nominal damages in the sum of $1. Althought the plaintiff apparently achieved a victory, as a matter of fact the rulings made by the court during the trial were such that the Carson patent, in any future litigation, can probably be easily invalidated. Such rulings arose out of the following situation:

On Jan. 15, 1907, Carson filed an application for letters patent and disclosed therein a reverberatory furnace provided with side-feed ports located in the furnace arch but having combined with each of said feeding ports a receptacle or hopper into which the ore was first fed and from which the feeding of the ore through the hole in the arch was controlled by a sliding gate. After such application was pending for many years, the Patent Office held, in 1915, that the application disclosed three different, distinct and separate inventions as follows:

The feeding mechanism for feeding the ore through the arch at the side of the furnace.

A particular construction of hearth embracing a dam, arranged crosswise of the hearth and making it possible to treat basic material at one end and acid material at the other end of the furnace.

A particular roof construction embracing a particular kind of bracket for supporting the arch.

On account of the rule that provides that separate inventions cannot be covered in one patent, the Patent Office in structed Carson to cancel his claims respectively covering the specific hearth structures and the specific roof structure. Mr. Carson did so, and reserved the right to file a separate application for letters patent on the hearth structure. Upon the cancellation of said claims, a patent issued on Aug. 10, 1915, on such original application, in which there was but one claim covering the Carson side-feed mechanism, but limited to a structure in which was a hopper into which the ore was first fed.

On June 26, 1915, Mr. Carson, of his own volition, filed a second application, in which he disclosed a furnace having two rows of holes arranged along the sides of the arch, but without any hoppers being provided. During the pendency of this application, the British Siemans patent was cited, but Carson was able to have the same found inoperative by reason of certain tests he said he made in Berkeley, Cal. As a result of this second application, a patent was issued to Carson in 1919 and covering broadly his side-feed mechanism, and it was this second patent that was involved in the case cited. During the course of the trial Judge Van Fleet ruled that the application for said second patent was not a proper divisional application, and, therefore, that the date of such application could not be carried back to Jan. 15, 1907, but must be deemed to be June 26, 1915. The result of said ruling is that any prior use in this country of the Carson invention, or any any description of the Carson invention in any printed publication or patent more than two years prior to June 26, 1915, will operate to invalidate such patent. Notwithstanding the said ruling, the defendant in the case, by reason of insufficient funds to make a proper defense, was not able to prove any such prior use or publication or patent, although it is understood that there are patents, publications, and prior uses antedating June 26, 1913, and which are sufficient to invalidate the patent.

Radium Reported Discovered in Belgian Congo

(Cable by Reuters to "Engineering and Mining Journal")

London—It is understood that radium has been discovered in the Belgian Congo. A special mission is about to leave Brussels to investigate the deposits.

Iron Ore Deposits Discovered in France

(Cable by Reuters to "Engineering and Mining Journal")

Paris—It is reported that ore deposits containing over 50 per cent of iron have been discovered in the Department of Lot.

NEWS FROM WASHINGTON

By **PAUL WOOTON**
Special Correspondent

Protests Continue Against Metal Schedule of Tariff Bill

Zinc Institute Representative Before Senate Committee—Foil Men Want Tin on Free List—Aluminum Discussed

E. H. Wolff recently appeared before the Senate Finance Committee as the representative of the American Zinc Institute to call particular attention to the fact that the industry, as a whole, believes it inequitable to give the products of zinc a two-year protection when the duty on raw material is for the life of the bill. He also urged that the committee adopt the rates of duty proposed by the Institute. These rates are somewhat higher than those contained in the Fordney bill, as it passed the House. To set forth clearly the situation as to zinc rates, Mr. Wolff submitted the table given below:

	Act of 1909 Cents	Act of 1913 Per Cent	Proposed by Institute Cents	Reported by Ways and Means Committee, 1921 (a) Two Years Cents	Thereafter. Cents
Ore up to					
10 per cent	Free	10	Free	Free	Free
10 to 20 per cent	½	10	1½	½	¼
20 to 25 per cent	¾	10	1½	1	½
Over 25 per cent	1	10	2	1½	1
Slab zinc	1⅞	15	2¼	2	1⅞
Zinc dust	1⅞	15	3¼	2½	1¾
Sheets	1⅞	15	3¾	2⅞	1⅞
Sheets, coated			3¾	2⅝	1¾
Old and worn out	1	15	2¼	2	1
Zinc oxide, dry (b)	1	10	2¼	1½	1½
Zinc oxide, in oil	1⅝	15		2	2

(a) Passed by the House July 21, as reported, except that two-year rates on ore were made permanent rates at last minute.

(b) 1909, zinc oxide not containing lead, 1913, zinc oxide not containing more than 5 per cent lead; reported zinc oxide not containing more than 25 per cent lead.

He also particularly called the attention of the committee to these paragraphs in a brief which he submitted as a part of his remarks:

"Just before the passage of the bill in the House the Ways and Means Committee awakened to the fact that the zinc-mining industry of this country is threatened almost with extinction. They, therefore, voted to make the two-year rates on zinc ore only the rates for the life of the bill. But in the stress of their work the members of the Ways and Means Committee overlooked the fact that after two years, if the rates on the products of zinc ore are not similarly advanced, these higher ore rates will be practically valueless to the zinc miners of this country.

"In this connection the question naturally presents itself as to where, after two years of the higher ore rates, are the zinc miners of the United States to find a market for their ores. That market is wholly a domestic one. It must, therefore, be obvious to all that, unless the rates on the products of zinc are advanced in keeping with the rates on zinc ore which were at the last minute decided upon the Ways and Means Committee as necessary to the salvation of our zinc miners, there will be no market for domestic zinc ore after two years."

In the course of his remarks to the Committee on Mines and Mining, Mr. Wolff said:

"Our operating costs are getting up higher than they were in pre-war years. One of the important facts to be considered is that the zinc industry as a whole operated on a twelve-hour basis. Today it is on the eight-hour basis, which is the American day, and no one expects that we will go back to the twelve-hour basis. That in itself is going to increase the labor costs permanently about 30 or 35 per cent.

"Then there is the further fact that freight rates have a very large bearing on our business. This is all heavy tonnage, and the amount of money involved in the payment of freight is very large indeed. While it is true that the rates are somewhat higher today than we care to see them, and we expect them to come back to a somewhat more normal basis, yet we do not expect them to go back to what they were in 1910, 1912, or 1913.

"Another matter to be taken into consideration is fuel. Fuel is high today compared with pre-war days, and we do not expect to see fuel come back to that point. I might say that the zinc industry has had protection for many years. It has been understood that zinc had protection. It has never been coming into this country in any large volume, and I do not think anyone expects it to come in from foreign countries. It is a domestic proposition. We should like to have it remain so."

Otto Ruhl, representing the zinc ore producers of Missouri, Kansas and Oklahoma, submitted figures to show the situation in that district and to call particular attention to the need of adequate protection against Mexican ores.

Charles T. Orr, of Webb City, Mo., called attention to the fact that all the mines which produce zinc only are closed down. The properties which are operating, he said, are those that produce lead as well. Prices of zinc are less than they were twenty-two years ago, with labor costing twice as much as it did then.

A protest against the removal of tin from the free list has been made to the Senate Finance Committee by Egbert Moxham, representing the Conley Foil Co. He also filed a brief from the Tin Foil Manufacturers of the United States supporting his contentions. It was contended that the dependence of the United States on the outside world for tin is so absolute that it is self-evident that any import duty imposed by the United States on this material will be followed by retaliatory duties on the part of producing countries. The levying of any duty on tin, it was declared, will react most unfavorably upon the consuming public of the United States. It is the contention of the tin-foil manufacturers that 4½c. may be considered as a normal price for lead. On that basis, the 2¼c. duty prescribed by the Fordney bill is equivalent to a 50 per cent ad valorem rate, it was pointed out. They argue that as the country is producing its full requirement of lead and is exporting large quantities of this material, it would indicate that the industry is in a position to compete successfully with foreign producers, and therefore a rate of approximately 50 per cent ad valorem is unnecessarily high.

A vigorous protest against a duty on aluminum in crude form was made to the Senate Finance Committee by Lawrence M. Brile, of New York. He also stated that the proposed rate of 9c. per pound on aluminum sheets, bars, and other forms would be equivalent to an embargo. He asked that, regardless of the rate fixed on crude aluminum, the rate on aluminum sheets and rods should not exceed that rate by more than 1½c. A rate of 9c. on fabricated aluminum would be entirely inconsistent with a rate of 5c. on crude aluminum, Mr. Brile declared.

Engineers Asked To Serve on Committee To Study Steel

In the hope that they will serve as a consulting committee to study breakage and heat treatment of drill steel, a joint invitation has been extended by the Bureau of Mines and the Bureau of Standards to the following engineers: B. F. Tillson, New Jersey Zinc Co.; F. W. Denton, Copper Range Company; Dr. Van. H. Manning, American Petroleum Institute; Dr. J. A. Matthews, Crucible Steel Co., and W. L. Saunders, Ingersoll-Rand Co.

Would Exempt Gold Mines From Excess-Profits Tax

Senator Smoot, of Utah, has introduced an amendment to the existing revenue laws which, if enacted, would exempt gold-mining operations from the war excess-profits tax assessed in the Revenue Act of 1917.

Ingersoll-Rand Co. Wants Tariff Unchanged on Hollow Drill Steel

Testifying before the Finance Committee of the Senate, C. F. Schwep, of the Ingersoll-Rand Co., asked that the present tariff rate of 8 per cent on hollow drill steel be allowed to remain in effect, instead of the higher rates prescribed by the Fordney bill. He pointed out to the committee that the old type of percussion drilling differs widely in principle from hammer drilling. The hammer drill, he said, uses hollow steel, and instead of lifting the steel in the chuck up and down, the drill is tapped on the end. Owing to the fact that the tool receives blows at the rate of 2,000 per minute, it must possess qualities which enable it to withstand this shock and vibration. Mr. Schwep declared that his company has found that there is something inherent in the Swedish steel, which is not revealed by analysis, which makes that steel much better adapted for the modern drill than is American steel.

Government Engineers Want Western Field Man To Head A. I. M. E.

There is much interest in Washington in the action which the nominating committee of the American Institute of Mining and Metallurgical Engineers probably will take at the Wilkes-Barre meeting of that organization in the selection of a candidate for president of the organization. There is a general desire among the mining engineers of the Government service that the committee select a Western field man rather than a New York engineer for this post.

NEWS BY MINING DISTRICTS

London Letter

Rebuilt Port Pirie Plant Has Only Half of Former Capacity — Sub-Nigel Disappoints—Lonely Reef Results Erratic—Yarde Kerri's Tin Production Lags

By W. A. DOMAN

London, Aug. 22—It would appear that the grade of ore treated by the Waihi Grand Junction Gold Mining Co. last year was slightly higher than that mined during 1919. The bullion return averaged [illegible] per ton, as compared with 32/1 per ton, and the tailings values were [illegible] in contrast with 2/11. A lower tonnage was milled, 57,450 tons, against 66,530 tons, and expenses were high. Bullion recovered was £109,[illegible], and, making various adjustments, the total revenue was £113,[illegible]. Costs, which include mine development redemption at 5/— per ton, depreciation and administrative expenses, aggregated £130,463, so that there was a loss on working of £16,778, raised to £21,016 by taxation. For 1919 the debit was £10,550, leaving the company to start 1921 with an adverse balance of £31,566. Development work was very satisfactory. At the beginning of the year the tonnage in reserve was 90,450, 57,450 tons milled, and the reserves at Dec. 31 last had risen to 120,500 tons. As the company is now obtaining power by contract from the government installation at Hora Hora, a substantial economy has been effected. The directors consider that the maximum working cost per ton has now been reached.

The reconstructed Port Pirie smelting plant is now in operation. To some extent it will relieve the labor position, and provide a certain amount of income for the Broken Hill mining companies, but unfortunately the capacity is only half that of the plant destroyed by fire six months ago, and metal prices are not in the least encouraging for the producers.

Although shareholders in Sub-Nigel have never been led to expect great things from the mine, it must be admitted that recent developments have proved disappointing. In the June quarter 2,850 ft. was advanced, and [illegible] Of the total [illegible] ft. were sampled, and only 20 per cent showed payable values. This gives some idea of the heavy burden which each payable foot has to bear, and [illegible] ter of [illegible]. Specific figures of value are not stated. Where profitable rock exists, the gold content is usually high, and the [illegible] tons milled in the June quarter gave a revenue of £[illegible], with a working profit of £[illegible], and an estimated net profit of £14,[illegible] the tonnage milled an average of 10/— is fairly good, but the ratio to revenue, which of course includes gold premium, is poor.

Erratic results, with some excellent values included, continue to be shown in the Lonely Reef mine. The 23d level north drive for the last 40 ft. averages more than 15 dwt. over 45 in. Relatively this is poor, but it is quite profitable ore. In the No. 24 level (the lowest) north drive the last 60 ft. shows a gold content of 3 oz. 10 dwt. over an average width of 40 in. At such a depth the value is exceptionally good, though it remains to be seen what further footage will disclose.

When the Yarde Kerri tin mining company was floated, sensational stories concerning the quantity of tin that could be recovered were circulating in the City. In fact, it was stated in one quarter that the assays were so high it would be misleading to publish them. Presumably it is the depressed condition of the metal market that has interfered with production. In March and onwards to July inclusive the output of concentrates has been in tons 13, 13, 34, 9½ and 6. Except under certain conditions it is not worth while to work tin properties at all; it is noticeable, however, that the Malayan companies are producing pretty well up to standard, whereas about two-thirds of the Nigerian areas and the whole of the Cornish mines are idle.

AUSTRALIA

Queensland

Mining for Silver-Lead Ore Near Brisbane Slowing Down—Electrical Prospecting Reported To Fail

Brisbane, July 30—The slump in the metal markets is affecting the mining for silver-lead ore in the Brisbane suburban center of Indooroopilly, and except in one case, on the original lease, holders of mining tenements are marking time. At the mine referred to, now owned by a company called Finney's Hill United, eighteen men are at work, a depth of 155 ft. has been reached, and the shaft is still in the second body of felsite, which had been entered at 155 ft. Since February, returns have been received from two parcels of ore shipped from this mine. One of these consisted of 48 tons of ore yielding 22.5 tons lead and 3,760 oz. silver, and the other 31 tons yielding 13.6 tons lead and 2,557 oz. silver, giving an average of about 46 per cent lead and 80 oz. silver per ton.

At the adjoining mine, now down 120 ft., workings have been sampled at 5-ft. intervals, and an average content of 10 per cent of lead with 14 oz. silver per ton is expected. The most recent shipments from this mine, covering two months, were one of 9.46 tons of ore containing 3.3 tons of lead and 435 oz. silver, and another of 10.50 tons containing 3.6 tons lead and 486 oz. silver, bringing the total production of this holding up to 65½ tons of ore containing 33.7 tons lead and 4,460 oz. silver, which is equivalent to 51½ per cent of lead and 68 oz. silver per ton.

Indooroopilly is four miles west of Brisbane. At Yeeronga pocket, two and a half miles to the eastward on the opposite side of the Brisbane River, mining holdings have been taken up on sites selected by the electrical "diviners," who had previously tried their "system" at the first-named place, and later the diviner has been active at another suburb (Coorparoo), which is three miles east of Yeeronga and at which numerous mining tenements have been either granted or applied for on residential areas. Incidentally, it may be mentioned that it is reported that on one of these areas the owner is running a successful poultry farm, and is said to be strenuously objecting to the granting of a lease to mine thereon, on the ground that the concussion incidental to blasting will seriously interfere with the incubation of his eggs. At present the local mining warden is considering this little problem.

As pointed out by the government geologist who contributes periodical notes on this silver-lead mining to the *Government Mining Journal* (Mr. L. C. Ball), so far the diviner has signally failed at Indooroopilly to locate orebodies of which there are no surface indications, and Mr. Ball is sceptical as to his claims at Yeeronga and Coorparoo. The survey at Indooroopilly was undertaken by the Electrical Mines Surveys, Ltd., and was carried out by two diviners with their "improved apparatus and methods, based on the Williams and Daft system."

CANADA

British Columbia

W. A. Cameron and Associates Lease Rambler-Cariboo Mine—Survey of Windermere Division Begun

Three Forks—Following the announcement of the intention of the Rambler-Cariboo Mines, Ltd., to suspend development operations on company account, official information has been given out that W. A. Cameron, mine superintendent, and a number of local residents have secured a lease on the Rambler-Cariboo mine and mill for the rest of this year and until the end of 1922. Provisions of the lease provide for certain development work to be done by the lessees. It is understood that for the present they will confine their operations from No. 7 level upward, seeking to develop high-grade orebodies in the Jennie ground. This claim was acquired by purchase two years ago.

Rossland—The mill at Le Roi No. 2 mine has begun operations and is working on dump material.

Sandon—Twelve men are working on development on the McAllister group, a dry ore property up the north fork of Carpenter Creek.

Invermere—Dr. S. J. Schofield, of the Dominion Geological Survey, Ottawa, with a party of surveyors, is encamped near Windermere, and has made a good start on a geological survey of the Windermere Mining Division. Such a survey has been hoped for by local mining interests for a number of years.

Trout Lake—The recent strike made by owners of the Noble Five group near this point is described as one of the most promising made in recent years, 7 ft. of galena ore having been uncovered on the property.

Grand Forks—Some shipments of reject fluorspar material from the Consolidated company's Rock Candy mill, on the North Fork of Kettle River, are to be made this fall to the smelter at Trail. Local fluorspar production has been at a standstill for some months following unfavorable marketing conditions.

The final chapter in the history of Granby's Grand Forks smelter operations is being written with the announcement that the company is to move the remnant of equipment from the smelter site and store it pending ultimate disposal. Decision to do this has been forced by the announcement of the Canadian Pacific Ry. to the effect that the steel bridge over the smelter dam is to be taken down at an early date.

Cranbrook — It is announced that the Federal Mining & Smelting Co. has again bonded the Stemwinder mine, in the Kimberley section, and plans diamond-drilling development on an extensive scale. The property has been held for a number of years by the MacKenzie & Mann railway interests and was under bond to the Federal before, but after some diamond-drilling exploratory work the bond was allowed to lapse. It is also believed the North Star mine, under lease for some time to Thompson & McKinney, has been taken under bond and lease by the Federal company.

Silverton—A number of men are now working at the Standard mine, operations being conducted by the new owners, who acquired the property from the old Standard Silver-Lead Co. W. H. North, general manager for the old company, continues in charge of operations.

Ontario

Mineral Output Declines Greatly in First Half of 1921—Patricia District Added to Kenora Mining Division

Cobalt—With the exception of gold, platinum, and lead, there has been a marked decline in the output of the Ontario mines for the first half of 1921 as compared with the corresponding period of 1920. The production of lead and platinum is small, so that it may be really said that the only metal to show an increase was gold. The mining industry is passing through the same crisis as the industrial world, and the base metals have all shown a very severe decline. Owing to the complete cessation of all operations by the International Nickel Co. in the Sudbury field, the report for the second half of 1921 is expected to show a still further decline.

The production of gold for the first half of the year shows an increase of

$71,000 over the 1920 figures. Though this is not a very large increase for the six months, its significance will be noted when reference is directed to the output for the first quarter of the year, which showed a decrease of $560,000 as compared with the corresponding period in 1920, so that the increase in production for the second quarter of 1921 is $726,000. The decrease in the first quarter of the year was due to a shortage of hydro-electric power.

The production of silver shows a decrease of $2,500,000, due largely to the severe decline in the price.

The greatest decreases are in the exports of copper and nickel matte. The value of the copper matte exported was only about 5 per cent of the corresponding 1920 production, and that of the nickel matte was only 8 per cent. The exports of metallic nickel for the 1921 period were only about 1 per cent of those in 1921. Metallic cobalt, cobalt oxide, and nickel oxide, which are produced almost exclusively from Cobalt ores, also showed severe declines. The total of the three products was only $362,000, as compared with $1,726,000 for 1920. The total value of the products of the province was $11,000,000, as compared with $22,000,000. In arriving at the copper and nickel in matte, the copper was valued at 8c. per lb. in 1921 as against 13c. in 1920; nickel was valued at 25c. per lb. for both years.

The mining area of the Province of Ontario has been increased by the inclusion of a large section of the district of Patricia, which has been added to the Kenora Mining Division. The new area is 300 miles long and about 100 miles wide, at the widest point. This action was taken by the government owing to the reported discoveries of valuable minerals in that section.

Signs are not wanting that the government's attitude with regard to increasing the mining taxes is undergoing a change, as recent information gives strength to the belief that there is little danger of new taxes being introduced at the next session of the House. This new attitude will, no doubt, be strengthened by the complete closing down of operations by the International Nickel Co. The provincial revenue from the mining industry will be very much smaller than last year, and the government officials are now beginning to realize that the mining industry is one that cannot be milked with impunity.

Irrespective of whether or not operations are resumed by the Dominion Reduction Co.'s mill, Crown Reserve will not attempt to get back on a producing basis this year. A small amount of high grade is being sorted out at one of the surface dumps.

Some high grade ore has been found in the bottom of the 38-ft. shaft of the Oxford Cobalt mine. The shaft is being deepened, and an attempt will be made to develop some profitable ore.

The fiscal year of the Kerr Lake ended Aug. 31, and it is understood that developments for the year have been satisfactory. No production, except a small amount of high-grade obtained in development work, has been attempted, as the Dominion Reduction Co., which treated the low-grade ore of the Kerr Lake, is closed. At the present time Kerr Lake's chief revenue is obtained from the Tahoe silver mine, in Utah, which is producing 60,000 oz. a month. During the fiscal year the company has paid $300,000 in dividends.

Work was recently resumed on the Violet property of the La Rose, and the company has cut its main vein on the 540 level, where it shows good silver values.

Porcupine—It is understood that during one day recently the Hollinger milled 3,490 tons of ore. It is probable that almost 1,000,000 tons of ore will be treated during the year.

It is understood that trouble has arisen with regard to the Allied Porcupine Mines, which is an amalgamation of the Three Nations, La Palme, and Cavana properties. The agreement calls for a certain expenditure per month, but the La Palme has maintained that this has not been fulfilled. It is understood that the merger will probably be dissolved.

Kirkland Lake—In recent decisions given at Osgoode Hall, Toronto, judgment was entered against Sir Charles Ross, finding him liable for debts incurred in the name of the Patricia Syndicate. The late C. A. O'Connell interested Sir Charles Ross in the Boston Hollinger Mines, on which Mr. O'Connell had an option, and Sir Charles put up $100,000. When this money was exhausted loans were obtained from the Bank of Commerce upon notes signed by Mr. O'Connell, as trustee for the Patricia Syndicate. It is held that Sir Charles is liable for the notes given by the Patricia and also for accounts of sundry creditors in northern Ontario.

MEXICO

Chihuahua

Naica Company Reorganized as Cia. Minera de Concho. To Employ Large Force

Chihuahua City—Henri Faivre, an individual operator, has a small force of men working his manganese properties at the Cerro Santa Rosa, near Chihuahua City. A shipment of 40-per cent ore amounting to forty tons was sent to the Monterrey smelter.

The Santa Eulalia camp is showing greater activity. All mines have resumed work on full time, giving daily work to all miners looking for it. This is in marked contrast to the past, when workmen were given work only three days a week, thus helping them over the critical period.

The Cia. Minera San Juan intends to increase operations [illegible] to employ fifty to sixty men. Shipments of silver-lead ore will be resumed Sept. 1. Jose Bovio is general manager.

The Erupcion Mining Co., at Los Lamentos, is pushing the survey work on its railroad line, which will connect the mine with a point of the National railroad yet to be decided upon. The road will have an easy grade and will be without a single bridge on the entire 47 miles of the line. After preparing the maps for submission to Mexican government's approval, bids will be received for the grading work. It is expected that the actual grading work will be started by Nov. 1.

The Alcaparra camp is setting great hopes on the building of the Lamentos railroad, which will pass about five miles from the northern, and three and one-half miles from the southern extension of the Sierra de la Alcaparra. At present a wagon road 15 miles long connects the camp with the station Villa Gonzales of the National Railroad. The lime formation of this part of the country is cut by several dikes of granite and porphyry, and the mineralization consists of silver, gold, lead and zinc. Most of the valuable ground was taken up in form of denouncement, and some of the owners are developing their properties on a small scale. It is reported that the owners of the Corona mine have a carload of silver-lead ore ready for shipment. Besides the above-mentioned ores, commercial iron is also to be found. A large vein 25-30 meters wide and assaying 55 per cent iron outcrops on the property owned by Federico Saenz.

The Rio Plata mine is reported to have resumed operations. Lincoln Bonneau, treasurer of the company, accompanied by his son and Frederick Pothast, left recently for the mines at Rio Plata, in the southwestern part of the state, to reopen the property for the owning company. The mine has been leased for some time to Mendoza and Nesbitt, and new arrangements will be made upon their return from the property.

An American company early this year entered into a bond and lease agreement with the British owners of the San Martin mine, in the western part of the state, in the El Rayo district. The operations were suspended in June for unknown reasons.

Parral—Charles C. Coulter, representing the [illegible] Co., of San Antonio, Tex., is taking up properties in the Parral district. It is rumored that the company which he represents may build a mill at Parral.

San Francisco del Oro—Jose Bovio has taken a bond and lease on the Transvaal mine. The property is already partly developed and the new company intends to start work immediately. The [illegible] carry gold-silver copper and lead ore. The company is planning to erect a mill. Electrical power will be furnished by the Cia. Agricola y de Fuerza Electrica del Rio Conchos, S. A., which has its power plant at La Boquilla, near Camargo.

Naica—The Cia. Minera de Naica has been reorganized as the Compañía

Minera de Concho S. A. This is a Mexican concern and Lic. Jose Estrada Otamendi is president. The company owns a large group of properties and is a well-known producer of lead carbonate ore carrying an average of 500-600 g. of silver. The total production of ore has reached 276,129 tons. The reserves consist of 200,000 tons of high-grade and of 100,000 of low-grade ore. Between 500-600 men were employed at the mine, the monthly production having been 4,000 tons. The company owns a 30-km. narrow-gage railroad connecting the mine with the Concho station of the National railroad. Twenty-seven cars and five engines are operating on the line. A complete repair shop, in which even all castings are made, is on the spot.

The mine is equipped with a 250-hp. gas engine and a new compressor, both of which could not be installed on account of disorders incident to the revolution, as the mine was constantly visited and greatly handicapped by bands of revolutionists.

Electrical power is to be taken from the Cia. Agricola y de Fuerza Electrica del Rio Conchos S. A. for all mining purposes. A large force of men will be employed at once, and it is intended to increase greatly the previous extraction of ore. José Bovio, who was mine superintendent for nineteen years, will act in the future in the capacity of consulting engineer.

Adargas—The Adargas mine, situated at Adargas, in southern Chihuahua, and owned by Guadalupe Galvan, is being examined by engineers for a Philadelphia concern. It is said that silver-lead ore was shipped in previous years from the property.

Zacatecas

La Luz Mining Co.'s Stockholders' Meeting Called for Sept. 12

Zacatecas—The La Luz Mining Co., with mines in Zacatecas, failing to obtain a quorum at the general meeting of stockholders called for Aug. 2, has issued another official call for the meeting to take place in the city of San Luis Potosi on Sept. 12.

An assessment of one peso per share has been levied against the outstanding stock of the Manuela y Anexas Mining Company to procure funds for carrying on development work at the property.

ARIZONA

Property of Kingman Consolidated Copper Co. Sold—Mascot Copper Co. Buys Railroad

Tombstone—V. L. and J. L. Mellgren have purchased the remaining six shares in the Co-operative Milling Co. The new owners have taken charge, and will operate on a custom basis as soon as a new steam plant is installed to furnish power.

Three shifts are working on the new cyanide plant at the State of Maine, operated by the Old Pueblo Leasing Co.

Cochise—A carload of timber has arrived for the Red Bird mine, a gold property being worked by Griffen and Smith.

Pearce—The mill is running on lessees' ore, and a fair recovery is being made.

Jerome—Verde Central is installing a heavy compressor, purchased from the United Verde Extension Mining Co., and has on the road a hoist that is to be used in deepening the main shaft 300 or 400 ft. A large share of the Verde Central stock is now in the hands of Calumet & Arizona interests, which purchased a late offering of treasury stock. In consequence, the corporation is well provided with funds.

Kingman—Under execution, at Kingman, the property of the Kingman Consolidated Copper Co. has been sold to satisfy claims aggregating about $30,000.

Bisbee—The Mascot Copper Co. has purchased from the Southern Pacific Co. the rails and material of the twelve-mile railroad that has been operated for ten years by the mining company between Willcox and the mines. The material heretofore has been used under lease. The price paid was $88,091.11.

Nogales—What is known as the Mejia part of the famous Planches de Plata mines of northern Sonora has been purchased by a Nogales company headed by Augustine von Borstel. The mines are twenty miles southwest of Nogales, on the Altar road.

NEW MEXICO

Abundant Water This Season Stimulating Placer Mining at Pinos Altos

Lordsburg—Shaft sinking at the Eighty-five mine is progressing steadily. A station is being cut at 1,200 ft. depth. A pump station will be cut at 1,350 ft. and a triplex electric pump installed to pump to surface. Drifting continues on the 1,050 level, with a satisfactory showing of good ore.

Pinos Altos—On account of the unusual rainfall this season, placer mining has been carried on with successful results in the old diggings in this vicinity. Some good results are reported. This district has been producing placer gold for small operators with more or less regularity since 1868.

Silver City—Stauber, Wright, Armstrong, and Bell have shipped two carloads of low-grade silver ores from their lease on the Stevens property in Chloride Flat. Another car is ready to ship. These are test shipments, and if it is found that this grade of ore can be handled at a profit, considerable tonnage will be sent to the El Paso smelter from this section. The above named signed a lease recently on the old Bohemia mine, principally owned by Frank Vesely, of Silver City. Other lessees at Chloride Flat are Perrault and Morales, who have shipped one car of high-grade silver ore; also Jake Reidlinger & Co., and John Blackwell.

COLORADO

Radium Co. of Colorado Increasing Force—Matterhorn Company To Use Flotation

Idaho Springs—The Gem Mining Co. is driving a drift 300 ft. to connect with the Franklin property. Operations will be conducted through the Newhouse tunnel. Ore mined from the Gem property will be shipped to the Newton mill for treatment.

Paradox Valley—The Radium Co. of Colorado, Inc., is increasing its working force by about fifty men, to meet the recent increased demand for radium ore. The product will be shipped via Whitewater, instead of via Placerville, as heretofore. James S. James is manager.

Ophir Loop—Flotation equipment will be installed in the plant of the Matterhorn Mining & Milling Co., of which P. J. Dills is manager.

UTAH

Garfield Smelter Producing 10,000 oz. Silver Daily—Utah-Salduro Company in New Hands

Salt Lake City—It is reported that the American Smelting & Refining Co. will not—as some other smelting companies have done—make a flat reduction in its smelting rates in conformity with the lower freight rates on bullion which went into effect Aug. 11. The reason given is that this company receives most of its ore under contract, and that these rates in many instances were not increased at the time larger shipping charges were initiated by the railroads. However, it is said that, wherever smelting rates had been advanced, the recent reduction in freight rates on bullion would undoubtedly redound to the shipper.

The Garfield smelter of the American Smelting & Refining Co., according to A. M. Richards, general superintendent, in an address before the Rotary Club of Salt Lake City, is producing in round numbers at the rate of about 10,000 ounces of silver daily from 1,200 tons of ore. Although some copper is being smelted in connection with the silver ores, the copper output of the plant is negligible. It will be remembered that to meet changed conditions, the copper smelters of the state made certain changes in their processes, which have made it possible for them to treat dry siliceous ores successfully, and at a profit. A good tonnage of ore of this character is now coming in, especially from the Tintic district, where mines were forced to curtail some time ago, when it was not possible for the smelters to take their ores, but are now working at capacity. Mr. Richards predicts that Utah in 1922 will produce more silver than any other state. During the first six months of 1921, the Garfield smelter handled an average of 1,210 tons of ore daily, recovering 100 ounces of gold daily and an average of 9,981 ounces of silver. The plant consumes 117 bbl. of oil daily and 223 tons of coal.

There are at present employed 550 workmen, and the monthly payroll is $60,000. The smelter has a daily capacity of 5,000 tons, and in normal times turns out 500 tons of blister copper a day. From present conditions, according to Mr. Richards, a revival of the copper industry of Utah may be expected on a light producing basis early in 1922.

Lead furnaces at the Salt Lake Valley plants operating at the end of August were: A. S. & R. at Murray, three lead furnaces; United States at Midvale, four furnaces including one on matte concentration. At Garfield the A. S. & R. has added a fourth reverberator for the treatment of siliceous ores.

The hearing before Judge Johnson of the United States district court on the exceptions taken by the Utah Apex Mining Co., of Bingham Canyon, to the accounting of the Utah Consolidated for ore taken by it from ground owned by the Utah Apex, has been concluded. The Utah Consolidated places the amount of ore taken out by it at about $500,000, and the Utah Apex claims in the neighborhood of $1,000,000. The final arguments will be heard the latter part of September.

Eureka—The Victoria has opened an orebody on the 1,700 level which is a continuation of the deposit followed from the 1,350 to 1,550 level. The deposit in question is furnishing the larger part of the output from the mine at present, although some ore is coming from the 900. The Eagle & Blue Bell in the two weeks ended Aug. 24 shipped thirty cars of ore. This and the Victoria properties are controlled by the Bingham Mines Co., which owns also the Dalton & Lark and Yosemite mines at Bingham. The Tintic Milling Co. in the two weeks ended Aug. 24 shipped two consignments of bullion. This company is opening up the old Swansea mine, which it has under lease, and expects a good tonnage of sulphide ore, of which it is in need, from the property.

Park City—Shipments for the week ended Aug. 24 were 1,378 tons, as compared with 1,212 tons the week preceding. Shippers were: Judge allied companies, 593 tons; Silver King Coalition, [illegible]; Ontario, [illegible].

The new mill of the Silver King Coalition is expected to be completed by the end of the year. Concrete work is now finished, and the steel work for the building will be started immediately. The large orebody in the O'Brien fissure opened on the 1,150 level has been followed downward for some distance, and continues strong on the lower level. There is also a large amount of low-grade ore in the mine awaiting the completion of the new mill. When this is completed shipments will be considerably increased, and earnings proportionately. The Park Utah is being opened up with a view to larger production. The present output is about two cars daily. This property is controlled by the Judge interests.

Salduro—The Utah-Salduro Company, owning large potash deposits in western Tooele County, has been taken over by the Allied Chemical & Dye Co. of New York. The Salduro company was a subsidiary of the Solvay Process Co., and is said to have spent in the neighborhood of $2,000,000 on a plant for the production of potash from the brines underlying the large salt beds near Wendover, and has had about 200 men in its employ. Recently the company closed down for the time being. These deposits are the largest in Utah, and a large potash industry could be developed in the state, it is believed. At present, owing to the coming in of potash from Europe, there is not much market for the output. Utah men are anxious to see a tariff on potash, so that the new industry may be started.

Gold Hill—The Western Utah Copper Co. reports a promising strike on the 700 level. The ore is sulphide, and carries 4 to 15 per cent copper and 6 to 30 ounces silver.

IDAHO

Coeur d'Alene District

Cedar Creek Company Makes Important Strike—Chicago-Boston Stockholders To Vote on Acquiring Kill Buck Claims

Wallace—The Cedar Creek Mining & Development Co. has made what appears to be an important strike on the North Side, near Murray. In extending a drift from the main crosscut about 700 ft., a large body of low-grade lead and zinc ore had been developed. This has now been followed by striking 2 ft. of high-grade galena, practically free from zinc, two samples of which gave the following assay results: No. 1, silver, 25 oz.; lead, 66.4 per cent; No. 2, silver, 31.3 oz.; lead, 78.7 per cent.

The Chicago-Boston Mining Co. has called a meeting of stockholders for Sept. 27 for the purpose of taking action on three propositions, namely: Increasing the capital stock from 1,500,000 shares to 2,500,000 shares; exchanging the increase in the capitalization for the property of the Kill Buck Mining Co., share for share; and changing the name of the company to the Galena Mining Co. The Kill Buck company owns five patented claims joining the Chicago-Boston, which are probably on the same vein, making its development and operation more economical [illegible] the Chicago-Boston. Both companies are controlled by the Callahan Zinc-Lead Co. and it is expected that the three propositions will carry.

The great orebody of the Morning mine at Mullan, owned by the Federal Mining & Smelting Co., has been cut on the 2,200 level, showing about 20 ft. of excellent ore, probably better than in the levels above. The ore shoot on the 2,000 is about 1,000 ft. long and has an average width of 15 to 20 ft., and it is believed that these dimensions will be found on the new level.

MONTANA

Butte & Superior Cuts Copper Deposit on 2,200 Level

Butte—The Tuolumne Mining Co. recently cut a band of ore in its west workings on the 1,600 level of the Main Range mine which shows an increasing copper content in a heavy pyritic ore. The Spread Delight vein shows a width of [illegible] ft. on the 1,600 level, narrower than on the next level above, the 1,200.

Butte & Superior has cut the copper vein on the 2,200 level. The crosscut is in 18 ft. showing ore apparently better than that on the 2,000 level. Assays are not yet available.

Neihart—Decision to reconstruct the mill of the Cascade Silver Mines & Mills Co. was reached at the recent annual meeting of stockholders in Butte. It also was decided to install what is known as the Schwarz process for the separation of zinc from the Cascade's silver ores. George G. Brabrook, of Boston, was elected president and William L. Creden, of Butte, vice-president.

Hassel—The Iron Mask mine of the Bamar Copper Co., near here, will resume operations this fall, according to advices from Butte interests which control the corporation. A tunnel has been driven a distance of 2,500 ft. to reach a point under an old shaft, and it will be necessary to drive this working 200 ft. further to reach its objective.

Jefferson City—The Assets Mining Co. is said to be planning to resume operations at the Golconda mine.

Elkhorn—The Merrill Construction Co., of Boston, has been awarded a contract for the installation of a heating system at the Elkhorn mill of the Boston & Montana Development Co. The Hardinge company, of New York, is furnishing the equipment for the concentrator, which installation is rapidly nearing completion.

WASHINGTON

Eagle Group, Near Chewelah, Leased to A. J. Moore

Orient — Extensive and thorough sampling of the First Thought mine, near here, has been made this summer for the Spokane owners, who acquired the property from the Boston interests two years ago. It is stated that if the results are satisfactory, installation of a cyanide plant will be commenced.

Chewelah—The [illegible] Mining Co., owners of the Eagle group of claims, two miles north of this point, has given a lease and bond on the property to A. J. Moore, a mining engineer. The lessee has gone to New York and upon his return in the fall intends to proceed with active development. The property has been idle for many years, but in the early stages of development is credited with a gross output of about $50,000.

Springdale—An air compressor is to be installed on the [illegible] Bee property this fall.

NEVADA

Tonopah Extension Sues Cash Boy for $15,000 — Tonopah Divide Resumes Shaft Sinking—New Capital May Enter Comstock District

Tonopah—The Tonopah Extension has brought suit against the Cash Boy for $15,000, for alleged trespass on the Golden Anchor lode claim. The Tonopah Extension shipped bullion valued at $42,000, which represents the clean-up for the first half of August. The Cash Boy has opened a 6-ft. face of ore assaying $24 per ton in the winze below the 1,645 level.

The Belmont is operating at full capacity. The clean-up for the first half of August amounted to $126,000, which is a record production.

Divide—The Tonopah Divide has resumed shaft sinking from the 1,000 level, and will continue sinking until the water level has been reached. Fifty tons of ore a day is being forwarded to the Belmont mill.

The Divide Extension has started regular shipments of high-grade ore to the McNamara mill from orebodies on the 100 and 200 levels. The Dividend has intersected the Extension orebodies on the 100 and 200 levels. The Giant Divide has resumed development work on the 400 level.

Virginia City—Sampling under the direction of Albert Burch and R. B. McGinness has been started in the Hale and Norcross tunnel. The sampling will be continued on the upper levels of the middle group of mines, which include the Best and Belcher, Gould and Curry, Savage, Norcross, Chollar and Potosi. Outside interests will start mining and milling operations on a large scale similar to the United Comstock Mines Co. at Gold Hill, should the sampling show sufficient tonnage.

Spanish Belt — The Consolidated Spanish Belt Mining Co. has recently started its new fifty-ton mill. The process used is a combination of concentration and flotation.

NORTH CAROLINA

Ten-Stamp Mill Bought for Spoon Mine —Development To Be Resumed at Coggins Property

Ashboro — At the Spoon mine, in Randolph County, twelve miles northeast of Ashboro, high-grade free-milling ore has been encountered at 70 ft. and at 110 ft. The level is now being opened. A pay streak of unusual richness is 18 in. wide, and there is other ore of lower grade available on the same level. A ten-stamp mill has been purchased, and will be erected immediately; only amalgamation will be attempted at the beginning. Robert G. Dickens is superintendent.

Eldorado—At the Coggins mine, at Eldorado, in Montgomery County, fifteen miles northwest of Troy, the county seat, surveys of the 450 and 550 levels were made recently. This was done to obtain data from which to plan work to connect the known orebodies of the 450 level with the opening on the 550 level, and to carry on the proper development of the 550 level. Work on the raises is expected to begin soon. Some addition is also to be made to the mill. Work has been suspended for nearly a year, for the same reason that other mines have shut down, namely lack of labor and the high price of supplies. This mine has been more extensively developed than any other gold property in the state. It has according to an engineer's statement, over 100,000 tons of ore ready for mining.

MICHIGAN

Menominee Range

Oliver Company Again Shipping From Stock at Chapin and Aragon Mines —Underground Work Stopped at Berkshire

Iron Mountain—The Oliver Mining Co. has issued orders once more to ship from stockpile from its Chapin and Aragon mines. Both are now idle, but considerable ore is in stock. There is not a mine in operation in Iron Mountain.

Crystal Falls—All underground work has stopped at the Berkshire mine. The Bates, Davidson, Dober, Homer, and Delta, employing less than 500 men, are the only active mines in the iron River field, which has close to twenty properties.

Marquette Range

Work Stopped at Princeton Mine—Equipment of Ford's Imperial Mine Continued

Gwinn — Operations were suspended Aug. 27 at the Princeton mine, the oldest in the district. Most of the men were given employment at other mines of the Cleveland-Cliffs Iron Co. in the district.

Negaunee—The Marquette Ore Co. is again mining at its Mary Charlotte property. The mine was closed down for a few weeks, and it was believed that no more underground work would be carried on this season. Two hundred and fifty men are working on a full-time basis. There is no ore in stock, and all being hoisted is shipped.

Michigamme — Machinery continues to arrive at the Imperial mine, which is being reopened by Henry Ford. About sixty men are engaged in getting the property in condition for production. A large compressor, of German manufacture, is ready to be installed as soon as the new buildings are erected. Two pumps for underground use have been purchased from the Hancock Consolidated Copper Co. Some other equipment, including rock drills, was secured from the White Pine mine of the Calumet & Hecla Co. It is believed that about 200 men will be on the payroll when mining starts, but over 1,400 applications for work have been received at the mine office. Captain William Holman, who formerly was in charge of shaft-sinking work for the E. J. Longyear Co., has taken a position at the Imperial and will be in charge of underground work. A new track is being constructed from the Duluth, South Shore & Atlantic road to the mine.

Ishpeming—The Marquette Range office of the Oliver Iron Mining Co. has been advised that the wages of all employees of the company were reduced on Sept. 1, but the amount of the cut was not given out. It is likely that it is one of 10 per cent, the same as announced for the steel employees. Altogether, the wages of Oliver employees have been lowered 40 per cent since Jan. 1, there having been two previous cuts, one of 20 per cent and one of 10. About 90 per cent of the men are working on a part-time basis.

JOPLIN-MIAMI DISTRICT

Missouri-Kansas-Oklahoma

American Zinc, Lead & Smelting Co. Takes Over High Five Mine

Waco—Decidedly increased production from the Waco, Mo., zinc field, when zinc ore prices improve, is confidently expected in the Tri-State district as a result of the recent taking over of the High Five mine, at Waco, by the American Zinc, Lead & Smelting Co. Development in this camp, which is about fifteen miles northwest of Joplin, has been comparatively slow during the period of dull prices, for the reason that heavy drainage is necessary in extracting a large part of the ore. With the assistance and co-operation of other companies, the High Five company has maintained a pumping station and has kept the water down to about 230 ft. Drilling and development by the Barnsdall and Butte-Kansas companies has proved the orebody to extend for at least 100 ft. deeper than this, however, and it is felt certain that the Barnsdall people will not be able to co-operate with the American company for this deeper drainage. Unofficial statements to this effect have been given out by officials of each company.

It is understood the purchase of the High Five mine by the American company involved no material cash consideration, but the ultimate purchase price is $250,000, though a large part of this is to be paid out of the ground. The sale is more in the nature of a long-term option agreement. Temple Chapman, of Joplin, and George E. Starr, of Philadelphia, Pa., were the principal owners of the High Five.

Joplin—Though no zinc producer in the Tri-State field really wants to push production at present, many companies are maintaining fairly complete operations in order to maintain their working organizations. The price of lead, which is not so bad, enables many of these companies to operate at a close margin of profit, but the general effect is to increase the surplus of ore in the field and to hold down the price of zinc ore. The situation is simply one that cannot be avoided, producers declare. Among the mines that have been started up recently are the Premier, at Picher, and the King-Brand, in Kansas, northwest of Picher.

THE MARKET REPORT

Daily Prices of Metals

Sept.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
1	11.75	26.25	26.75	4.40	4.125@4.20	4.175
2	11.75	26.50	26.875	4.45	4.25@4.30	4.20
3	11.75	26.50	26.875	4.45	4.25@4.30	4.20
5		......				.
6	11.75@11.875	26.75	27.125	4.425@4.50	4.30	4.20
7	11.75@11.875	26.75	27.25	4.45@4.50	4.30	4.20

*These prices correspond to the following quotations for copper, "delivered": Sept. 1st, 2d, 3d, 12c.; 6th and 7th, 12@12.125c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
1	67⅞	68⅜	71½	154⅜	156¼	23½	22¾	24¾	25½
2	68⅜	69	71½	156¾	159	23½	22¾	24¾	25¼
3									
5	68⅞	69¾	73	159¼	161¾	23¼	22¾	24¾	25½
6	68¾	69⅝	73	161¼	163¼	23¼	22⅞	25	25¾
7	68¾	69⅝	73	162	164¼	23¼	22⅞	25¼	25⅞

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver			Sept.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York, Foreign Origin	London
1	373¼	99½	62½	37⅞	5				38⅝
2	372⅞	99½	63	38⅛	6	369¼	99½	63¼	39⅛
3	372	99½	62¾	38¼	7	371¼	99½	63⅛	38⅞

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, Sept. 7, 1921

The prices of all four of the major non-ferrous metals have increased during the last week, despite the holiday on Monday, and which really included Saturday also. This stronger tendency, coupled with a belated recovery in the stock market, has caused producers and traders to feel more optimistic, though no runaway market is expected in any metal, and it is the general prediction that the price recovery, if it has now started in earnest, will be gradual.

Followers of copper should not disregard the aluminum market. Aluminum can now be imported for 18c. or slightly above, and at that price is a formidable competitor of copper at 12c. In fact, there are reports that fairly large quantities of aluminum have been sold for the manufacture of cable and other apparatus in which copper can be displaced by the lighter metal. Germany, of course, being an important producer of aluminum, would spare no expense to carry this substitution as far as possible. It is reported, however, that aluminum has not proved altogether successful in the electrical uses to which it has been applied.

Copper

Even as late as last Thursday some copper was obtained as low as 11.75c., delivered, by consumers to whom low delivery charges applied. The bulk of the sales, however, were made at 12c., delivered, and on Friday this was the lowest price which was quoted. Tuesday found most of the 12c. sellers off from the market, the generally quoted price being 12.125c., delivered, with sales in some cases at fractional concessions. Today September business has been booked at the same prices, but with producers generally quoting 12.25@12.375c. for October deliveries. There is a marked hesitation in quoting further forward than October. One 100-ton lot for October is offered today by a dealer at 12.125c., delivered, but it is doubtful if more could be obtained. Many of the small consumers and some of the larger are taking more interest in the market now that the price is advancing, but domestic business has not been large.

Export business continues excellent, considering conditions in Europe.

Total sales for August are estimated at 80,000,000 lb., well over production for the same month.

Lead

The American Smelting & Refining Co. advanced its official contract price for lead from 4.40c. to 4.50c. on Sept. 2.

Lead has been active during the last week, particularly in the Chicago and New York markets. The demand in the St. Louis district does not seem to have been so marked, and on last Thursday the best one producer could obtain was 4.125c. The Smelting company's advance had a good effect in the outside market, however, and yesterday and today 4.30c., St. Louis, and 4.40c., Chicago, were the ruling prices by most sellers, though one large interest held consistently above these figures. Some large orders have been placed through New York agencies and more are expected soon, as stocks in the hands of prominent consumers are generally very low. Business for later than October is almost absent, and many producers will only quote on October deliveries when coupled with lead for September.

Zinc

Zinc has held the advance which started last week; in fact, the price today is a slight improvement over that quoted a week ago. Demand is still quiet, however, and galvanizers are taking very small lots. With the large stock of zinc on hand, and knowing that numerous small producers have been selling far below cost prices in the past, they do not feel that buying beyond current requirements is advisable. Brass special is quoted at 10 points premium over Prime Western, and high-grade [illegible] delivered at Eastern points.

Tin

Tin has advanced slightly with the improvement in London and steady sterling exchange, but consumers remain aloof. The domestic business is reviving, but the spectre of large Eastern stocks still hangs over the market. No one knows when the governments of the Federated Malay States and the Dutch East Indies will find it necessary to throw some of their stocks on the market. United States deliveries of tin during August, as announced by the New York Metal Exchange, amounted to 3,320 long tons, compared with 1,525 long tons for July. This increase was unexpected and most encouraging, and no doubt was the cause to some extent of the advance in London. It is understood that most of this tin went to steel interests.

Arrivals of tin, in long tons: Aug. 30th, Straits, 60. Total for August, 2,560 tons. Sept. 2d, Straits, 10; 3d, Straits, 25; 6th, London, 40; Rotterdam, 100; Straits, 840.

Gold

Gold in London: Sept. 1st, 110s. 4d.; 2d, 109s. 8d.; 5th, 110s. 10d.; 6th, 110s. 9d.; 7th, 110s. 10d.

Foreign Exchange

Sterling prices have held steady, but other European exchanges, particularly German, have tended to become weaker. Sterling cables continue to be quoted one-half cent higher than checks as given on page 435. On Tuesday, Sept. 6th, francs were 7.63c.; lire, 4.33c; and marks, 1.08c. New York funds in Montreal, 11⅛ per cent premium.

Silver

In spite of the holiday, there has been somewhat more activity in the market in the last week, and the greater part of the business continues for New York account rather than for San Francisco. The price today at 63⅞c. is the highest since Jan. 28, 1921. The market closes steady.

Mexican Dollars—Sept. 1st, 48; 2d, 48⅜; 3d, 48⅜; 6th, 48⅞; 7th, 49.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 18@20c. per lb.; 18½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 4.50c.; market dull. W.C.C. brand, 5.25c. per lb. Cookson's "C" grade, spot, 9c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb., black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $160@$170 per oz.

[1]**Molybdenum Metal**—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb. f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominally, $52@$55 per oz.

Platinum—Nominally, $72@$78 per oz.

Quicksilver—Nominal, $45@$46 per 75-lb. flask. San Francisco wires $45.70. Little demand.

[1]**Rhodium—$150 per troy oz.**

[1]**Selenium—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.**

[1]**Thallium Metal—Ingot, 99 per cent pure, $20 per lb.**

[1]**Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.**

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $30; ground, $35; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—22c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 55@60c. per lb. of contained sulphide, New York.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3@$3.25, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]**Zircon—Washed, iron free, 8c. per lb.**

[1]**Zirkite—According to conditions, $70 @$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.**

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 3—Zinc blende, per ton, high, $23.25; basis 60 per cent zinc, premium, $20; Prime Western, $19@$20; fines and slimes, $19@$17; average settling price, all grades of blende, $21.48.

Lead, high, $54.80; basis 80 per cent lead, $54; average settling price, all grades of lead, $51.80 per ton.

Shipments for the week: Blende, 4,930; lead, 964 tons. Value, all ores the week, $155,850.

Considerable zinc ore sold late on Saturday of last week on $19 basis, closing around 10 o'clock at night on $20 basis. All ore purchased after noon was included with purchases this week. A little ore was purchased this week on $19 basis. The Empire Zinc Company, out of the market since last December, purchased 2,100 tons, re-entering the market late last Saturday. Two companies purchasing regularly materially increased purchases, one on $19 basis, the other on $20 basis. This increased competition disposed of 8,200 tons of zinc blende this week, the largest single week's purchase since March 12, and exceeded but twice this year. The average purchases this year were 4,570 tons per week. Sellers are greatly encouraged by the stronger demand.

Platteville, Wis., Sept. 3—Lead ore, $51 per ton. No sales. Zinc ore shipments, none. Lead ore, 123 tons. Shipments for the year: Blende, 8,461; lead ore, 1,131 tons. Shipped during the week to separating plants, 351 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,500@$2,000; No. 2, $850@$1,250; spinning fibers, $350@$850; magnesia and compressed sheet fibers, $225@$350; shingle stock, $95@$150; paper stock, $55@$70; cement stock, $16@$27.50; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $24@$30 in bags, carload lots; (off-color) $22@$26 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Borax—Granulated, crystals, or powdered in bags, carloads, 5¾c. per lb.; in bbls., 5½c.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

---

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

China Clay (Kaolin)—Crude, $6.50@$8.50; washed, $9@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $35@$45, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points

Feldspar—No. 1 soap grade, $7@$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, $6@$6.50; No. 2, $5@$5.50. Market dull. Large stocks are available and quotations are nominal. Producers report cancellations of orders. No. 1, Canadian, ground, $26 f.o.b. cars.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $13.50, f.o.b. Lordsburg, N. M. Ground, acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, 1@2c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $45@$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton, depending upon quantity; ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, $30 per unit, duty paid

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $11.65; 75 per cent, $10.65; 75@74 per cent, $10.15; 70 per cent, $6.25; 68 per cent, $5.75; 68@66 per cent, $5.50.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 12c.; Spanish lump, 12@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $7.50@$11 per ton; less than carload, $25, f.o.b. cars. Imported, $35@$40; Canadian, $20@$40 per ton.

Mineral Products

Arsenic—6c. per lb.

Sodium Nitrate—$2.10@$2.30 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $12.50 per ton, f.o.b. in bulk, Western mines, spot and six months' contract; $22@$25 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.25 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 12c. per lb. of chromium contained; 4 to 6 per cent carbon, 13c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $65@$67, f.o.b. furnace; resale, $90, delivered; English, $65@$70, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $26@$25, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.50 per lb. of contained metal, f.o.b. works. Imported material, $1.70@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $40; 50 per cent, $65; 75 per cent, $1[illegible]

Ferrotungsten—Domestic, 70 to 80 per cent W, 40@45c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$4.25@$4.50 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 19.50c. per lb.; wire, 13.25@13.50.

Lead Sheets—Full lead sheets, 7¾c.; cut lead sheets, 8c. in quantity, mill lots

Nickel Silver — 29.50c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets, 16.25c.; sheathing, 15.25c.; rods, ⅜ to 3 in., 13.25c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina $50 per ton; 76 per cent, $90@$95 f.o.b. works.

Chrome Cement—40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—$52@$55 per net ton

Fire Brick—First quality, 9-in. shapes $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35

Magnesite Brick—9-in. straights, $65@$70 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98 f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

New York, Sept. 6, 1921

Business in pig iron in the eastern district last week was less active than during the two preceding weeks, according to *The American Metal Market*. Several large consumers who have put out inquiries for fourth quarter of this year and first quarter of next failed to close, and there was less demand even for small lots for prompt shipment. Furnace interests in all districts made an effort to secure higher prices, so that at least an old dollar might be swapped for a new one if possible, but the freer buying by consumers which was evident during the second half of August seems to have been checked by the advance. Fewer inquiries are now in the market. It is too early after Labor Day holidays to expect any unusual activity. In fact, consumers seem less disposed to buy, although not a few of them are expected in the market during the course of the week.

Steel [illegible] that had continued dull in the east [illegible] have not changed [illegible], but in the Central West and [illegible] higher [illegible] are asked and, in a few instances, obtained.

Coke

Connellsville — Furnace, $3@$3.25; foundry, $4[illegible]@$4.50.

---

[1] Foote Mineral Co., Philadelphia, Pa.

Lead Has Had Minimum Price Depression

Market the Most Active of the Non-Ferrous Metals—Heavy Importations of Spanish Lead During May and June—World Production Has Declined 36 Per Cent Below Figure of 1913

EDITORIAL MARKET STUDY

ALTHOUGH lead is cheap, and some producers, in selling it around 4.25c. per lb. St. Louis, are virtually presenting a check to the metal purchaser which represents the difference between cost and sales price, the lead-mining companies have had a comparatively fortunate time of it. Compared with zinc, the position of lead has indeed been far superior; the market has been the most active of all of the non-ferrous metals since the Armistice, and its statistical position much better than that of the other metals. The industry is not burdened with heavy surplus stocks, as in the case of copper, zinc and tin, overproduction, or under-consumption, of lead being absent.

The production of lead, in company with that of all other metals, has declined, and for the month of July was estimated at about 28,000 tons, compared with about 39,700 tons monthly in 1920, and 34,300 monthly before the war. Consumption has been satisfactory, considering the general industrial depression, and the business done has enabled producers to avoid accumulating a surplus. Excess stocks have been a wet blanket on any spark of life in copper and zinc, so that the absence of any unusual accumulation at lead mines or smelters places lead in a good statistical position.

There is a distinct determination noticeable among lead miners to aid the lead market as far as possible by not pressing the sale of their product when the market goes below the cost of production. Two of the largest lead producers have repeatedly taken the attitude that if their lead cannot be sold at a small profit, the best plan is to cut or stop production, withholding the lead from the market. As lead-mining companies have had no extended period lately in which the price of lead permitted sales only at a loss, they are generally in a good financial position and can afford to play a waiting game in a depressed or declining market.

The world's production of lead for 1920 is far below that of pre-war years, as the following figures given by the American Bureau of Metal Statistics testify:

WORLD'S PRODUCTION OF LEAD

(In Short Tons)

1911	1,237,500	1916	1,241,600
1912	1,330,200	1917	1,284,300
1913	1,297,600	1918	1,257,400
1914	1,286,300	1919	951,800
1915	1,171,400	1920	827,500

World's lead production in pre-war years, according to these figures, was not exceeded by either war or post-war production. On the contrary, the 1920 output is about 36 per cent below the 1913 figure. At the same time, United States production has more than maintained its pre-war rate, so that relatively the United States has become more important as a producing country.

As has been stated in previous reports, the impression is prevalent among some lead producers that the world's lead reserves not only have been getting smaller, but that the failure of any new discoveries of large lead deposits points to a logical increase in the value of the present lead resources of the world. The only notable exception to the rule has been the recent development of Burmese lead fields in Asia. The most important lead-producing nations, such as the United States, Spain, Germany and Mexico, show a steady or declining output. In other words the world has been fairly well prospected and combed for lead, and from now on a situation different from that of pre-war times faces the lead industry. However, the lead resources of the world are still plentiful, and the strong position of lead need not be ascribed to a lack of ore reserves, but is to be attributed to the disturbed state of the world's lead industry and the consistent demand for the metal. The thought is merely advanced here that possibly there is something in the lead-producing position of each nation that will alter the future market for lead.

The record of exports and imports of lead for the first seven months of 1921 is featured by the unusually heavy importations of pig lead during the months of May and June, when 23,481,000 lb. and 17,443,000 lb., respectively, were imported. Department of Commerce statistics indicate that most of this imported lead came from Spain (16,800,000 lb.), France (11,200,000 lb.), and Mexico (13,300,000 lb.). The French lead was in all probability of Spanish origin. It will be recalled that Spanish lead has become a factor in the American market and that large quantities of it have been sold to American producers. The imports of lead in general for the first seven months of 1921 have been below the pre-war average. Exports of domestic lead have been negligible, and the exports of lead from foreign ores far below the rate of 1910 to 1913. Bonded Mexican lead has, however, recently been freely sold abroad.

Stocks of lead in London are larger than in the United States, and Spanish lead is being shipped to London in addition to that which has come to American ports. The dearth of production from Australian points, coupled with a possible further decline in Spanish production, would throw the burden of supplying most of the world's requirements upon the United States.

If, as some economists predict, the industrial corner has been turned, and better times are in store, lead will have been one of the few metals to pass through the depressed period with a minimum of price disturbance. The position of lead in the near future should not change materially, as fundamental conditions have not been altered. In fact, the prospect of a higher tariff and a maintenance of the present status of foreign producers would seem to indicate that lead's fortunate position will continue.

MOVEMENTS OF LEAD TO AND FROM THE UNITED STATES

In Pounds

	Monthly Pre-war Average	Monthly Average 1920	Jan., 1921	Feb., 1921	March, 1921	April 1921	May, 1921	June, 1921	July, 1921
EXPORTS									
Lead produced from domestic ore	.	455,700	151,000	198,150	77,500	136,600	119,700	63,059	171,202
Lead produced from foreign ore	13,453,000	2,805,200	3,304,707	2,131,138	3,138,800	448,100	505,400	2,800,204	574,595
IMPORTS									
Lead in ore	3,640,000	2,457,300	1,627,400	440,200	341,200	988,500	1,209,500	688,585	1,346,980
Lead bullion	10,328,300	8,008,600	5,561,800	47,400	1,900	11,380,900	8,466,200	5,582,016	9,971,247
Lead, pigs and other forms	268,600	5,953,000	905,400	2,000,900	,993,300	4,558,400	23,480,900	17,442,890	2,305,038

COMPANY REPORTS

Mount Morgan Gold Mining Co., Ltd.

Gold, Copper; Australia

A report of operations of the Mount Morgan Gold Mining Co., Ltd., for the year ended May 29, 1921, shows the following financial results:

Total income for the year from all sources amounted to	£[illegible]	[illegible]	[illegible]
Expenditure charged to profit and loss account, including development and depreciation, etc., been	[illegible]	[illegible]	[illegible]
Showing surplus (a)	£120,158	8s.	9d.
Add balance brought forward from last account	[illegible]	[illegible]	[illegible]
Balance forward to next account	£212,350	7s.	6d.

(a) This surplus is due to realizations of copper and gold produced prior to the present financial period and at prices greater than those at which they were taken into account for the previous financial period.

Included in the income from all sources referred to above is 2,528 tons of copper on hand at the close of the year, and, as usual, this has been valued at £55 per ton. If the present ruling prices for this copper are realized, plus the present premiums on gold, and allowance is made for the actual surplus realized on copper produced prior to May 30, 1920, and taken into the accounts at that date at £55 per ton, the result of the operations for the year under review would show a substantial loss instead of the profit of £120,158 8s. 9d. as above.

It should be noted that some of the copper realized during the latter part of the twelve months ended May 29, 1921, was produced in Mount Morgan as blister as far back as December, 1919.

The unfortunate series of strikes in 1919 and 1920 considerably delayed refining and realization, and the direct result due to these "hold-ups" meant a very serious loss through missing the high-price copper market.

The ore raised during the period amounted to 260,062 tons; 167,802 tons of ore was treated for a production of 60,033 tons of concentrates. These tonnages produced 5,149 tons of fine copper and 76,463 oz. of gold.

Nevada Consolidated Deficit for Second Quarter, $278,858

A report of operations of the Nevada Consolidated Copper Co. for the quarter ended June 30, 1921, states that as operations were suspended March 31 production of copper during the quarter was only 298,243 lb., compared with 9,064,082 for the first quarter of 1921, this output coming from clean-up of bins and plant during early days of April. Income account compares for quarters ending:

	1921		1920	
	June 30	Mar. 31	June 30	Mar. 31
Operating loss	$32[illegible]	$112,424	$42[illegible]	$4[illegible]
Plant shut-down expense	247,[illegible]			
Other income	[illegible]	10[illegible]	14[illegible]	[illegible]
Total income	(a)[illegible]	[illegible]	[illegible]	[illegible]
Dividends				4[illegible]
Deficit	278,858	[illegible]	28[illegible]	[illegible]

(a) Loss.

A small force of miners is still retained at the underground workings of the Ruth mine developing the direct smelting, high-grade orebody recently opened up on the 700 level. This work shows conditions believed to be favorable for the development of new and larger tonnages of high-grade smelting ore.

Organization at mine, mill, and smelter has been reduced to lowest reasonable limit consistent with maintenance and protection of plant and equipment. All expenses have been reduced to absolute minimum, and salaries of company officials have been cut 20 per cent.

Quarterly reports are suspended until operations are resumed.

Chino's Deficit for Second Quarter, $304,609

A report of operations of Chino Copper Co. for the second quarter of 1921 states that the complete suspension of operations and closing down of the plants became effective as of March 31, 1921. There was no output of copper for the second quarter therefore, other than the nominal quantity produced during the time required to properly clean up and shut down the mill. The net production of copper after smelter deductions was 567,248 lb., as compared with 8,570,034 net lb. produced during the first quarter. At the mines all mining and stripping operations were suspended, and the equipment and apparatus cleaned up and prepared for an indefinite shutdown. Immediately after the treatment of the tonnage of ore at the head of the mill and a general clean-up of the plant, the concentrator was also closed down.

During the period of suspension there will be retained in service only sufficient employees properly to guard and take care of the property and to prevent undue depreciation of plants, machinery, and equipment. All expenses have been cut to the absolute minimum, including a reduction of 20 per cent in salaries of company officials. The details of the financial outcome for the quarter are shown in the following statement:

Operating loss	$[illegible]
Plant shutdown expenses	[illegible]
	$[illegible]
Miscellaneous income, including [illegible]	[illegible]
Deficit for quarter	$[illegible]

The item of "plant shut-down expense," as stated above, includes, in addition to the actual and necessary cash outlay for the period, the regular monthly accruals for taxes, insurance, and the usual fixed and general overhead charges.

Though there has been no marked improvement in the market demand during the last few months, it is satisfactory to note that current sales and deliveries, since the cut in production of crude copper, have taken care of the output for the first quarter and are making inroads on the surplus stocks of refined metal on hand at the beginning of the year. As there will be no production to report during the period of temporary suspension, the issuing of further quarterly reports will be discontinued until such time as operations are resumed.

Mining Dividends for August, 1921

The following dividends were paid by North and South American mining companies during August, 1921:

Companies in the United States	Situation	Per Share	Total
[illegible]	[illegible]	$[illegible]	$[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible] pfd.	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible] pfd.	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Companies in Canada and Mexico			
[illegible]	[illegible]	$[illegible]	$[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

One more copper company, the United Verde Extension, succumbed to the low price of copper and passed its dividend, which was 25c. in May, for the first time since August, [illegible]. The dividend of the New Jersey Zinc Co. is reported to be paid out of surplus. An increase of the Hollinger dividend is being speculated upon. The Rand Mines, Ltd., paid a dividend to holders of the so-called American shares, amounting to [illegible], on Aug. [illegible].

MINING STOCKS

Week Ended September 3, 1921

COPPER

Stock	Exch.	High	Low	Last	Last Div.	
Ahmeek	Boston	43	42	43	Sept. '20, Q	$0 50
Alaska-Br. Col.	N. Y. Curb	*38	*2?	*37	......	
Allouez	Boston	17¼	17	17	Mar. '19	1 00
Anaconda	New York	35¼	33¾	35	Nov. '20, Q	1 00
Arcadian Consol.	Boston	1 3/16	1 1/16	1 1/16	......	
Ariz. Com'l.	Boston	7¾	7½	7½	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*24	*21	*24	......	
Bingham Mines	Boston	†9¼	†9	9¼	Sept. '19, Q	.25
Calumet & Arizona	Boston			45½	June '21, Q	50
Calumet & Hecla	Boston	224	219	222	June '20, Q	5 00
Canada Copper	N. Y. Curb	*27	*27	*27	......	
Centennial	Boston	7½	7½	7½	Dec. '18, SA	1 00
Cerro de Pasco	New York	26	25	26	Mar. '21, Q	.50
Chile Copper	New York	10	9½	10	......	
Chino	New York	22¼	21	22	Sept. '20, Q	37½
Columbus Rexall	Salt Lake	*17	*16	16	......	
Con. Arizona	N. Y. Curb			*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1	*83	*90	......	
Copper Range	Boston	32¼	30	32	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*38	34	35	......	
Davis-Daly	Boston	5¾	5	5⅝	Mar. '20, Q	.25
East Butte	Boston	8	7¼	8	Dec. '19, A	.50
First National	Boston Curb	*55	*54	*54	Feb. '19, SA	15
Franklin	Boston	†1¼	†1¼	1½	......	
Gadsden Copper	N. Y. Curb			*25	......	
Granby Consol.	New York	16½	16½	16½	May '19, Q	1 25
Greene-Cananea	New York	20	20	20	Nov. '20, Q	.50
Hancock	Boston	2	1¾	1¾	......	
Howe Sound	N. Y. Curb	2¼	2	2¼	Jan. '21, Q	05
Inspiration Consol.	New York	32¼	30⅛	32½	Oct. '20, Q	1.00
Iron Cap	Boston Curb			5⅝	Sept. '20, K	.25
Isle Royale	Boston	†18	†17	17	Sept. '19, SA	.50
Kennecott	New York	18⅛	17½	18⅛	Dec. '20, Q	.50
Keweenaw	Boston	1	1	1	......	
Lake Copper	Boston	2¾	2¼	2½	......	
La Salle	Boston	†2	†1¾	1½	......	
Magma Chief	N. Y. Curb			7	......	
Magma Copper	N. Y. Curb	*18	*18	*18	Jan. '19, Q	50
Majestic	Boston Curb			*5	......	
Mason Valley	Boston	1¼	1¼	1¼	......	
Mass Consolidated	Boston	†1¾	†1¾	1½	Nov. '17, Q	1 00
Miami Copper	New York	20	19	20	Aug. '21, Q	50
Michigan	Boston	†2	†1¼	1¼	......	
Mohawk	Boston	46¾	44	46⅝	Nov. '20, Q	1 00
Mother Lode Coa.	N. Y. Curb	4	4	4	......	
Nevada Consol.	New York	10½	9¾	10¼	Sept. '21, Q	.25
New Baltic	Boston Curb			3	......	
New Cornelia	Boston	13	12¼	12¼	Aug. '20, K	.25
North Butte	Boston	9	8	8¾	Oct. '18, Q	25
North Lake	Boston	†*25	†*15	*15	......	
Ohio Copper	N. Y. Curb			*6	......	
Old Dominion	Boston	21½	21	21	Dec. '18, Q	1 00
Osceola	Boston	22	22	22	June '20, Q	50
Phelps Dodge	Open Mar.	†1 50	†1 40		July '21, Q	1 00
Quincy	Boston	34½	34	34½	Mar. '20, Q	1.00
Ray Consolidated	New York	11¾	11	11¾	Dec. '20, Q	25
Ray Hercules	N. Y. Curb	*20	*15	20	......	
St. Mary's Min. Ld.	Boston	35	34	34	June '20, K	2.00
Seneca Copper	Boston			13¾	......	
Shannon	Boston	†*90	†*90	*90	Nov. '17, Q	25
Shattuck Arizona	New York	6½	6	6½	Jan. '20, Q	25
South Lake	Boston	†1¼	†*50	*50	......	
Superior Copper	Boston	3	2½	2½	Apr. '17,	1 00
Superior & Boston	Boston	1¾	1½	1½	......	
Tenn. C. & C. cfs.	New York	7	6¾	7	May '18, I	1 00
Tuolumne	Boston	*39	*39	39	May '13,	.10
United Verde Ex.	Boston Curb	23	18	23	May '21, Q	.25
Utah Consol.	Boston	3¼	3½	3½	Sept. '18,	.25
Utah Copper	New York	46¾	43¼	46	June '21, Q	50
Utah Metal & T.	Boston	1⅛	1⅛	1½	Dec. '17,	.30
Victoria	Boston	1⅛	1⅛	1⅛	......	
Winona	Boston	*50	*50	*50	......	
Wolverine	Boston	†12	†10½	10¾	......	

NICKEL-COPPER

Stock	Exch.	High	Low	Last	Last Div.	
Internat. Nickel	New York	12¾	12¼	12¾	Mar. '19,	.50
Internat. Nickel, pf	New York			80	Aug. '21, Q	1.50

LEAD

Stock	Exch.	High	Low	Last	Last Div.	
National Lead	New York	75	72½	74¾	June '21, Q	1.50
National Lead, pfd	New York	103	103	103	June '21, Q	1 75
St. Joseph Lead	New York	11½	11	11½	June '21, Q	.25

QUICKSILVER

Stock	Exch.	High	Low	Last	Last Div.	
New Idria	Boston	†*50		*50	......	

ZINC

Stock	Exch.	High	Low	Last	Last Div.	
Am. Z. L. & S.	New York	7½	6¾	6¾	May '20,	1 00
Am. Z. L. & S. pfd.	New York			23	Nov. '20, Q	1 50
Butte C. & Z.	New York	4	3¾	4	June '18,	50
Butte & Superior	New York	11½	11½	11¾	Sept. '20,	1 25
Callahan Zn-Ld	New York	4	3¾	3¾	Dec. '20, Q	50
New Jersey Zn.	N. Y. Curb	116	115	115	Aug. '21, Q	2 00
Success	N. Y. Curb			*2	July '16,	.03
Yellow Pine	Los Angeles		†*30	*55	Sept. '20, Q	03

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

GOLD

Stock	Exch.	High	Low	Last	Last Div.	
Alaska Gold	New York	⅝	½	½	......	
Alaska Juneau	New York	1⅛	1½	1½	......	
Carson Hill	Boston	14¼	13½	14	......	
Cresson Consol. G.	N. Y. Curb	1 11/16	1 7/16	1 11/16	June '20, Q	$0.10
Dome Extension	Toronto	65	*65	*65	......	
Dome Mines	New York	16½	17⅛	16½	July '21, Q	.25
Florence Goldfield	N. Y. Curb	*37	*34	*37	......	
Golden Cycle	Colo. Springs	*67½	† 65½		June '21, Q	.02
Goldfield Consol.	N. Y. Curb			*6	Dec. '19,	.05
Hollinger Consol.	Toronto	7 35	7 25	7 35	Aug. '21, 4 wks.	05
Homestake Mining	New York			57	Aug. '21, M	25
Kirkland Lake	Toronto	*41	*37	39	......	
Lake Shore	Toronto	1 28	1 25	1 26	Aug. '21, K	.02
McIntyre-Porcupine	Toronto	2 04	2 00	2 00	May '21, K	.05
Porcupine Crown	Toronto	*17	16	16½	July '17,	03
Porcupine V. N. T.	Toronto	*18	*15	*17	......	
Portland	Colo. Springs	*40	*40	*40	Oct. '20, Q	01
Reorgan. Booth	N. Y. Curb			*4	May '19,	05
Schumacher	Toronto	*24	*22½	*24	......	
Silver Pick	N. Y. Curb	*10	*10	10	......	
Teck Hughes	Toronto	*17	16¼	*17	......	
Tom Reed	Los Angeles	†*75	†*65		Dec. '19,	.02
United Eastern	N. Y. Curb	2¼	2 1/16	2⅛	July '21, Q	.15
Vindicator Consol.	Colo. Springs	*25	*25	*25	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb			*4	......	
Yukon Gold	N. Y. Curb			*94	June '18,	02½

SILVER

Stock	Exch.	High	Low	Last	Last Div.	
Arizona Silver	Boston Curb	*20	*18	*18	Apr. '20, M	.03
Batopilas Mining	New York	⅝	¾	⅝	Dec. '07, I	.12½
Beaver Consol.	Toronto	*28	*25	*27	May '20, K	.03
Coniagas	Toronto	1 60	160	1 60	May '21, Q	.12½
Crown Reserve	Toronto	*10	*8½	*10	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3¾	3½	3½	July '21, Q	.12½
La Rose	Toronto	*28	*20	28	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*15½	*14	*14	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1 15	1 05	1 10	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4½	4¼	4½	July '21, Q	.15
Ontario Silver	New York			3½	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	*13	*11	*11	Jan. '12,	.10
Temiskaming	Toronto	*28	*24½	*25	Jan. '20, K	.04
Trethewey	Toronto	*14	*10	*14	Jan. '19,	.05

GOLD AND SILVER

Stock	Exch.	High	Low	Last	Last Div.	
Barnes-King	Butte			*60	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*70	*66	*70	......	
Cash Boy	N. Y. Curb			*4	......	
Consol. Virginia	San Francisco			*21	......	
Dolores Esperanza	N. Y. Curb			1¼	......	
El Salvador	N. Y. Curb	*16	*14	*15	......	
Jim Butler	N. Y. Curb			7½	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb			*4	June '16,	.05
Louisiana Con.	N. Y. Curb			⅛	......	
MacNamara M. & M.	N. Y. Curb	*15	*12	*14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.			4	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1¼	1 3/16	1¼	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*71	*67	*70	......	
Tonopah-Extension	N. Y. Curb	1 5/16	1½	1 5/16	July '21, Q	.05
Tonopah Mining	N. Y. Curb	1 3/16	1⅛	1 3/16	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	*80	*75	*80	Dec. '19, SA	.05

SILVER-LEAD

Stock	Exch.	High	Low	Last	Last Div.	
Caledonia	N. Y. Curb	*8	*8	*8	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1 00	1 00	1 00	Dec. '21,	.15
Chief Consol.	Boston Curb	2¼	2¼	2¼	Aug. '21, Q	.05
Consol. M. & S.	Montreal	15	14¾	15	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†3 00	†1 30		July '20, Q	10
Daly-West	Boston	2¼	2½	2¼	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb			2	Apr. '21, K	.05
Electric Point	Spokane	*6¾	*6½	*6½	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*33	*29	*30	......	
Federal M. & S.	New York			7	Jan. '09,	1 50
Federal M. & S., pfd	New York	21	21	21	June '21, Q	1 00
Florence Silver	Spokane	*10	10	10	Apr. '19,	.01½
Grand Central	Salt Lake	†*25			June '20, K	03
Hecla Mining	N. Y. Curb	4	3 15/16	4	June '21, Q	18
Iron Blossom Con.	N. Y. Curb	*19	*18	*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†2 95	2 00		Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*3	*3	*3	June '21, I	.02
Prince Consol.	Salt Lake	*16	*8½	*8½	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*2½	*2	*2	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*8	*7	*8	......	
South Hecla	Salt Lake	†*35	†*15	*35	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*8	*8	*8	Oct. '17,	.05
Stewart Mining	N. Y. Curb	*4	*4	*4	Dec. '15	.05
Tamarack-Custer	Spokane	1 72	1 70	1 70	Jan. '21, K	.04
Tintic Standard	Salt Lake	2 10	1 82½	2 07½	July '21, Q	05
Utah Apex	Boston	2	1½	1⅞	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*2	*2	*2	Nov. '17,	.01

VANADIUM

Stock	Exch.	High	Low	Last	Last Div.	
Vanadium Corp.	New York	31½	27	30¾	Jan. '21, Q	1.00

ASBESTOS

Stock	Exch.	High	Low	Last	Last Div.	
Asbestos Corp.	Montreal	42	36	40	July '21, Q	1 50
Asbestos Corp., pfd	Montreal	70	67	67	July '21, Q	1 75

MINING, SMELTING AND REFINING

Stock	Exch.	High	Low	Last	Last Div.	
Amer. Sm. & Ref.	New York	34	31½	33¾	Mar. '21, Q	1 00
Amer. Sm. & Ref. pf	New York	65	64½	65	June '21, Q	1.75
Am. Sm. pf. A	New York	63½	63½	63½	July '21, Q	1 50
U. S. Sm. R. & M.	Boston			27½	Jan. '21, Q	.50
U. S. Sm. R. & M. pf	Boston			37½	July '21, Q	.87

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
F. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries

METALS NON-METALS PETROLEUM

F. E. WORMSER
[illegible] REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
[illegible]
Consulting Editors

Volume 112 New York, September 17, 1921 Number 12

Why the Mining Engineer?

A RECENT VISITOR, the president of a school of mines in the Old World, has noted that students are going in more reluctantly for mining engineering, since they feel that in the pursuits of commerce, or even in the established professions, they can obtain as substantial financial rewards, without the hardships which attend upon mining.

There is little doubt that such students are right. Unfortunately, it appears to be true that there are more opportunities in commerce and in the professions than in mining. The pay is as good, and the chances of promotion are more numerous. More important, the young man will have fixed abode, may put forth social roots, become identified with and honored by various groups representing various angles of life, and may buy a home and marry without the perplexity and anguish of dragging his wife and little ones from one mining camp to another—from the high mountain altitudes to the tropical heats.

If all this is true—and there is no doubt that it is—it seems wonderful that we have at present any army of young mining engineers at all. But we have, and we fear, at present, more than one to each job. The supply rather exceeds the demand. What is the economic answer—since, it is currently understood, all modern problems have an economic solution?

The answer, we believe, is that it is not a problem in economics. That modern problems are all economic problems is, in our opinion, bunk; and he that so views it will not understand human nature nor current or past history. And we will propound another question: Why is it that among mining engineers, Americans and British have led the world, and are doing most of the world's mining, with the French well represented as a third party? The answer to this problem will perhaps give us a clue to the first.

The love of ease, stability, security and of the accumulation of goods does not mark the noblest of the youth of that racial group which we vaguely term Anglo-Saxon. Let those who will choose the shop and the law—so long as the Anglo-Saxon group and the kindred dominating groups of northern Europe cannot help but penetrate the wildernesses, and "Fell the dark forests, and let in the sun," and for so long will the charm of travel, the stern joy of hardship, the sweetness of rude adventure, draw the swift-footed young descendant of pioneers who has brains, character, and the racial unrest, to the remote places of the earth, to the problems of discovering primeval earth secrets, conquering the unconquered rocks, in preference to the trifling game of outwitting other human beings.

So we shall never be without mining engineers, and the supply will at least equal the demand, even though the rewards be no greater than for softer living, showing the premium which our young men are willing to pay for the privileges of manly adventuring.

The Cards on the Table

IN THIS PERIOD of business slackness, methods which promise to increase efficiency are being sought after more earnestly and appreciatively than during the busy times of financial joy-riding. Work, brains, good-will, co-operation, now come to be valued at what they are: the elements whose quality decides whether a business shall or shall not go on. In the automobile world, for example, Henry Ford is a household word and a subject almost as universal as the weather. Henry Ford may not know the difference between Arnold Bennett and Benedict Arnold, but his enormous business scarcely bumped when the hardest of situations in the automobile industry overtook it. What is the answer? Work, brains, good-will, co-operation—he gets them all. He pays high wages, and the men work for him and for themselves. Recently he bought a railroad which was not paying. He eliminated some of the employees, raised the wages of the rest; they began to turn out more work: and the railroad began to show a profit.

There is one truth that every employer must remember—a man will work for himself harder than he will work for any one else. Therefore, if the employer is wise he will so arrange and organize that each man will feel and know that he is serving his own interest—that is to say, the common interest. In the old days, and sometimes in these days, the employee looks on the boss or on the company as hypocritical, grinding, and mendacious; and the bosses suspect the men of shirking and conspiracy to obstruct the business.

Thinking that a situation is so, often goes far toward making it so. But in these days, the employer is apt to be a "regular fellow" himself and no upstart, and he goes after a partnership with his men. There are all sorts of ways to get this. First you must be careful that you select the right kind of employers, just as it is said that children should be careful in the selection of their parents. Such an employer may bring about the right kind of good will and possible welfare partnership, without any set form of [illegible]; or he may work out some system of conferences and frank interchange of ideas. In such an organization the terms capital and labor, used as if designating rival football teams, will soon become almost obsolete from disuse, and the rivalry will be for the efficiency (and hence the earnings) of "our company" with other companies in the same line of business.

The various devices to induce and expedite cooperation go by different names. An article in the *Outlook* for Aug. 31 by Sherman Rogers discusses "Employee Representation: Success or Failure?" interestingly and [illegible]. His verdict is altogether in its favor. An employee of the Mergenthaler Linotype Company, in which the system is in vogue, told him, "It is the greatest possible success because it is an *honest method* applied to dealings between *honest men*." Regarding quarrels between employer and employee, this employee said, "There has never been serious ill feeling, no trouble about getting a square deal on wages. We have no strikes, because both men and management are looking at the same set of figures. Each realizes what must be done to keep the accounts on the ledger out of the red-ink column. Every man in the works realizes that the prosperity of one means the prosperity of both."

Mr. Rogers makes a strong statement regarding those who have supported employee representation. "They have found that practically all men are both honest and reasonable when wild statements and abstract theories are shattered with broadsides of cold chilled facts."

This may or may not be too strong a statement—exceptions will be found among both employers and employees; but as a generality there is little doubt as to its being a practical working hypothesis.

To some these experiments in co-operation and adventures in common sense may seem wild and "radical." We remember, reverting again to Henry Ford, that when he established an unusually high wage scale for his men, the average wise and experienced employer pronounced him crazy. When we consider the money that through his methods has been put into the pockets of his employees, and especially of Henry, and when we view his methods of economy and finance which surprised the bankers whose panacea for industrial depression is simply to borrow, we could well wish that other employers could be inoculated with the same variety of insanity.

A Slump in the Humanitarian Market?

IT IS NATURAL to expect, with the general retrenchment now evident in the activities of the mining industries, that there will be a consequent slowing up in certain work that, due to its general adoption by mining and other industrial concerns and its direct relation to employer and employee, has come to be regarded as a necessary supplement to producing operations. We refer to that work coming under the head of welfare—a Mother-Hubbard term, perhaps, as it covers a great deal—but variously classified as educational and recreational work, publicity, and the like.

Naturally, the skillful manager cuts his cloth to suit his needs, and, finding that the demands for his product have fallen off, or that the price offered is below the cost of production, accordingly makes his program to fit those circumstances. He curtails and if need be discontinues proposed expansions, or effects economies of operation and makes such adjustments as will best conform with the general situation. Those plans relative to actual production detail can be carefully weighed and figured on a cost basis; the earning capacity of each item is apparent on the cost sheet, so that it is possible to visualize just where and what changes must take place. The adjustments are made not only with a view to present conditions, but the possibilities of the future are also considered.

The cost of so-called welfare work is known. We read in the various bulletins, company reports, and other statements that certain sums have been spent for this, that, and the other thing—all of which are productive of no tangible income when compared with, say, stoping operations and ore tonnage. But an actual earning ratio does exist, though it cannot be calculated and must simply be put down as psychology. The returns for this sort of work can be found in the loyalty of the employees and in their satisfaction with their employment and surroundings.

Mining engineers are, as a rule, very capable psychologists; only they do not know it, and it is very difficult to tell them. Those intangible qualities that make a man a leader of men—and there are more of the engineering profession making practical use of leadership than of any other profession—are nothing but the application of practical psychology. On the other hand, our mining engineer deals with facts, and when mathematical calculations, such as are involved in costs vs. tangible income, are placed before him, together with a consideration of expenditures for a return that is based on psychology, he is quite likely to favor the former.

With the mining business at the top of the wave it was comparatively easy to put through appropriations for welfare expenditures. It was then the consensus of opinion that money spent in that way was well spent. But we have noted a tendency among some companies toward a slump in this particular line of activity, and we question if it is not a mistaken policy. Some curtailment is, of course, to be expected, but if, after all, welfare work is as essential as we have been led to believe, should it not receive the recognition due its relative importance, and accordingly be subjected to a proportionate curtailment instead of complete extinction? Not only have we especial need for the continuation of welfare activities at the present time, but to a large degree the success of future operations depends on them.

News Service

THESE ARE DULL TIMES in the mining-publication industry, as well as for the mining industries. They are times which lead us to rigorous inspection as to quality, economy, efficiency, and giving the reader and advertiser the worth of his honest dollar. Many of our changes result in increased expenditure, but if they improve the quality of the *Journal* we shall try to put them into effect, and by good management reduce along other lines which will mean no loss of quality. Our news service, for example, is a thorough and expensive one. It is entirely original, from special correspondents, and is, therefore, expensive; but we believe our subscribers read it gladly, as we do ourselves, as forming by itself the predominating newspaper of the mining industries.

One of our recent experiments has been to arrange for cable news through a well-known international news organization. We trust that these cabled dispatches will prove accurate and readable, as the reputation of the organization leads us to believe; and that thus our readers will be early apprised of certain happenings in the remote parts of the mining world which would otherwise be presented to them more tardily, through the mails, if at all.

E. & M. J. Index

THE INDEX for Vol. 111 of the *Engineering and Mining Journal* is now ready for distribution and will be mailed only to those who request it. Those who wish a copy of the Index are requested to send for it promptly. A postcard will do.

WHAT OTHERS THINK

Competition Offers Solution of Industrial Problems

In *Engineering and Mining Journal* of July 23, L. O. Kellogg, in a letter, "Profit Sharing in Mining," asks for the testimony of mine managers on their success or failure with profit sharing. I am not a mine manager, but a mine employee, and as such would like to say something about some of the questions involved in profit sharing.

In a discussion of this sort, it is first necessary to determine from what point of view the question is to be considered; otherwise we may not only disagree but misunderstand one another. There are four interests that require consideration: viz: that of the employer, that of the employee, that of the buying public, and that of the general welfare. The viewpoints of the employer, the employee and the buying public are personal and are likely to be more or less antagonistic. For this reason the viewpoint of either one of these can not be taken unqualifiedly as a measure of what is good. The only viewpoint that is equally fair to all, and the only one on which all can agree, is the welfare of the whole. It is useless to discuss the questions from any other angle when in actual practice the viewpoints of all the others have to be taken into consideration. The time is rapidly passing when industrial questions can be discussed and settled without the working man "sitting in."

All the different schemes for profit sharing that have been advanced are nothing but castrated forms of true profit-sharing or honest-to-God co-operation. They are counterfeits of the genuine. They are a cross between pure and simple wage slavery and genuine industrial democracy. They may raise the wage of the worker, but they do not touch the real thing at issue; the thing, above all others, that is of more consequence to the working man than anything else. Nothing short of a thoroughgoing profit-sharing system, in which the present obnoxious relation of employer and employee, which is essentially no different than that of master and slave, is entirely done away with, will do. Nothing short of a relationship in which all men are put on an equal footing will for long satisfy the worker. It is the only relation that is equally fair to all; it is the only one that makes for lasting peace, and the only one in which the self-interest of all concerned is not in conflict with the welfare of the whole.

There are just two working relations—one is where a man works for another or for others, and the other is where a man works for himself or where men work together for themselves. The working relation that should be established is the one where men work with, instead of for, another or others.

In discussing the question of ownership and industrial relations in general, a great mistake is made in assuming that there are only two forms of ownership—government ownership and private ownership—and that no other form is possible. There is another, a third form, and to my way of thinking the right form, viz: that an industry be owned and controlled by those working in it, no man to have more than a working interest and no man working for another or others, but all men collectively working for themselves. That is to say, the railroads to be owned and run by the railroaders, the telegraphs to be owned and run by the telegraphers, and so on. This is the principle of self-determination self-rule government by consent of the governed—applied to industry. This is true industrial democracy, and that is what the worker wants, and that is what is best for the welfare of the whole.

Mr. Kellogg asks, "Is in general any formula deducible on which to base the distribution of profits among the management, the heads of departments, the bosses in the departments, and the body of workmen? . . . Finally, can any rational basis be established for determining the percentage of profits to be segregated for distribution to the employee?" This is the wages question, which is one with all problems of distribution. The wages question may be divided into two parts: (1) the question of how to determine the wages of men doing the same kind of work, but who are of different efficiency; (2) the question of how to determine the wages of men who do different kinds of work. As to determining the wages of men who do different kinds of work, so difficult is it to determine the number and quantities of the factors entering into the production of a thing that it is practically impossible to base wages on the measurement of any factor or group of factors. No comparison can be made. In addition to this, even if comparisons could be made, who could be trusted to decide impartially what wages should be paid? Certainly, the decision couldn't, with any certainty of justice being done, be left to any party or combination concerned.

How, then, it will be asked, are we to determine wages? The answer is, competition. Adam Smith says, "By free and equal competition all problems of production and distribution will work themselves out to the very best advantage." That is to say, wages and prices will work themselves out to the very best advantage. In a system of free and equal competition, in which there are jobs enough for all, and where men have free access to all jobs, and all stand on an equal footing, every man, practically speaking, determines for himself the justice of the wage he receives. If he thinks he is not getting a square deal, he is always at liberty to go where he thinks he can do better.

What does it indicate when men flock from one industry to another in such numbers that they cannot be profitably employed? Doesn't it indicate that conditions are, as a whole, in that industry better than they are in other industries? What is the remedy? Isn't it to change the wages or other conditions in the various industries until all are equally desirable to work in? No one can kick at that. For when a man goes from one industry into another he is just as much as admitting that, to him, the workmen in the industry he goes into are getting the best of the bargain. He has no just claim to advantages over his fellow workmen in other industries.

Many, particularly the socialists, claim that competition does more harm than good. The reason for this is, the conditions to make a competitive system a success have never been fully complied with. To make it a success all must be put on the same footing; all must be given the same opportunity.

Under present conditions, in order to give all an equal opportunity, all should be allowed to seek employment and obtain it wherever they will, under the same conditions as anyone else, without anyone having the power to deny them such employment. And all, without exception, should be made to compete for their jobs. The idea in competition is not to throw anyone out of a job; all must work; but to find the man who is best suited for the job.

The only formula on which to base the distribution of profits in an equable manner among the management, the heads of departments, the bosses of departments, and the body of workmen is to throw all of them into the same competitive system on the same footing, and exclude none from the full effect of economic law. It is the only system which is fair to all, and the only one not against the welfare of the whole.

In passing, it might be remarked that a thoroughgoing competitive system, one that excludes none from the full effect of economic law, solves the perplexing problem of the unearned increment.

As to determining the wage of men doing the same kind of work, but who are not equally efficient: It has been said that "it is an axiomatic proposition if one man produces twice as many chairs as another, he is entitled to twice the salary, and if one man displays twice the capacity or skill, energy and industry as another man he is entitled to twice the salary even if they be engaged in different occupations." I disagree with this proposition; it is not as just and axiomatic as it appears. To determine how just it is we will have to go away back into the past, and inquire as to just how it happens that one man hasn't the ability to do as much as another. It might be found, if it were possible to trace the thing out, that this inequality was due to some accident over which no one had any control, and least of all the men most concerned. Also, it might be found that others were responsible for the inequality. Who can say? All the factors that might enter into producing such an inequality are so numerous and varied that it is absolutely impossible for anyone to say positively how just a certain wage is. It is foolish to try.

How, then, should the wage be determined? The answer is, pay all the same wage that are doing the same work. And then proceed to make every man worthy of his hire, by making all equally efficient or as efficient as possible. This is the most sensible way out of the difficulty. With the present methods of wage payment we are always living in the dead past. What we are concerned with is the future. What we want is a system of wage payment that will bring out our potentialities. How do this?

The first principle of good management is to treat all men equally. They may not, at present, be equal, perhaps, but as a matter of policy, as a principle of action, they should be treated as if they were. As a matter of principle, men are assumed to be potentially equal, and for that reason should be treated as equal. The effect of such treatment will be to really make them equal. In the case of wages, giving the same wage for the same work would cause the competent, in a system where all men received according to what was produced, as a matter of self-interest, to train or cause to be trained the less competent up to their own standard of efficiency. And, also, to cause the competent, if the incompetent were not naturally suited for the occupation, to find that occupation most suited to their abilities. In this way, by making all men doing the same kind of work equally competent, we can with justice give all men doing the same kind of work equal pay. Also, in this way we force some one—the employer and the workmen in an industry, who are naturally the best fit to give instruction—to assume the responsibility for the industrial education of the uneducated worker. In this way all that is in men will be brought out to the very best advantage, in the quickest possible manner.

Mr. Kellogg asks, "How, then, can profits be shared and at the same time protection be secured against gutting, neglect of development, neglect of maintenance, and shortsighted policies in general?" While inquiring into this it would be well to inquire into why there is a gutting of our natural resources, why we have a conservation problem, and that without any profit-sharing system. It is quite likely the reason will be found to be the same in both cases.

The reason why workingmen, in a profit-sharing system such as Mr. Kellogg speaks of, are liable to find it to their interest to gut a mine and encourage all sorts of short-sighted policies, is the uncertainty of the future. It is this uncertainty of what the future will bring forth that causes most of the unsocial acts of men; it is the cause of short-sighted policies in general, whether of an individual, or a mining corporation, or of a government. Men are put in a position where they have to choose between a present certainty and an uncertain future. And they choose the present certainty, of course, to the detriment of the future of the average man. If men were certain of the future, if they were sure that in the future they would have the same opportunity as others, they wouldn't gut the mines nor would we have a conservation problem similar to that which we have today.

From what has been said, the remedy is obvious; establish a system in which all men are given free and equal access to all our resources, by giving all men free and equal access to all jobs. This is the only way all can be given a free and equal opportunity at all times. The legal right to own without limit the natural resources on which all depend and can't possibly do without, is the principal cause of the trouble. Such a right gives a right to deny any and all access to these resources. The man who controls the job controls the man who depends on it.

A thoroughgoing competitive system—free and equal competition (it has never been equal)—is the formula by which all our industrial problems will find their solution.

A pretty good line can be had on what to expect from profit sharing, by what happens in leasing, which is a species of profit sharing. On page 158, in the same issue in which Mr. Kellogg's letter appears, there is something showing the ill effects leasing has had on zinc mining.

The profit-sharing scheme of the copper companies is not without its serious faults. It puts the worker where his self-interest — his immediate self-interest — is against that of the whole. It puts him in a position where it is to his interest to curtail the production of copper, by loafing and other means, in order to raise the price.

WILLIAM CROCKER.

Prescott, Ariz.

Possibilities of Tungsten-Bearing Deposits

The opponents of a duty on tungsten base their opposition largely upon the supposition that our known resources in that metal are too limited to justify a duty, and contend that such as we have should be preserved for war-time emergency. This idea is reflected in the editorials of the *Engineering and Mining Journal* and *Mining and Scientific Press*, and in the expressions of some of their contributors.

Mr. Hess, of the U. S. Geological Survey, has been a prolific disseminator of the belief that the United States is incapable of producing a significant part of our requirements, and is one of the early expositors of the conservation idea as applied to tungsten. It appears that the attitude of the leading mining magazines has been absorbed from the impressions conveyed by the Hess reports.

I am certain that the majority of the engineers and geologists who are genuinely interested in the tungsten problem, and possessed of more accurate knowledge of existing conditions, will agree with me that Mr. Hess' conclusions are considerably at fault. In taking this view, I do not wish to depreciate Mr. Hess' ability, nor imply to him any other than the highest motives in expressing his conclusions, but I feel that the opportunity in the field to observe closely and thoroughly was denied him. He had a large territory to cover in a limited time; he was investigating the occurrence and production of a mineral to which but little thought had previously been given. His conclusions may be justified in the light of the knowledge and facts he was able to gather at that time, but they should not govern when the conditions existing today are under consideration.

In 1915 the tungsten-bearing, contact-metamorphic deposits of the Great Basin and Inter-Mountain regions were practically unknown to either prospector, miner, or geologist. During the following three years of intensive exploration and development of some of them much was learned—particularly by those intimately associated with such exploration and development. Little of the valuable information thus gained has been made available to the public, and the impressions of Mr. Hess and others, gathered in their necessarily hurried war-time investigations, have been spead far and wide.

The stand taken by the opponents of a duty on the metal, upon the grounds of its limited known resources, becomes untenable when it appears that these "known resources" are but a small fraction of the potential resources of the country. To dispose of such opposition, and invite co-operation in obtaining reasonably just conditions for the industry, it only remains to prove the actual existence of our large potential resources. This is practically impossible for an individual to do, but my experience during the last five years, directed largely to studying contact-metamorphic deposits containing scheelite, leads me to believe that there is no doubt that a large number of deposits exists which are capable of economic exploitation. In Nevada today it is easier to find tungsten-bearing prospects than those containing gold, silver, lead or any other mineral, and Arizona and New Mexico, with their abundance of granitic intrusions in limestone, should offer still better opportunities.

Representative Longworth, in defending the potash schedule, admitted his personal doubts as to the ability of the country to develop the industry, but was willing to try for five years in the hope that it could be attained. Why cannot the mining press assume the same charitable view toward tungsten, with its brighter prospects, and give it their active support?

Little has been published upon the occurrence of scheelite in contact-metamorphic deposits. It differs from other metals commonly mined from such deposits in its distribution, its relative quantity with respect to the gangue materials, and its place in the sequence of mineral deposition (or formation) from the parent magma. I find that when scheelite is present with garnet as the principal gangue mineral it is distributed throughout the mass; that its introduction into the mass was most likely contemporaneous with the formation of the garnet. (This does not hold true with epidote, which it follows.) In such deposits, then, the measure of the garnet becomes the measure of the ore.

That there are innumerable deposits of garnet in western America is well known; that many of them are tungsten-bearing is less known, but is certainly an assured fact. There is no real foundation in fact for the belief that the United States cannot produce all the tungsten it needs in time of peace, and at the same time create adequate reserves which would be available for use in case of war.

As long as the strict policy of conservation, recommended by Mr. Hess and tacitly concurred in by the mining press, is followed, the status of the tungsten industry in this country will remain just where it is today. Picture a sudden declaration of war two generations hence—a mining population ignorant of tungsten ores or the location of available deposits, which the policy of the nation had decreed should be of no value in time of peace. A frantic, incoherent effort to hunt up old prospects or search for new ones; a mad scramble to finance and equip such as may be found; imports cut off, prices soaring, with a tremendous demand. After the lapse of a year or two the "known resources of 1918" are rediscovered and brought to the point of high production—3,500 to 4,000 tons per year. It took this country nearly four years to attain that production prior to November, 1918. Would we expect our grandsons to do better?

On the other hand, suppose the price of tungsten had been stabilized at about $15 per unit during the two preceding generations. The industry is on a going-concern basis; the search for and development of pay ore at $15 has been carried on thoroughly. But now the demand is suddenly doubled or trebled—and the price with it. Then there become immediately available immense tonnages that did not pay to mine with the price at $15. That is what happened with copper, lead, zinc, and silver during the late war.

Some of the silver mines of Tonopah are today running solely upon ore, with silver at $1 per ounce, that could not be mined with the price of that metal at 50c. or 60c. per ounce. Hundreds of properties that were considered exhausted were reopened and produced copper, lead, zinc, and other metals under the stimulus of high prices when the country needed them.

The dread fear of exhausting our resources is comparable to the prospector who was afraid to sink a few feet deeper because he dreaded the possibility of spoiling his prospect.

CARL STODDARD

Reno, Nev.

Recent Applications of the Cottrell Processes

Electrical Fume and Dust Precipitators Installed Within the Last Year At the Plants of the National Lead Co. and the Williams-Harvey Corporation Will Save 20 to 50 Per Cent on the Cost of Equipment

By R. B. Hesson, P. E. Landolt, and A. A. Heimrod

Written for *Engineering and Mining Journal*

THE DESIGN and construction of Cottrell electrical precipitation equipment for the recovery of the valuable metallic particles carried away as fume from metallurgical furnaces has now been standardized and thoroughly tested in continuous commercial operation. The installations described in this paper are at the plants of the National Lead Co. and the Williams-Harvey Corporation, both in Brooklyn, N. Y., and illustrate the kind of electrical precipitation equipment used for the type of metallurgical problems there encountered. Both of these installations were constructed by the Research Corporation during the last year.

It is assumed that those who will read this paper are familiar with the fundamental principles underlying the Cottrell processes. For those who may not be acquainted with previous developments, a selected bibliography is appended for reference.

Related Plant Operations and Origin of Fume Losses

The Cottrell equipment at the plant of the National Lead Co. replaced an original installation of these processes which proved inadequate and unsatisfactory. This installation recovers the metallic losses, consisting of tin, lead and zinc in the gases from metallurgical furnaces, including a ten- and a five-ton reverberatory furnace for the treatment of various white-metal drosses. The path of the gases from the furnaces to the stack is as shown in Fig. 1. The gases from the individual furnaces are led into a common brick flue. From a point in this brick flue just beyond the point at which the gases from the last furnace enter, the mixed gases are led into a brick chamber where they can be humidified, when necessary, properly to condition them for treatment in the precipitator. From this brick chamber the gases pass through a steel balloon flue approximately 175 ft. long, placed as shown in Fig. 1, the primary purpose of this flue being to cool the gases to the proper temperature for treatment. The gases are then admitted, through individual openings at the end of this steel flue, into the bottom headers of the double precipitator unit to be described later, and from there pass up through the precipitator pipes in which the finely divided suspended particles of fume are removed. The cleaned gases then leave the top headers of the precipitator unit and pass through a common downcomer into a brick flue, and from there to a brick stack. A fan and bypass flue are provided, beyond the point at which the downcomer from the precipitator enters the brick flue, for use at such times as the stack may not give sufficient draft to operate the furnaces.

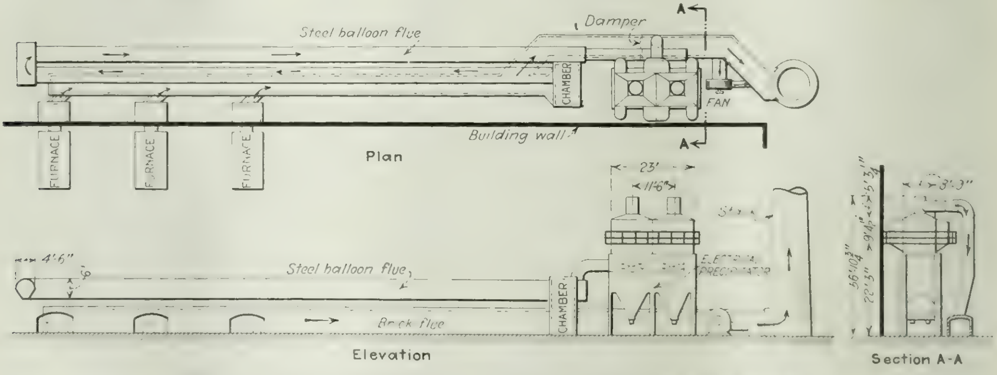


FIG. 1. PLAN AND ELEVATION OF NATIONAL LEAD CO.'S FLUE SYSTEM

At the plant of the Williams-Harvey Corporation, the Cottrell equipment recovers the dust and fume from the following furnaces used in the smelting of tin ores: three reverberatory smelting furnaces, one inclined rotary roaster, and one blast furnace. This installation supersedes and supplements a wet filter originally used to recover fume from the reverberatory furnaces only. This wet filter, although fairly effective, proved expensive to operate and maintain. A building, approximately 60 x 120 x 25 ft. high, originally housed these filters and is now used to house the complete Cottrell installation.

The path of the gases from the furnaces to the stack is as shown in Fig. 2. Precipitator unit No. 1 treats the gas from the calciner or roaster. In a similar manner units 2, 3, 4 and 5 take care of the gas from the reverberatory furnaces, and units 6 and 7 handle the gas from the blast furnace. Each metallurgical operation has a separate flue system, so that the fume is collected separately, furnishing a flexibility in retreatment, if necessary.

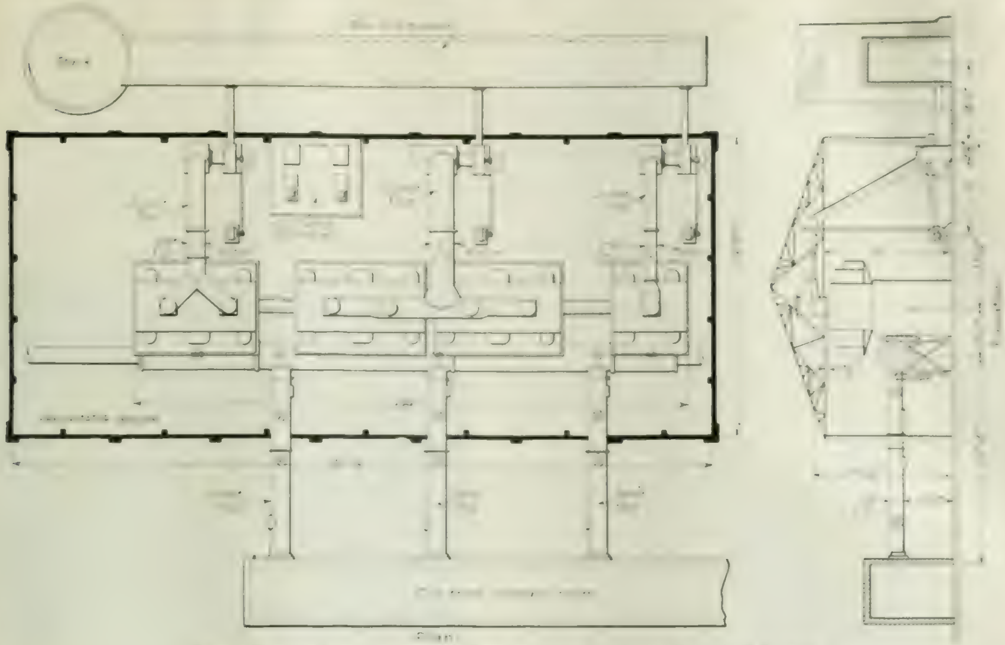


FIG. 2. PLAN AND ELEVATION OF WILLIAMS-HARVEY INSTALLATION

A Cottrell installation is usually made up of a number of individual units with separate gas connections and electrical control to permit of flexibility in operation and proper control, dependent upon plant operating conditions. Each of the units at both the National Lead Co. and the Williams-Harvey Corporation installations has forty-eight pipes, forty-four of which are 8 in. in diameter and 12 ft. long, and four of which are 12 in. in diameter and 13½ ft. long. Such a precipitator unit, when used to recover finely divided suspended fume particles, can treat effectively approximately 6,000 cu.ft. of gas per minute, measured at any treatment temperature between 150 and 600 deg. F. The general construction of this forty-eight-pipe unit at both of these installations is essentially the same, although certain details may differ, such as the design of the bottom header and the method of removing the collected material. Each of these forty-eight pipe units consists of a concrete bottom header or dust chamber, steel superstructure and top header, precipitator pipes or collecting electrodes, discharge electrodes with supporting framework, cleaning and rapping devices, high-tension connection and switches, and dampers and flue connections. The general location of the installation at the National Lead Co. is shown in Fig. 1, the appearance of the double precipitator unit by Fig. 3 and a cross section in Fig. 5. The arrangement of the Williams-Harvey Corporation equipment is shown in Fig. 2, an exterior view in Fig. 4, and a view of some of the electrical equipment, including the switchboard for the installation, in Fig. 6.

The electrical power, both at the plant of the National Lead Co. and at that of the Williams-Harvey Corporation, is supplied by the Brooklyn Edison Co. and is 250 volts, 3 phase, and 60 cycles. To obtain the high voltage uni-directional current for operating the precipitator, the following is required per unit of electrical equipment:

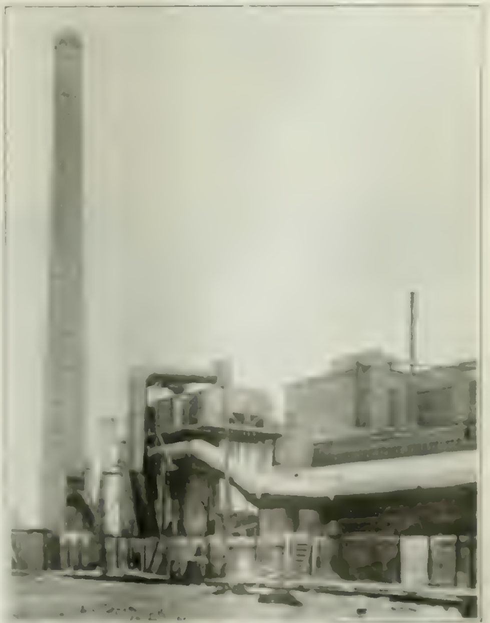


FIG. 3. COTTRELL INSTALLATION AT THE NATIONAL LEAD CO.'S PLANT

One 5-hp. synchronous induction motor for driving the mechanical rectifier.

One special high-voltage transformer; 200 volts / 55,000 to 75,000 volts, with necessary taps.

One mechanical rectifier for converting the high-tension alternating current to a uni-directional high-tension current.

One control switchboard panel, with switches, meters, resistances, and other equipment. In order to obtain regulation between the voltages supplied by the various ratio taps of the transformer, a non-inductive series resistance is provided in the primary circuit. This resistance is divided into eight steps and so arranged that it can be controlled from the switchboard.

Necessary high voltage switches and insulators.

The National Lead Co. installation has one unit of electrical equipment, and the Williams-Harvey two units. A General Electric Co. synchronous induction motor and a 20-kva. American Transformer Co. transformer were used on the National Lead Co. unit; and two synchronous induction motors and two 25-kva. transformers supplied by the Westinghouse Electric & Manufacturing Co. were used for the Williams-Harvey Corporation units.

Three high-tension conductors, properly screened, led from the two electrical units of the Williams-Harvey installation to three high-tension switches, which give great flexibility of operation of the treater units.

Performance tests conducted to determine the operating efficiency of the completed installation at the National Lead Co. plant indicated the following:

Up to 12,000 cu.ft. of gas per minute at an average of 650 deg. F. were treated in the two units, recovering an average of 97 per cent of the suspended matter in the gases, with a daily saving of 1,500 to 2,000 lb. of dust. The recovery of dust from the cooling and settling flues leading to the precipitators amounted to only 7,000 lb. in ninety days of operation under the same general operating conditions. The dust analyzed 40 to 50 per cent Zn, 15 to 20 per cent Pb, and 15 to 20 per cent Sn, all in the form of oxide.

The furnace charges were a mixture of lead and tin scrap, and drosses carrying some zinc. From two to three gallons of water per minute were introduced into the gases by means of Schutte & Koerting sprays to condition the gases properly for electrical treatment. Electrical power supplied to the installation varied between 300 and 350 kw.-hr. per twenty-four hours. The fan indicated in Fig. 1 was not used, as sufficient draft was available for maximum furnace operation. In the way that the installation will be operated, only periodic attention is necessary to clean the electrodes and adjust the electrical operation and water sprays, requiring about one-third of one man's time per shift.

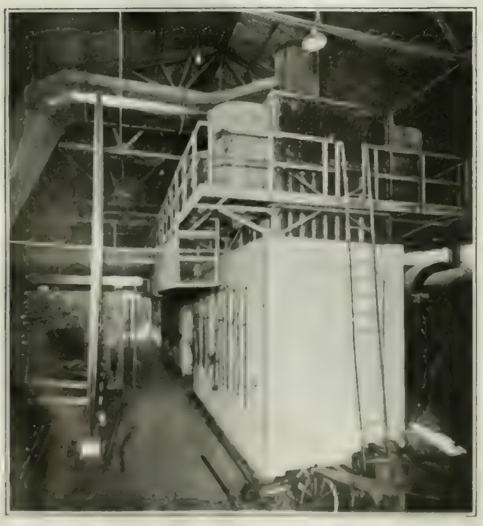


FIG. 4. EXTERIOR VIEW, WILLIAMS-HARVEY EQUIPMENT

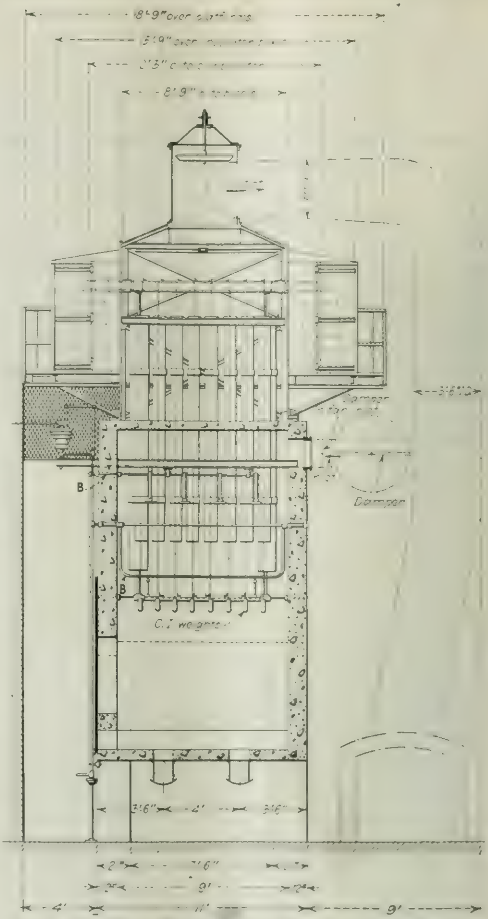


FIG. 5. A CROSS-SECTION OF THE NATIONAL LEAD CO.'S PRECIPITATOR

The cost of the installation, including the precipitators, electrical equipment, flues, and other equipment, was approximately $30,000.

Therefore, with fixed charges at 20 per cent (inc. repairs)	$6,000
Power at 3c. per kw.-hr.	3,000
Labor, pro-rated at $5 per day	1,500
The total annual operating charges will be approximately	$10,500

and the expected recoveries will be 450,000 lb. dust per year, containing 40 per cent Zn, 15 per cent Sn, and 15 per cent Pb, with a gross value of metals recovered, neglecting the zinc in the dust, of $16,000 to $20,000, leaving a net return of $6,000 to $10,000, or 20 to 30 per cent net on the investment.

At the Williams-Harvey Corporation, each of the smelting-furnace precipitator units recovers approximately 1,000 lb. of dust per twenty-four hours, and usually two of the three furnaces are operating, assuring a total of 500,000 to 750,000 lb. of dust per year. The blast furnace is only operated periodically, and the precipitators connected to it collect about 500 lb. of dust per twenty-four hours, or a total of 50,000 to 100,000 lb. of dust per year. The precipitator on the roaster flue collects about 1,000 lb. per twenty-four hours, or about 250,000 to 300,000 lb. per year. This dust contains appreciable bismuth as well as tin, and is difficult to re-treat. The smelting-furnace dust contains about 50 per cent Sn, and about 98 to 99 per cent recovery is made of the dust passing through the precipitators. The gross recoveries in the precipitators approximate, at present market conditions, about $100,000 to $125,000 per year. The investment in the Cottrell installation, including precipitators, flues, fans, and electrical equipment, but not including buildings or waste-heat boilers, is approximately $125,000.

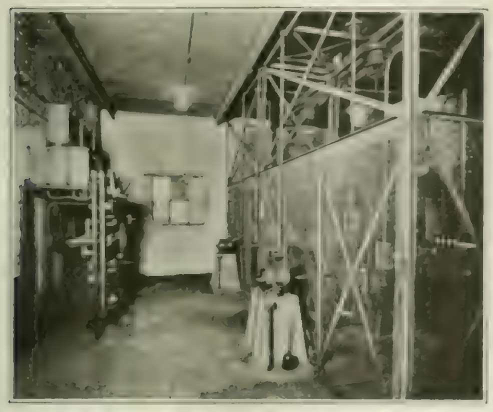


FIG. 6. PART OF THE ELECTRIAL EQUIPMENT AT THE WILLIAMS-HARVEY INSTALLATION

Therefore, with fixed charges at 20 per cent.......	$25,000
Power at 3c. per kw.-hr.	6,000
Labor and supervision..........	4,500
The annual operating charges will be approximately.	$35,500

and the expected saving will be at least $60,000 to $70,000, or over 50 per cent on the investment made.

Acknowledgment is hereby made to the officials of the companies herein mentioned for information furnished in connection with their respective plants and for their co-operation in making these installations successful. Especial appreciation is expressed to G. W. Thompson, chief chemist, National Lead Co., and vice-president Williams-Harvey Corporation; W. F. Kemble, general superintendent, Williams-Harvey Corporation; and C. W. Gesregan, superintendent, Crooke Works, National Lead Co.

SELECTED CHRONOLOGICAL BIBLIOGRAPHY

1824. Hohlfeld, M., "Das Niederschlagen des Rauchs durch Electricitaet." *Arch. fur die Gesammte Naturlehre*—K. W. Kastner, Vol. 2, 200.

1850. Guitard, C. F., "Condensation by Electricity." *Mechanic Magazine*, Vol. 53, 346.

1886. Lodge, Sir Oliver, "The Electric Disposition of Dust, Smoke, etc." *Jour. Soc. Chem. Ind.*, Vol. 5, 57.

1911. Cottrell, Dr. F. G., "The Electrical Precipitation of Suspended Particles." *Jour. of Ind. and Eng. Chem.*, Vol. 3, 542.

1912. Schmidt, W. A., "The Control of Dust in the Portland Cement Industry." Vol. 5, 117, *Proceedings* 8th Intern. Congress Applied Chemistry.

1912. White, Alfred H., "The Electrical Separation of Tar From Coal Gas." *American Gaslight Journal*, Vol. 97, 210.

1914. Howard, W. H., "Fume Precipitation at Garfield." *Bull. Amer. Instit. Min. Eng.*, Vol. 49, 540.

1914. Cottrell, F. G., "Problems in Smoke, Fume and Dust Abatement." *Smithsonian Institution Report* for 1913, p. 653, Pub. No. 1307.

1915. Strong, W. W., "Theory of Electric Precipitation." *Proc. Am. I. E. E.*, Vol. 34, 220.
Nesbit, A. F., "Theoretical and Experimental Considerations of Electrical Precipitation." *Ibid.*, p. 507.
Bradley, Linn, "Practical Application of Electrical Precipitation." *Ibid.*, p. 523.

1915. Schmidt, W. A., "Cottrell Processes of Electrical Precipitation." *Trans. Canadian Min. Inst.*, Vol. 18, 110.
Aldrich, C. H., "Treatment of Silver Furnace Fume by the Cottrell Process." *Trans. Amer. Electrochemical Soc.*, Vol. 28, 119.

1916. Ricketts, L. D., "Dust Losses in Copper Smelting." *Eng. and Min. Journ.*, Vol. 102, 396.

1917. Meston, A. F., "Electrical Precipitation in the Chemical Industries." *Electric Journal*, June, 1917, p. 248.

1918. Carothers, J. N., "Electric Furnace Smelting of Phosphate Rock and Use of Cottrell Precipitator in Collecting Volatilized Phosphoric Acid." *Jour. Ind. and Eng. Chem.*, Vol. 10, 35.

1918. Heimrod, A. A., and Egbert, H. D. "The Cottrell Processes in the Sulphuric Acid Industry." *Chem. and Met. Eng.*, Vol. 19, 309.

1918. Egbert, H. D., "Cottrell Process and Its Application to Foundry Dust Problems." *Trans. Amer. Foundrymen's Assoc.*, Vol. 27, 266.

1918. Davidson, J. G., "Electrical Precipitation of Tar Fog." *Trans. Canadian Min. Inst.*, Vol. 21, 252.

1919. Lamb, A. B., "Portable Electrical Precipitator for Smokes and Bacteria." *Trans. Am. Electrochemical Soc.*, April, 1919.

1919. Gellert, N. H., "Electrical Cleaning of Blast Furnace Gas." *Blast Fce. and Steel Plant*, July, 1919.

1919. Smith, W. C. and Heimrod, A. A., "Application of the Cottrell Process to the Recovery of Fume From Silver Refinery Operations." *Chem. and Met. Eng.*, Vol. 21, 360.

1919. Gellert, N. H., "First American Potash From a Blast Furnace." Amer. Fertilizer, Sept. 13, 1919, p. 64.
Gellert, N. H., "Electrical Cleaning of Gases as Applied to Blast Furnaces." *Journal of the Philadelphia Engineers' Club*, December, 1919, p. 449.

1920. Landolt, P. E., and Pier, H. M., "Air Cleaning by the Cottrell Electrical Precipitation Process." *Bulletin Am. Soc. Htg. & Ventilating Engrs.*, January, 1920.

The Bureau of Mines and Private Investigations

Co-operative Studies of Great Technical Value to Mining Industries and To the Nation—Experiment Stations and Safety Demonstrations Keep Advance in Practice Before Engineer, Millman, and Miner—Conserving Public Interest in Patent Rights —Moving Pictures Effective Propaganda

By H. Foster Bain
Director U. S. Bureau of Mines
Written for *Engineering and Mining Journal*

No more puzzling problems come up for decision in the administration of the U. S. Bureau of Mines than those relating to the division of investigative work between public and private agencies. In the various hearings before Congress at the time the Bureau was established, and in reports of Congressional committees since, it has been made abundantly clear that the plan of operations laid down by law contemplated widespread co-operation with the states and with industry. It was recognized that the National Government has a part to play, but only a part, in the work of increasing safety and decreasing waste in mines and works. It is not too much to say that such success as has been achieved—and it is definite and tangible already—has flowed from the widespread and generous co-operation that has been effected.

The states rather than the National Government have the police power necessary to enforcement of regulations. A Federal bureau can only recommend, and even sound recommendations accomplish but little without the interest and support of the industry. Fortunately, all these agencies have so far worked together in close harmony. It may be worth while to consider briefly the question whether the Bureau, in the effort to meet the industry half way, has at any point overstepped the boundary and got into the field of private work. I understand there are those who think it has, and in discussing the question I am less anxious to make a case for the Bureau than to get the advice of fellow members of the profession. The policy so far followed is one which has grown out of experience. If it is wrong, or can be modified to advantage, let us find it out promptly.

The Bureau's Field Defined

In all of its work the Bureau is necessarily limited in its action by the organic law defining its scope and by the terms of the various appropriation acts. In the fundamental law there are two sections which bear especially on the relation of the Bureau to practicing engineers and to private work. These are as follows:

"In conducting inquiries and investigations authorized by this act neither the director nor any member of the Bureau of Mines shall have any personal or private interest in any mine or the products of any mine under investigation, or shall accept employment from any private party for services in the examination of any mine or private mineral property, or issue any report as to the valuation or the management of any mine or other private mineral property: Provided, That nothing herein shall be construed as preventing the temporary employment by the Bureau of Mines, at a compensation not to exceed $10 per day, in a consulting capacity or in the investigation of special subjects, of any engineer or other expert whose principal professional practice is outside of such employment by said Bureau.

"That for tests or investigations authorized by the Secretary of the Interior under the provisions of this act, other than those performed for the Government of the United States or state governments within the United States, a reasonable fee covering the necessary expenses shall be charged, according to a schedule prepared by the Director of the Bureau of Mines and approved by the Secretary of the Interior, who shall prescribe rules and regulations under which such tests and investigations may be made. All moneys received from such sources shall be paid into the Treasury to the credit of miscellaneous receipts."

These sections would seem to make clear the expectation that the Bureau would do work for the Government itself, the states, and for industry in general, but that as regards the latter certain safeguards were erected:

1. No member of the Bureau can have any personal or private interest in any mine or product examined.
2. No member of the Bureau may accept private employment in making examinations, nor may he issue any valuation or management report on a private property.
3. When tests or investigations are made other than for a state or the National Government, a reasonable fee covering costs is to be charged and the receipts are to be turned into the Treasury of the United States.

Fee Work Profitable to Government

The first two restrictions are aimed clearly at preventing members of the Bureau making a personal profit out of a public office. No one questions the propriety of them, nor, so far as I am aware, has there ever been any question as to their having been strictly enforced. The provision covering the making of tests and investigations, when authorized by the Secretary, for fees is a necessary and reasonable one. It is under this that the system of examination for permissibility of apparatus and explosives used in mines is conducted. Each year a number of thousands of dollars are turned into the Treasury from this work, so that so far as it assumes a routine character the Government is reimbursed. There is no temptation for the members of the Bureau to push this to extreme, as the practical effect is to reduce by just so much the money available for new investigations, and it is in research that the main interest of the Bureau and its staff lies. Indeed, there are practical objections to any great extension of the fee work.

Appropriations to the Bureau are made by Congress upon specific requests for funds for definite researches. In practice estimates must be made in August for the money that is to be spent in the year beginning the following July first. That is one of the handicaps of a big organization such as the Government is. Always the departments ask support for more work than Congress can possibly finance, and no appropriation is made in the regular course without clear and definite showing of its need. It would in most cases be a mistake to stop the work after the money had been obtained. The time for considering its necessity lies long before.

In practice the demand for such work as is done under the fee system comes up suddenly. A state, a city, or an industry finds itself facing an emergency and comes to the Bureau for help. If men be detailed for the new work they must be taken from other investigations, and studies long considered and previously approved by Congress be stopped. Before these could be resumed it would be necessary to get the money reappropriated by Congress, with all the resulting delay and uncertainty. No one familiar with the conduct of investigative work can have any doubt as to the effect on results.

In the effort to meet situations of this sort the Bureau has built up a system of co-operative studies under which it assumes cost of the supervision only, which would in any event be charged to general funds, and the co-operating agency pays directly the expense of the new work. This is simpler, and in the end the financial result is the same as though the Bureau stopped other work, detailed men, was reimbursed by the co-operating agency, turned the money into the Treasury and then waited for Congress to reappropriate it so that the interrupted regular investigations could be resumed. That is, the result is the same in every case except where a state is the co-operating agency. In such cases there would be no reimbursement, and the net effect would be to stop work for which after due consideration Congress had made a specific appropriation. It has seemed better logic to assume that when Congress allotted money to conduct an investigation the money should be used for that purpose, and if any other agency had work which it felt should be done that agency should pay for it unless content to await the time necessary for the Bureau to make the proper presentation to Congress and secure an appropriation. In many cases that would necessarily mean that the work would not be done.

Outside Funds Expended for Specific Technical Work

At present about one-fourth of the total expenditure controlled by the Bureau is from funds outside appropriations made to it by Congress. The amount of control exercised over these co-operative funds by the Bureau varies according to their source and purpose. The State of Oklahoma makes a direct appropriation toward the support of the Petroleum Experiment Station at Bartlesville, and the money is expended on order of the superintendent. In a few instances sums of money have been placed in bank subject to check of a Bureau official and for use in a specified way, such as when the Bartlesville Chamber of Commerce furnished the money with which to pay for building the station in that city. Usually each party to a co-operative agreement keeps control of its own funds, and the Bureau merely directs the work, hires the men, and, after auditing the bills, sends them to the co-operating agency for payment.

The larger number of the co-operative contracts are with the states, especially state schools, and relate to joint maintenance of experiment stations. Not all are in this class. In Wyoming at one time Bureau engineers examined the methods of production of petroleum, especially the care of the wells, of two large companies. They criticized these methods and insisted that certain changes would result in important savings of gas and petroleum. The companies thereupon asked the Bureau to do the necessary work and furnished $30,000 per year for several years with which to meet the expense. The bills were paid by the companies, but the men were organized and directed by the Bureau. A real saving of gas and oil was made and sands were protected from damage. The saving was national and the expense of supervision, met by the Bureau, was minor.

Improved Practice and Safety Are Bureau's Chief Purpose

The prime purpose of the Bureau is to improve practice, to the end that safety and efficiency be increased. Its main function is to undertake the fundamental researches which have wide applicability and which it would be unnecessary and uneconomical to have each state or producer carry out for himself. The information acquired is intended to be of general service, and the obligation to disseminate it is as clearly laid down in the law as to acquire it. The means of conducting research are primarily those of the laboratory, and the common method of dissemination of information is by use of print. It would, however, be indefensible to stick so closely to these means alone as to defeat the main purpose, which, after all, is to increase safety and decrease waste.

It has often happened that an excellent piece of research described in technical language and published in a Government report has produced no practical result. The Bureau has therefore adopted the policy of using demonstrations and of employing service men to spread the gospel. This has reached highest development in the safety work, where mine rescue and instruction cars are kept traveling through the mining districts. Literally thousands of men are yearly trained by the men on these cars, whereas no number of printed reports would ever accomplish this result. The car work is now being supplemented, especially through the co-operation of the National Safety Council, by a limited amount of special service work. Engineers are sent to observe safe and unsafe methods at the various mines, to discuss them with the responsible officials, and to pass on from one to another good ideas as they are found. It is believed that this is strictly in line with the purpose the Bureau was designed to serve.

Experiment Stations Clearing Houses for Improved Practice

Similarly, Congress has provided for a number of experiment stations in the heart of the mining regions with the expectation that they will become centers of research and by conducting investigations on problems at the point where they are of most interest will bring about more quickly the adoption of such new practices as may be developed and may stand the criticism of the technical men of the local community. It was desired and expected that informal relationships would be built up between the Bureau men and local engineers and metallurgists, to the purpose that any new and valuable idea would be promptly tested under service conditions and, if found good, adopted.

In development of a new process of operation there are three well-defined stages. The first is the laboratory study; next follows a semi-commercial small-scale test; and finally there is the reduction to engineering practice on a working scale. All are necessary if new ideas are to be set to work. The first step is clearly within the province of the Bureau whenever the problem is one of sufficient general interest to be of import to the nation as a whole. The second step is in debatable territory.

though usually outside the province of the Bureau, as the third is almost wholly. Nevertheless, the second two steps are equally necessary with the first if practical results are to flow from laboratory investigations.

DETAILS OF CO-OPERATIVE PLAN

The Bureau is attempting to meet this situation by co-operation. A company, or by preference a number of companies or a trade association, is interested if possible in the idea which it is desired to reduce to practice. The Bureau offers freely such information as it has and the services of its staff and equipment in assisting or supervising the further development. Usually a definite contract is entered into, and the co-operating agency agrees to allot a definite sum of money to the experiment. In all cases, and in the interest of the public, the Bureau reserves full right to publish details of the work, and heretofore such contracts have carried a clause to the effect that patents, if any, resulting from the joint work should be assigned to the Secretary of the Interior. Recent decisions have greatly disturbed the situation as regards patents flowing from Government work, and this particular plan probably cannot be exactly followed in the future, but in the past every effort has been made, and in the future will be made, to reserve in the interest of the public the maximum of rights, even though to these later and more expensive steps the monetary contribution of the Bureau is small. It may freely be admitted that this plan has drawbacks, but so far no better one has been found.

ASSURING RESULTS OF PRACTICAL VALUE

It is not thought advantageous that ideas developed in the Bureau laboratories should be put into books and left to accumulate dust. Nor has the Bureau been prepared to recommend, even if Congress could be brought to accept its recommendation, that the very considerable sums necessary for large-scale development of new ideas should be paid out of the National Treasury. That would be an easy way to waste, for everyone knows of the enthusiasm of the inventor, and Bureau investigators have as much human desire to see all their ideas tested in practice as have men in private life.

The plan now followed operates as a check on hasty or unwarranted expenditure on work beyond the relatively inexpensive laboratory-scale investigations, as no large-scale plant, and rarely even a semi-commercial plant, is built until some one actually in the business has enough faith in the idea to risk his own money on the test. This seems on the whole the best rough-and-ready method of making decision as to whether an idea is sound, and, if so, whether it can be fitted into current practice.

DESIRABILITY OF PROTECTING INVENTOR

Granted that it is desirable that ideas developed in the Bureau laboratories should be given a try-out in industry, it would seem hypercritical to insist that the men who developed them so far should have no part in their reduction to practice. If they do, they must either resign, in which case the Bureau loses what has been put into giving them experience, or they must be allowed to take part in the tests. The most feasible way of accomplishing this has seemed to be by arranging a carefully drawn contract for co-operation in the further development of the process or apparatus.

Another field in which there is extensive co-operation between the Bureau and those outside it, in this case mainly with individual companies, though occasionally with trade associations, is in the making of moving pictures. One of the functions of the Bureau is to disseminate sound ideas as to good technical practice, and a burden is also laid on it in regard to the economic development of the country. At first the Bureau employed a moving-picture photographer, and attempted to create a library of films showing best practice in mining as well as safe and unsafe methods. The technology of picture making soon got far beyond what it was reasonable for the Bureau to expend, and an educated public became at the same time intolerant of poorly made pictures. There was an era of faked pictures staged by people with little or no adequate knowledge of mining. These taught wrong practice. Incidentally, they were being used in places to promote the sale of fake stocks. It was felt that here was a responsibility that the Bureau should meet and that it should, if possible, get a reasonable number of fine pictures into circulation, if only to set up a standard.

FILMING THE MINING INDUSTRY

Having no funds for the work, the Bureau asked the co-operation of the industry, and this has been so generously given that within a year films costing more than $100,000 have been made available. The arrangement is as follows: The Bureau detailed one man for part time to supervise the work. He hunted up a competent film maker and educated him to the needs and character of the work. The film maker invented and built necessary apparatus for the special work and then named a price for film based on the expected (and resultant) scale of operations as a whole rather than on each job.

Mining, smelting, and manufacturing companies interested in the mineral industry were invited to have films made which would picture good work and be truly educational. They have responded most generously to this invitation. The Bureau advises with them as to subject matter, scope, and technical problems and reserves the right to edit the film so that it will be worthy a place in the series. The contract for manufacture is made direct between the film maker and the company concerned in each case. The Bureau does not receive, nor does it handle, one cent of the money involved. It does ask, and does receive, a limited number of copies of the film, which it lends freely for showing to non-paying audiences. The borrower pays the transportation charges both ways. This circulation is not exclusive, and the co-operating firm is free to arrange for circulating any additional sets in any way it sees fit. In practice the firm usually has a long film made for inter-company use, and from this a shorter public film is compiled under the Bureau's direction.

PICTURES CARRY AMERICAN METHODS ABROAD

In the circulation of films the only expense met by the Government is in conduct of the necessary correspondence and in the minor repair of damaged films. Through the Pan-American Union and other agencies the films circulate abroad as well as at home, and I am persuaded they do a valuable work in spreading correct ideas as to American industries. Incidentally, the Bureau has several times been under the necessity of refusing to accept and circulate otherwise desirable films because they were designed for advertising purposes. Any good film is an advertisement, it is true, but there is a difference between films in which the educational character is its main purpose and those in which this is merely brought in to carry advertising. The Bureau does not consider that circulating the latter is its function, and, admitting that differences of opinion are inevitable here as elsewhere, can merely plead that an honest attempt is made to live up to the ideals stated.

There are other points at which the work of the Bureau and private workers impinge, but enough has perhaps been said to illustrate the nature of the contacts. I would be glad to have suggestions as to any manner of arranging to cover the border field so as to make the Bureau most useful and to make the least possible incursion into any field properly occupied by private engineers, metallurgists, and chemists.

Cost of Tin Mining in Straits Settlements

The principal items of cost of tin delivered to the smelter at Penang or Singapore are labor, equipment and supplies, fuel, transportation charges, and government taxes, according to John A. Fowler, trade commissioner, in *Commerce Reports* of Aug. 20, 1921. Before the war the Chinese tin-mining coolie was satisfied to make approximately 55 Straits cents (1 Straits cent = $0.0057 at normal exchange) a day when working on a day basis. The increase of living costs (especially the cost of rice) and the high prices secured for tin were the chief factors contributing to the rise in wages of tin-mine coolies to 1.33 Straits dollars (1 Straits dollar = $0.568 normally) per day at the peak of the inflation in March, 1920. Rice prices have dropped considerably since that time, although they have not yet reached pre-war levels, and the price of tin has gone a little below the pre-war level. This general slump is reflected in the wage scale, the present day rate in the State of Selangor, where extraordinary transportation problems are not involved, is 80 Straits cents per day.

The high prices for tin led to the operation of properties that connot be profitably worked at the present prices, and most of these have now closed down. It is impossible to get accurate information on the movement of labor, but the ability of the country to absorb the large numbers of coolies released from the tin mines and rubber estates is one of the anomalies of the time and speaks well for the recuperating powers of the British Malayan possessions. From information at hand it appears that there has been a reduction in the number of coolies employed in tin mining of approximately 30 per cent in the State of Selangor, and this figure may be taken as representative of the situation in Perak also. For some time there has been an extraordinary movement of Chinese tin-mine coolies to China, but this has ceased. The present time is offering an excellent opportunity to the mine operators to force wages down to as near pre-war level as possible. The success in this endeavor will be gaged largely by living costs, and it may be said that when rice and transportation charges reach pre-war levels wages may do so.

Under cost of equipment, supplies and transportation is included capital charges, depreciation, replacements and machinery supplies, such as oils, packing, and other incidentals. It is claimed that the cost of machinery has increased during the war period by 150 per cent and more, and there is no present indication of a prospective decrease. Tip cars that sold in pre-war years at 70 Straits dollars each are now selling at 230 Straits dollars. The prices of spares, pipe, fittings, packing and lubricating oils, and all the sundries that make up a large part of the running expenses of a tin mining plant have not responded to the general economic depression in reduced prices that has been evident in other branches of mining.

Railroad freight rates were increased by 25 per cent for long hauls and on an increasing sliding scale for shorter hauls. Some of the miners claim that the increase for some short hauls amounts to 200 per cent. On April 15, a reduction of 10 per cent for hauls over 100 miles and 20 per cent for over 200 miles went into effect. Transportation by bullock carts, which enters into the cost of every article shipped to or from the mines, has increased in cost in proportion to other increases. Before the war a pair of Benali bullocks could be bought for 350 Straits dollars, but today they are bringing 800 Straits dollars a pair. It is claimed by some of the miners that this form of transportation has not responded to the general decline, but the price of wood and some other staple products of local production seems to indicate that bullock-cart transportation charges have declined to a considerable extent. The tax on tin is on a sliding scale, based on the Singapore market price for refined tin, concentrates from the Federated Malay States being fixed at a ratio of 72 per cent refined tin.

Irish Deposits of Gypsum

Five bores sunk at Knocknacran, about two miles from Carrickmacross, in County Monaghan, Ireland, early in 1921, proved the existence of a large deposit of gypsum, according to Consul F. T. F. Dumont in *Commerce Reports*. Bores put down at Lisaboe, County Meath, in prospecting for coal or other minerals disclosed a body of gypsum estimated by an expert of the Department of Geology at 1,000,000 tons. The Farney Development Co., Ltd., is said to have secured the mineral rights over this property and to be building a factory capable of producing twenty-five tons per day of plaster of paris. About 1,000 tons of high-grade gypsum has been quarried and is ready for manufacturing. Some large blocks of beautifully colored Irish alabaster have also been secured, and it is reported that the entire output of this product will be taken by the Irish Marble Co., of Kilkenny, for disposal among its customers.

Mining in Syria Unpromising

Notwithstanding reports at various times of rich mineral resources in Syria, operations conducted thus far have not justified such optimistic conclusions, according to Vice Consul Frederick O. Bird in *Commerce Reports*. None of the workings have, in fact, proved financially successful. Minerals have been discovered and worked to some extent, but reliable engineers report that the quantity of such minerals is so small and the quality so poor that the continuation of operations of the [illegible] would prove unprofitable. Certain [illegible], for instance, were worked prior to 1914, but ceased after a short period.

APPROACH TO STEAM-SHOVEL WORKINGS AT TOFO, COQUIMBO, CHILE

The Economic Situation of Iron-Ore Mining In Latin America

Development of the Iron-Ore Resources Dependent Upon Four Principal Factors—Chief Drawback of Latin-American Iron Ores Is Inaccessibility of Deposits—Summary of Distribution, Characteristics, Possible Reserves and Development of Principal Deposits

By D. E. A. Charlton*
Managing Editor, *Engineering and Mining Journal*

IN A CONSIDERATION of the commercial possibilities of any iron-ore deposit it is necessary to take cognizance of certain factors, all of which have a decided bearing on the successful or unsuccessful outcome of the enterprise. This, of course, is true of any ore deposit, but owing to an unusually large distribution of iron ores throughout the world and to the extensive utilization of iron and steel as compared with the other metals, operations are necessarily on a greater scale, and the total tonnage mined during, say, a year's time aggregates a figure not reached by any other metallic ore.

These governing factors are as follows: Iron content; the presence of beneficial or deleterious constituents; size of deposits and applicability to mining methods; and the proximity to transportation facilities or treatment plants.

Although it has been variously estimated that metallic iron forms approximately 5 per cent of the earth's crust, the distribution is such that large deposits of commercial value are few, and the available resources can be increased only by new discoveries, extensions of the fields already known, or the development of present treatment processes which will make the lower-grade ores available. With regard to the latter it may, at this time, be advisable to mention that considerable advance has been made, particularly in the United States, in the work of beneficiation of iron ores. Washing plants have received considerable attention, and the development of iron-ore concentration has added largely to the reserves of marketable ore which were hitherto confined to deposits containing a high percentage of iron.

In any prepared estimate of an iron-ore field the figures should properly include respective tonnages for the various grades, for such an estimate will serve as the best index as to what may be expected when the enterprise is placed on an operating basis. Thus we may have several million tons of iron ore averaging 60 per cent iron, a greater quantity averaging 50 per cent, and so on. In the aggregate the entire deposit may be calculated on a ton-per-cent basis and so used for comparative purposes. Necessarily the amount of reserves in an iron-ore field can be indefinitely increased by lowering the grade of the material to be included in the estimate.

THE EFFECT OF CERTAIN ELEMENTS ON IRON MAKING

In consideration of the beneficial or deleterious constituents of an iron ore it is necessary to regard the availability of material from the viewpoint of the furnaceman who is governed in his choice of ores by their effect on his ultimate product. Also, there enters into such a consideration the question of mixing ores

---

*Written especially for and published in the October, 1921, issue of *Ingenieria Internacional*.

of different composition, to obtain a suitable mixture which will react properly to the fluxes used. Thus it is that in furnace practice a low-iron, low-phosphorus ore may be mixed with a high-iron, high-phosphorus ore and a satisfactory pig iron may be obtained. Other constituents are also considered in mixing, but as the treatment of furnace practice does not properly come under the head of this discussion no attempt will be made to elaborate. However, a few words may be said with regard to the effect of certain constituents of iron ore.

In the basic process of steel making, phosphorus, within certain limits, is not detrimental, but this is not true in the acid process, where it is decidedly injurious. The presence of titanium carries with it the detrimental effect in the furnace of raising the temperature of fusion, which leads to greater fuel consumption and a heavier blast. Manganese, on the other hand, is beneficial, as it helps to get rid of the sulphur. A high silica content is an objection because of the limestone that has to be added to the charge to neutralize the acid constituent, thereby reducing the output per furnace and increasing the cost per ton of pig iron; but a carbonate ore is sought after, as it is either self-fluxing or can, if the lime is present in excess, be mixed with siliceous ores in a proportion required for a fusible charge. A self-fluxing ore containing 25 per cent of iron may be as valuable as, or even more valuable than, a refractory ore containing 35 or 40 per cent iron.

As with any ore deposit, regardless of its geological occurrence, the size exerts considerable bearing on its commercial value. Obviously, the richness is of little account if sufficient extent is not assured. When it is proved that a reasonable tonnage of ore having the proper content is present, the next step, and one which is necessarily supplemental to the size of the deposit, is that of determining whether or not a suitable method of ore extraction may be profitably used. In many cases the formation may be such that several methods are applicable; in which event the operator naturally chooses that best suited to his needs. This perhaps may include a combination of methods, and in any case is subject to careful study and planning.

FACTORS INFLUENCING PROMINENCE OF IRON DISTRICTS

In any mining operation the operator must bear in mind the disposal of his product, and, regardless of whether or not he himself may act as the selling agent, the delivery of the ore to the furnace or smelter is dependent on adequate transportation facilities. These must be provided, and at a cost sufficiently proportionate to the value of the ore to assure a reasonable margin of profit to those engaged in any part of the enterprise. Up to this point an iron-ore property may offer every promise—extensive reserves, desirable grades, and cheap mining methods—but if the distance to available furnaces cannot be covered at reasonable freight rates the property ceases, for the time being, to be an economic factor. On the other hand, the deposit may be so situated that coal, limestone, and other requirements in blast-furnace practice may be within easy reach, in which case there is opportunity for the upbuilding of a local steel industry. But it is characteristic of the steel centers that they are situated at the conjunction of waterways, markets, and coal fields. The pre-eminence of certain iron-ore districts is due to the size and comparative ease of mining of the deposits, to nearness to transportation facilities, to development of automatic machinery, and to low costs on account of large-scale operations.

It is not the intention of this discussion to attempt a complete treatise of the subject of iron-ore mining in Latin America, but merely to point out certain facts that have a bearing on the subsequent development of that industry in those countries. There is little need of emphasizing the important part that iron and steel have played in the upbuilding of civilization, and there is no doubt that they will continue to remain the most potent factor in the world's business. The tremendous impetus given to the demand for steel products during the Great War shows every indication of continuing, and this is manifested by an increasing need of those products for industrial uses. Such a demand must necessarily be met by increased production of the raw material (iron ore), and with the gradual exhaustion of the older producing districts will come the development of the new. Obviously, those districts which can first fulfill the necessary competitive conditions will be the earliest to realize their commercial value. But in the meantime even those that lack the requirements necessary to place them on a commercial producing basis will undoubtedly receive consideration.

In order to formulate a general idea of the distribution of the known iron-ore deposits of Latin America, their characteristics, possible reserves, and development, the following summaries are given:

CERRO DEL MERCADO IS LARGEST MEXICAN DEPOSIT

According to figures presented to the Minister of Industry and Commerce in Mexico in 1918, 242,978,000 tons of iron ore were among the available mineral reserves of that country. This figure includes important deposits in the states of Lower California, Coahuila, Durango, Guerrero, Michoacan, and Oaxaca. In a report of mining claims in Mexico, made in the same year, it was stated that 425 iron-ore claims were held, although this figure does not include claims held for minerals other than, and including, iron ore. The iron and steel industry already has reached a point of importance in Mexico, and there is a considerable activity in iron mining. The largest steel plant—that of the Compañia de Acero y Fierro de Monterrey, situated in Nuevo Leon and operated by Spanish capital—secures its iron ore from Coahuila. The largest and best known iron-ore property is the Cerro del Mercado, situated near Durango City, which was taken over in 1920 by a Boston syndicate. This deposit is stated to be 3,600 ft. in length and 1,100 ft. wide, and is estimated to contain 200,000,000 tons of magnetic iron ore, assaying 68 per cent iron. Small iron-mining operations are being conducted in Hidalgo, Puebla, Vera Cruz and Oaxaca, and active work has recently been started on the mines of Las Truchas, in the State of Michoacan. In Lower California the deposits near San Isidro are extensive and considerable ore has been uncovered, although little actual mining has been done.

According to recent reports, American financial interests representing an important independent steel company are preparing to ship to [illegible] large tonnages of high-grade iron ore from a deposit adjacent to the Pacific Coast, in the State of Colima. Wharves are being built at the deep-water port which is being developed for ocean vessels. It is stated that a railroad will be constructed from the mines. Preparations are being made by the Monterrey Iron & Steel Co., which has purchased a part of the great Iron Mountain at Durango, to make large shipments of the ore to its iron and steel plant in Monterrey.

Cuban Iron Ores Principally in Three Districts

According to J. E. Spurr,[1] there are two principal groups of iron-ore deposits in Cuba: the magnetite and hematite ore on the south coast, and the brown ore, or limonite, on the north coast. All are near the eastern end of the island. The ores of Firmeza and Daiquiri, on the south coast, are mixed magnetite and hematite, averaging about 58 per cent iron and 0.03 per cent phosphorus. They are associated with igneous rocks. A determination of tonnage is difficult because of the irregularity of the orebodies and estimates of reserves range from five million to nine million tons. The brown ore of the north shore is hydrated brown hematite, a laterization product of serpentine. The dried ore averages about 46 per cent iron, 0.01 per cent phosphorus, and 1.7 per cent chromium. The reserve tonnage, estimated as high as 3,000 million tons, is mainly contained in the three large deposits of Camaguey, Mayari, and Moa. The principal deposits of Cuba are owned and operated by the Bethlehem Steel Co. Important undeveloped deposits are owned by the Buena Vista Iron Co. (Midvale Steel & Ordnance Co.), the United States Steel Corporation, the Guantanamo Exploration Co., and the Eastern Steel Co.

Brazilian Ores Now Constitute Greatest Untouched Reserves

It is of interest that the first iron foundry in the Western Hemisphere was established in 1600 at Ipanema, in the State of São Paulo, Brazil, and the ore used was obtained from that district. Iron ore exists in practically every state in Brazil, and the deposits constitute the greatest and richest undeveloped reserves in the world. The most important are those of the State of Minas Geraes, which lie in an area roughly 175 kilometers square, the center of which is about 350 kilometers north of Rio de Janeiro. The principal iron-ore deposits of Minas Geraes are found in an iron-bearing quartzite called itabirite, which shows considerable folding, and occur as lenses interlayered with the quartzite. Some of these lenses consist of a high-grade, hard hematite, some are soft and powdery hematite, and others are soft hematite intermixed with sand and clay. Magnetite of high purity is also abundant. The outcrops consist mainly of the hard hematite, the softer ores usually not showing on surface. Blanket deposits, known as "canga," have resulted from the cementation of eroded material and iron oxide, and these cover most of the ore-bearing areas. These ores are principally hematite and limonite and average from 55 to 65 per cent in iron and are moderately high in phosphorus. It has been estimated that the reserves in the Minas Geraes district total 3,500,000,000 tons, most of which is of bessemer grade, having a low phosphorus content. Other important deposits exist in Parana, Bahia, São Paulo, Santa Catharina, Espirito Santo, Matto Grosso, Goyaz, and Rio Grande do Sul.

LOADING IRON ORE FOR SHIPMENT AT CERRO DEL MERCADO, NEAR DURANGO CITY, MEXICO

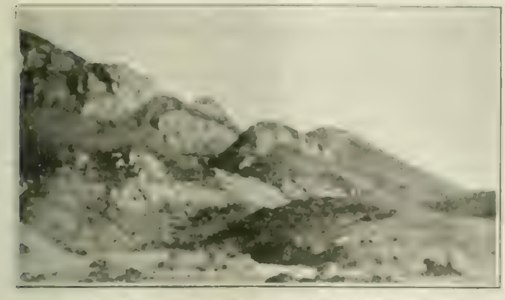
Several Companies Exploiting Brazil Deposits

Numerous companies have been formed for the purpose of exploiting the various deposits, and these include Brazilian, American, British, French, and German firms. Among those may be mentioned: the Itabira Iron Ore Co., the St. John del Rey Gold Mining Co., the Brazilian Iron & Steel Co., the Companhia Metallurgia Brazilera, the Minas Geraes Iron Syndicate, the Société Franco-Bressiliene, the Deutsch-Luxemburgisches Bergwerks und Hutton Aktiengesellschaft, and others.

Owing to the high cost of fuel and transportation the development has been slow in all of the districts, and only the higher grade ores have been mined to any extent. The Central Railroad of Brazil runs through the Minas Geraes district, but the heavy grades encountered have prevented extensive transportation of iron ores. Iron mining in Brazil has been favored by the passage of a decree in March, 1918, which provided government loans to further iron smelting and also agreed to arrange for minimum freight rates on machinery and supplies, as well as on the transportation of raw materials. Some progress is being made in electric smelting of iron ore in Brazil. A recent report states that two electric furnaces of a capacity of 3,000 kw. each are being installed, but the location of these is not stated.

---

[1] "Political and Commercial Geology."


IRON-ORE DEPOSITS AT MINAS GERAES, BRAZIL

TOFO IRON DEPOSITS ACCESSIBLE FOR LARGE-SCALE OPERATION

The iron-ore deposits of Chile occur in the coastal mountain region, the principal deposits extending a distance of about 250 kilometers parallel to the coast. Most of the orebodies are inclosed as lenses in granitic rocks, and a few are in sedimentary rocks near the contact of igneous rocks. The largest deposit, Algarrobo, is owned by a Dutch-German syndicate controlled by William H. Muller and Gutehoffnungshutte, but the best known and most advanced, from the viewpoint of operation, is Tofo, which is under lease to the Bethlehem Steel Co.

The Tofo iron mines are situated at Tofo, in the Province of Coquimbo, and within about nine kilometers of the port of Cruz Grande. The mines, which comprise about 100 hectares, were previously owned by a French company, which made an unsuccessful attempt at smelting the ores, and finally suspended operation in 1911. In 1913 the property was taken over by the Bethlehem Chile Iron Mines Co. It is stated that explorations have shown a reserve of about 200,000,000 tons of ore, the average analysis being about 68 per cent iron and 0.05 per cent phosphorus. Mining at Tofo is open-cut work, as the ore is exposed and practically no stripping is necessary. The ore, after being mined and crushed, is hauled to storage bins at Cruz Grande and there discharged through chutes to the ore boats. An electric power plant which uses oil-fired boilers is situated at Cruz Grande and furnishes the mine with 22,000 volts over a transmission line nine kilometers long. This plant also serves the electric railway, forty kilometers in length, used for hauling ore from the mines, and provides the necessary power for the operation of the crushing plant, and other complementary machinery.

According to investigations[1] conducted by the government in Peru, that country may be favorably viewed by the iron miner. Not only are some of the deposits comparably of a high order, but the proximity of coal and limestone in certain districts offers good opportunity for the upbuilding of a steel industry. There are also deposits of vanadium, tungsten, and molybdenum in good quantity. At Tambo Grande, in the Department of Piura, there is a conglomeritic deposit made up of quartzite pebbles in a hematite cement, the latter assaying about 51 per cent iron. Although there is lime and coal in that region, the iron deposit is small, and little work has been done. The deposits at Aija, in the Department of Ancachs, consist of veins of magnetite containing a small quantity of pyrite, which is easily separated. The lack of fuel in the immediate neighborhood and the absence of a railroad naturally hamper development in this district. North of Aija are the iron deposits of Callycancha, also in the Department of Ancachs. These deposits consist of three parallel veins, the outcrops of which can be followed for 600 meters. Assays of the iron oxide forming the filling material of the veins show from 51 to 70 per cent iron, high silica, and 0.25 per cent phosphoric acid. The veins appear to continue to the Callejon of Huaylas, the valley on the east of the Cordillera-Nebra, which is a short distance from coal and lime deposits and is also contiguous to the Santa River, which can supply considerable water power.

One of the most important iron deposits in Peru is at Huancavilica, in the Province of Huancayo. This deposit is situated within close proximity of the Mantaro River, and is also accessible from the Central Railway of Peru. The ore is principally red hematite with small amounts of pyrite. Lime of good quality is abundant, and the immediate coal fields of Jatunhuasi make the situation a particularly favorable one. Water power is also available from the Virgin and Mantaro rivers.

LOADING DOCKS FOR IRON ORE BOATS OF BETHLEHEM CHILE IRON MINES CO. AT CRUZ GRANDE, CHILE

The deposits at Marcona, in the Province of Ica, have been estimated at 500,000,000 tons. The ore is a good grade hematite, having a low phosphorus and low sulphur content. From reports it would appear that an excellent opportunity exists for open-pit mining, and, because of the short distance to the sea, the problem of transportation is not one of great difficulty. The exploitation of coal fields at Huayday will doubtless exert considerable influence on the active development of the Marcona iron field.

---

[1] From a report prepared by Dr. J. J. Bravo, Director of the [illegible] [illegible]. See Engineering and Mining Journal, [illegible] 1921, pp. [illegible]

Among the favorable features which will affect iron mining in Peru is the liberal attitude held by the government with regard to taxes, mining laws, and concessions.

DEPOSITS IN NORTH COASTAL REGION OF SOUTH AMERICA

Deposits in Colombia, Venezuela, and the Guianas offer certain possibilities, principally on account of their proximity to the coast. In Colombia the orebodies appear to be of considerable extent. These occur in the Department of Cundinamarca, in which Bogota is situated. Other deposits have been located, but these are inaccessible, because of inadequate means of transportation. Small deposits of brown ore, similar to the Cuban ores, are reported as existing in the Guianas. The principal iron-ore deposits in the north coastal region are those in the eastern part of Venezuela, in the delta region of the Oronoco River. This district has attracted considerable attention from outside capital for the last twenty-five years, but, owing to political disturbances and difficulties of transportation, the deposits have not received the development warranted. The ore is mainly hematite averaging about 65 per cent iron and occurring in lenses.

URUGUAY AND PARAGUAY

North of the City of Minas, in Uruguay, micaceous iron schists are known to exist, and other types of iron ores are also found in various sections of that country. Large pockets of good-grade hematite are found in the Department of Cerro Largo. In Paraguay little mining is done at present, but with the continued development and an increase in transportation facilities, the iron deposits, though not of great extent, may become available.

CENTRAL AMERICA'S DEPOSITS

Although iron deposits occur in all of the Central American states, their exploitation is handicapped by lack of fuel and the fact that most of the deposits are, relatively, of small size. However, in Honduras the so-called "Iron Mountain" of Agalteca, situated about forty-eight miles northwest of Tegucigalpa, is estimated to contain several million tons of high-grade magnetic ore. A company was organized to exploit this deposit some years ago, but little has been done recently. Several deposits of merchantable grade have been found in Guatemala and also in Costa Rica, but these are of small extent.

In Hayti there are several small deposits that offer some promise, but these, according to Eckel,[2] are relatively unknown commercially. Deposits in Jamaica and some of the other West Indian Islands are of little importance.

LACK OF TRANSPORTATION HANDICAPS PORTO RICAN DEPOSITS

In Porto Rico the iron deposits are scattering, and their development is mainly dependent on adequate transportation. The districts around Guayama and Humacao are particularly rich, and the best indications of iron ore extend from the eastern end of the island toward Juncos for nearly ten miles. In this district considerable prospecting has been done, and it has been proved that ores are present in sufficient quantity to make working profitable if adequate transportation can be provided. The ores are chiefly hematite and magnetite, assaying about 60 per cent in iron and low in phosphorus and sulphur. There are also deposits on the south side of the island not far from Ponce, but here also there is need for transportation to assure marketing of the ore.

SANTO DOMINGO ORES INACCESSIBLE

Investigations in Santo Domingo have disclosed numerous evidences of iron ore in various districts, particularly in the central part. Here the ore is a limonite of dark-brown color, occurring in blocks which outcrop on surface. In other parts of the country low-grade ores, similar to those found in Cuba, are quite common, but as most of those areas are now inaccessible they have not attracted attention, and cannot be regarded as being of immediate promise.

GENERAL SUMMARY AND CONCLUSIONS

From this brief review it will be seen that already considerable headway has been made in iron mining in Mexico, Cuba, Brazil, and Chile, and although, judged from a production basis, the iron districts of these countries have not yet attained the prominence of the older established fields, they will undoubtedly play an important part in the future iron-ore history of the world. The development of iron-ore mining in the other countries of Latin America is dependent upon the several factors which were mentioned in the early part of this discussion, and also on the ability of the operators to compete with those who are already in the producing field. It may be expected that the tendency in those countries will be more toward local steel industries than toward the development of an export trade.

The several methods for the removal and concentration of iron ores now in use in established fields offer a variety that should make the production problem of the iron-ore operator an easy one. Underground, open-pit, and a combination of both methods of mining have been developed to a high degree. Wet and dry concentration of iron ores are established practices in most of the districts. There are drawbacks such as taxes, labor difficulties, and adverse market conditions, but these are to be expected and are encountered in most mining enterprises.

Iron mining is not a "poor man's game," for primarily it is one involving the production of large tonnages, and these cannot be obtained without the use of extensive equipment. Several of the deposits existing in the various countries of Latin America already show available ore in sufficient quantity to justify the expense of immediate development. Others await exploration, and in some cases much time and money must be spent before further capital can be justifiably applied for development.

In conclusion it may be said that the possibilities for the further development of an iron-mining industry in the countries under discussion are most favorable so far as natural resources are concerned. However, much will depend on fair and reasonable legislation and on the manner in which all branches of the various operations are conducted.

---

[2] "Iron Ores: Their Occurrence, Valuation and Control."

BY THE WAY

Hamlet and Hayden

Shakespeare, hell, and mining claims were linked by Representative Hayden, of Arizona, in the House recently, when he pointed out the advisability of ending the assessment work year at noon instead of midnight. "Rights to mineral claims henceforth will be initiated," said he, "when the sun is at meridian height, instead of at that time of night 'when churchyards yawn and hell itself breathes forth contagion to the world.' " This is a new thought. Anyone glancing at the interminable list of seemingly interminable lawsuits over mining property would be justified in thinking that the mineral rights involved had had their beginnings in iniquity with Satan looking on. But an excellent chance is afforded of studying the geology of local strata when churchyards yawn, if the churches happen to be in mining communities.

Mr. Bellows Roars

The w.-k. bard of Avon would probably exclaim "Well roared, lion!" again upon reading the latest statement of the California Commissioner of Corporations in regard to George Graham Rice, if it were at all possible for him to exclaim anything. Bingham-Galena is, of course, the commissioner's theme, and after stating wherein George, or Jake, to be exact, has erred, he says: "In offering this stock for sale here without a permit from E. C. Bellows, Commissioner of Corporations, both Rice and Child, Barclay & Co. violated the Corporate Securities Act of this state, and if they desire to test the virtue of this act, they have only to place themselves within the jurisdiction of the California courts, where warrants await them." Even at the risk of hurting Mr. Bellows' feelings, we can't help saying that though the act be virtuous, it is slow in acting. In fact, the whole procedure in California reminds one of nothing so much as locking the stable after the horse is loose. "Any stock proposition polluted by the touch of George Graham Rice and his associates will be regarded with grave suspicion in California," continues the commissioner, to which we add, "even as every Rice proposition has long been regarded in other parts of the country." Mr. Bellows concludes: "It has been stated that nothing was ever created in vain, but California investors incline to the opinion that the hand of Providence slipped a cog when George Graham Rice put in an appearance." The hand must have slipped a cog indeed. Providence should look after its gears at once.

Oddities of the Northwest

A wonderful deposit of something or other 2 to 20 ft. thick has been located in Idaho by residents of Buhl. It covers 120 acres of what is thought to be an old sea bed. The mineral is said to work up like fine flour or talcum and has qualities which make it valuable for silver polish, window wash, tooth powder and soap. One expert is quoted as saying that it will make an egg food surpassing anything on the market today. From this we suspect that it is merely [illegible] of the edible variety. And, by the way, the E & R Placer Association at Grant's Pass, Ore., informs us that it has deposits of olympium, to say nothing of the platinum group of metals. We are still guessing about olympium, but suspect it is the stuff from which Mr. Heath, at Billings (or is it Helena?) reduces his element wilsonium.

An Explanation

What's the good of having kind intentions when some one with a chip on his shoulder is constantly mistaking them for bad? Some time back we inadvertently mentioned Cousin Jacks and mules in the same breath, not to be disparaging the former or praising the latter, but simply because we happened to be thinking about carrots, which naturally brought the two to mind at the same time. A mule would leave home for a carrot, and anyone who has ever tasted a Cornish pasty knows that one without a carrot is like a kiss without whiskers or an egg without salt, or like many another thing without something indispensable. That's all we meant; yet T. Bray, of Camborne, has written us very excitedly, wishing to know if it were our intention to cast insult at the entire fraternity of Cornishmen. No indeed, Mr. Bray. We have the highest admiration for the Cornish miner, individually and collectively. The backbone of the industry is Cornish, and without the Cousin Jack the mining world wouldn't be what it is today; that is, it would be a whole lot worse. As it is, the Cousin Jack has made it a decent place to be merry in. To prove this we close our explanation with another of D. E. A. C.'s reminiscences of Cap'n Dick:

THE PERSONAL PRONOUN

"Time an' again," said Cap'n Dick, "I do 'ear discussions baout 'ow words should be used an' w'ot a man should say w'en 'ee wants to be a-sayin' sumthin'. Tha 'ole bloody thing looks to me like as though tha mos' h'important part wuz tha h'ununerstanin' o' w'ot a chap is meanin'. Moor o' this 'ere clarity o' h'expression is w'ot we wants, m'son. I remember one time in tha Copper Country w'en tha Trevarthans moved h'out to tha Mo'awk location, an' took tha 'ouse nex' to tha Joneses. Mrs. Jones wuz one o' these 'ere fussy body's, an' she wuz very much 'eated w'en tha young Trevarthans started playin' right below 'er window. One day, h'out she come an' h'ordered them h'over h'in their h'own yard. Mary Jane Trevarthan speaks right h'up to tha res' an' sez, ' 'Ear 'er a-h'orderin' we. Us don't belong to she.' Now, dam-me m'son, there might be some 'oo couldn't make that h'out, but any chap 'oo h'unnerstan's tha h'English language couldn't fail to naw wo't wuz meant."

A Step in Metallurgy

Dean Francis A. Thomson, of the School of Mines at Moscow, Idaho, submits the following from a would-be research fellow:

"In the name of the [illegible] of what your University is offering in Re[illegible] Fellowships [illegible] that only applies to [illegible]. This is disappointing as if it was open, I would want to get in and show you that I have Patents for a [illegible]

"I own the Patent on a [illegible]. That will give you [illegible]. A perfect [illegible]. I [illegible] Placer mining.

"I [illegible], I [illegible], I [illegible]. I do all [illegible] dollars.

"[illegible] Tell me how you [illegible] and I will give you all the [illegible]."

CONSULTATION

Magnesium, Its Production, Uses, And Prospects

"Is magnesium widely used in industry? What companies produce it, and how? I would greatly appreciate any information you may give me regarding the development of the industry in the United States and what its prospects are."

Magnesium is one of the commonest metals of the globe. Magnesium reserves are practically inexhaustible, but the metal has a limited application, and only in the last six years, under stimulus of war, has any attempt been made to produce it in this country, to expand its uses, and to learn more about its general characteristics. Formerly Germany, as with many other commodities, furnished the bulk of the American supply of magnesium.

Production of the metal in the United States is confined to two companies. They are the American Magnesium Corporation, affiliated with the Aluminum Company of America, at Niagara Falls, N. Y., and the Dow Chemical Co., Midland, Mich. The American Magnesium Corporation is the largest producer, and markets its product in both stick and powdered form. Only a small part has been sold as alloys and castings. The Dow Chemical Co. has produced the stick form of magnesium, for experimental purposes, for various automobile and aircraft manufacturers. There was no appreciable production in the United States prior to 1915. Since then the output has been as follows, according to the U. S. Geological Survey:

METALLIC MAGNESIUM PRODUCED IN THE UNITED STATES, 1915–1920

Year	Number of Producers	Quantity, Pounds	Value	Average Price per Pound	
				Stick	Powder
1915	3	87,500	$440,000	$5.00	.....
1916	4	75,400	311,462	4.13	.....
1917	5	115,813	233,626	2.02	.....
1918	4	284,118	615,217	1.81	$2.67
1919	3	127,465	247,302	1.83	2.85
1920	2	(a)	(a)	1.60	2.75

(a) Permission to publish withheld; slightly less than 1919.

Magnesium is not found native, but is a common constituent of many minerals, the chief ones being brucite, magnesium hydroxide, containing 69 per cent MgO; magnesite, the carbonate, containing 47.6 per cent MgO; kieserite, the sulphate, containing 29 per cent MgO; and carnallite, the chloride, containing 16⅔ per cent MgO.

Two methods are used in the United States for producing magnesium. The Dow Chemical Co. uses the chloride, and the American Magnesium Corporation the oxide of magnesium. Hydrous magnesium chloride, which is obtained by the Dow Chemical Co. as a by-product from its salt and bromine industry, is mixed with common salt in the proportion of 4:1 and with a small quantity of ammonium chloride, and heated in shallow vats over a slow coal fire to remove about 50 per cent of its combined water. A second furnace is used completely to dehydrate the chloride, and the metal is produced by electrolysis of the fused magnesium chloride in a bath of common salt and ammonium chloride. Graphitized carbon electrodes are used as anodes, and cylindrical sheet-iron cells containing the bath serve as cathodes. Formerly carnallite was imported for the purpose of producing magnesium.

The metallurgy of magnesium as well as its properties closely resembles that of aluminum, and cheap electric power is necessary for its economical production. The American Magnesium Corporation has worked out a process using magnesite, or the oxide, which it obtains from the Pacific Coast in a calcined form. The metal is produced electrolytically in a bath of fused fluorides, the oxide going into solution and being decomposed by the electric current. Power consumption is high, and the main advantage is in the low cost of raw materials. The metal may be refined by remelting the magnesium ingots produced, in small retorts.

The U. S. Tariff Commission estimates that existing plant equipment represents a capital investment of over $2,000,000 and that large sums have been spent for experimental purposes and discarded equipment. The General Electric Co. and the Electric Reduction Co. of Washington, Pa., were prepared to produce magnesium when the Armistice was signed.

Magnesium is used mostly as a scavenger (due to its great affinity for oxygen) in the manufacture and use of the non-ferrous metals and alloys, particularly nickel and brass, but it finds notable employment in alloys designed for lightness and strength. Magnesium is only two-thirds as heavy as aluminum, and resembles it closely in appearance.

Alloys of magnesium are in demand in aircraft construction. The skeleton of the first dirigible to cross the ocean, the British R-34, and gaffs of the yacht "Resolute," which carried off the honors in last year's cup races, were made of a magnesium-aluminum alloy. In the form of powder, magnesium is used for flashlight photography, pyrotechnics, star shells, and projectiles.

As an alloy with aluminum, magnesium is said to make it stronger, giving it a fine grain. Alloys of aluminum and magnesium containing 5 to 30 per cent of Mg have approximately the same mechanical properties as brass. Hardness increases with magnesium content, and with 70 per cent magnesium the alloy is as hard as mild steel. It is reported that a very promising application of magnesium aluminum alloys is for hydraulic valve fittings usually made of brass and bronze. Besides being as serviceable as the brass, it is cheaper. Aluminum and its light alloys are described in *Chem. and Met. Eng.*, Vol. 19, No. 8, Oct. 15, 1918.

Producers maintain that magnesium is in the position that aluminum occupied a few years ago, and that as the demand for the metal continues to grow and its application becomes better understood the price will be cheapened. Competition from Germany in the future is expected to be particularly keen, as that country will no doubt make a strong bid to recover the trade which it controlled before the war. Germany is in an excellent competitive position.

HANDY KNOWLEDGE

A Review of Drilling—Part IV*

BY GEORGE J. YOUNG

Western Editor Engineering and Mining Journal

DRILL STEEL CHANGES

Sets of drill steel are arranged in length increments of 1 to 2 ft. and longer where a feed-screw length of 2½ ft. is used.

Tests should be made to determine the maximum and average distances drilled by standard bits in the different kinds of rocks in a mine. This data will enable standard drill steel sets to be made for holes of various depths. For hard, tough rocks the change increment is usually 1 ft. and for intermediate rocks, 2 ft. The fewer the steel changes, the greater the time saved in drilling a hole of given depth. In Fig. 1, *Engineering and Mining Journal*, Sept. 10, p. 420, the bit diameter for 6-, 8-, 10- and 12-ft. holes is shown for six and twelve changes of steel per hole. It is evident that for the shorter increment the number of drill steels per hole is doubled, this calling for a greater time in changing steel, more time in getting steel to and from the working and a greater amount of blacksmithing.

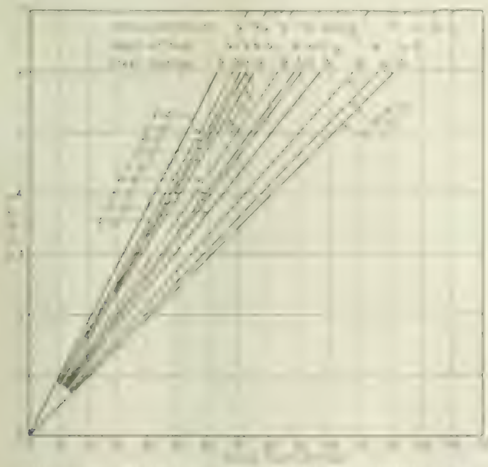


FIG. 1. FOOTAGE DRILLED BY DRIFTER WITH 2-FT. STEEL CHANGE. HOLES OF 6, 8, 10 AND 12 FT. DEPTH AND DRILLING RATES OF 4, 8 AND 12 IN. PER MINUTE

DIAMETER AND DEPTH OF DRILL HOLE

The starting diameter of the drill hole is determined by the reduction of drill diameter for successive drills, the drill-steel change length, the depth of the drill hole and the diameter of the powder used. The most commonly used powder sizes are 1¼ and 1½ in. in diameter. Occasionally 1 in. is used. In any one mine the cartridge size is usually constant. The bottom diameter of the drill hole is thus from 1½ to 1¾ in. in diameter. Drill bit sizes vary by ⅛ or 1/16 in. With hammer drills and well-designed bits a 1/16-in. decrease in size per drill is usually all that is necessary, providing the blacksmithing is all that it should be. With twelve drill steels, a 12-ft. hole would require a starting diameter of 2 in. for a 1/16-in. change in bit diameters. The smaller the starting diameter, the greater the drilling rate and the lower the cost per drill hole. There is economic waste in rock drilling due to using starting diameters unnecessarily large. Experimental work in standardizing drill diameters to suit the conditions of a given mine is essential, if drilling costs are to be reduced to a minimum.

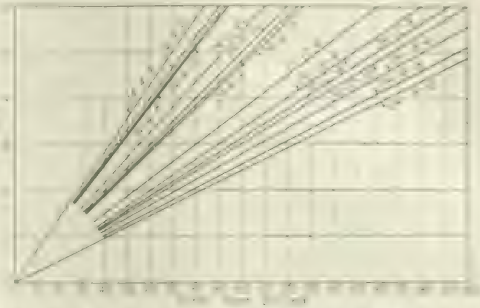


FIG. 2. FOOTAGE DRILLED BY STOPER WITH 1-FT. STEEL CHANGE. HOLES OF 4, 6, 8 AND 10 FT. DEPTH AND DRILLING RATES OF 4, 8, 12 AND 18 IN. PER MINUTE

The depth of the drill hole is determined by blasting conditions. In drifting, 6 to 7 ft., in raising, 6 ft., and in shaft sinking and stoping, 8 to 10 ft. represent prevailing practice underground.

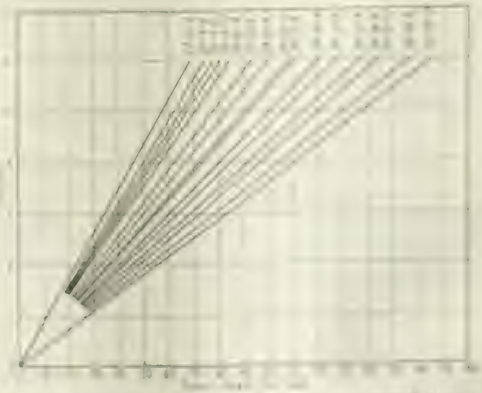


FIG. 3. FOOTAGE DRILLED BY [illegible] WITH 2-FT. STEEL CHANGE. HOLES OF 6, 8, 10 AND 12 FT. DEPTH AND DRILLING RATES OF 4, 8, 12 AND 18 IN. PER MINUTE

Actual drilling time in an eight-hour shift ranges from three to four hours. Setting up a drill upon a column requires from thirty to forty minutes, taking down, somewhat less; loading holes, one hour, and barring down at the beginning of a shift, from thirty minutes to one hour. One man is required for operation of the drifter, stoper, or plugger. In some instances he is given assistance in setting up the column in drifting work and in stoping where the drifter is used. Where light drill mountings are used, assistance is usually unnecessary. Drill steel is distributed by tool carriers or "nippers." Efficient tool and powder distribution increases effective drilling time and co-operation on the part of the mucker facilitates setting up the drill. Fig. 2 indicates aggregate footage drilled by drifter, stoper, and plugger for holes of various depths and different drilling rates. These charts must not be interpreted too literally, as they have been computed with the object in view of permitting a visualization under certain assumed conditions of the quantitative side of drilling. Actual charts for operating conditions in a given mine would no doubt depart greatly from those given. For a given drilling time with all types of drills, the deeper the drill hole, the greater the aggregate footage. This is due to fewer changes of the position of the drill. Necessarily, faster drilling rates give greater aggregate footages. Stopers and pluggers give greater footages than drifters, as less time is required for shifting and steel changing. With the drifter, eleven to fifteen holes, 4½ to 5 ft. in depth, or from 55 to 75 ft. of drilling; for the stoper, twelve to fifteen 6-ft. holes, or a total footage of 72 to 90 ft.; for the plugger, 60 ft. per man-shift are fair performances in medium hard rock.

---

*Continued from Sept. 10 issue.

B. F. Tillson gives the drilling rates in feet per shift for the Franklin and Sterling Hill mines of the New Jersey Zinc Co. His tables have been condensed to the following:

	Ft. per Drill Shift	Cu. Ft. per Ft. Drilled	Cu. Ft. per Lb. Drill Steel
Franklin Mine:			
Drifts (1¼-in. hollow round)	121.2	1.51	23.9
Raises (⅞ Q. O. solid)	118.1	0.93	.
Stopes (⅞ Q. O. hollow)	117.9	7.16	.
Top slices (⅞ Q. O. s. and h.)	96.2	2.86	.
Average	106.6	4.44	60
Quarrying (1¼ hollow round)	101.1	11.18	71.9
Average—all	106.4	4.67	49.7
Sterling Hill Mine:			
Drifts (1¼-in. hollow round)	151	1.71	
Stripping	122.9	3.96	
Total average	145	2.1	47.10
(⅞ in. Q. O.)			
Stopes	78.1	9.85	
Stripping	86.7	3.5	....
Raising	129.1	0.91	..
Total average	96.5	5.24	34.25

The results as compared with those obtained in Western mines are high, and consideration should be given to the fact that the rock broken is crystalline limestone, a rock which is softer than most rocks encountered in Western mines. The stopes are also wide.

ROUNDS

The objective of drilling is the breaking of rock by explosives. Mere drilling footage is secondary as compared with the proper placing of drill holes. It costs just as much to drill a poorly placed as an effectively placed hole. The close observation of the physical features of the rock and the determination of the number, distribution and depth of holes constituting a round are essential factors in attaining low drilling costs.

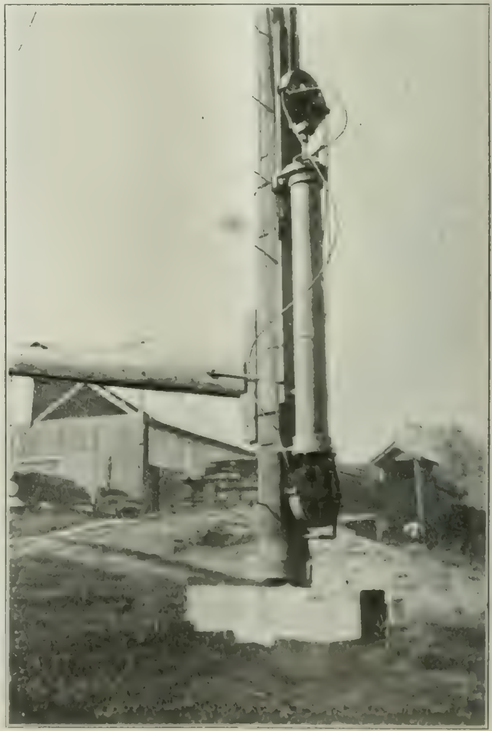
Standard rounds and the so-called blueprint round are all efforts in the right direction. Foremen, shift bosses, and engineers can effectively co-operate in systematizing drifting, raising, shaft sinking, and stoping in a given mine. Every foot of drill hole should contribute its proper share in ground breaking. The ratio of cubic feet of ground broken per foot of drill hole is indicated for the New Jersey zinc mines in the preceding table. Greater footage per unit broken is required in restricted workings such as raises, drifts, and winzes and shafts. At the North Star mine, in California, Bedford and Hague give a ratio of 3.6 ft. per ton (1 ft. drill hole to 3.6 cu.ft. broken) for narrow stopes in hard granodiorite and quartz, or twice the amount of drilling footage for the same volume broken.

To be continued

Air Cylinder Operation of Boom Derrick

Written for *Engineering and Mining Journal*

At the Old Eureka mine, near Sutter Creek, Cal., a boom derrick is used in the timber yard for handling 16-ft. mine timbers. The timbers are lifted from the truck by the derrick and stacked in a pile, which is formed concentrically with the mast of the derrick. The timbers are removed in the same way as needed. To operate the hoisting cable quickly, an air cylinder is attached to the mast of the derrick, as shown in the illustration. On the bottom head of the air cylinder, two sheave pulleys are carried by bearings and an axle. On the end of the piston rod a pair of sheaves and bearings are also mounted, together with a crosshead, which operates in a pair of guides. The cylinder is approximately 10 in. in diameter and of 6-ft. stroke. This gives a cable lift of 24 ft. In place of an air cylinder, a Tugger hoist would be an excellent substitute.



BOOM DERRICK OPERATED BY AIR

THE PETROLEUM INDUSTRY

Decrease in Petroleum Production and Prevention of Lower Prices Considered Encouraging

WASHINGTON CORRESPONDENCE

The Federal Reserve Board has recently issued an analysis of the business situation and has the following to say in regard to petroleum:

"Although production of crude petroleum during the month of July continued in excess of consumption, a slight but gradual decline was noticeable. This decrease in production, together with the halt in the tendency toward lower prices in the petroleum industry, is considered encouraging by the producers. The fall in prices during July averaged 12 per cent for crude petroleum and 5 per cent for leading refined petroleum products. Since the peak was reached last October, the average price of crude petroleum in the United States has receded 64 per cent.

"A favorable feature in the oil situation has been the good demand for gasoline, which has been running about 10 per cent in excess of the requirements during the corresponding period last year. However, it must be remembered that this is the season for the greatest consumption of gasoline. Production figures compiled by the U. S. Geological Survey show that production of crude petroleum in the United States for the month of July was 111 per cent of that for July a year ago, or 40,228,000 bbl., as compared to 36,203,000 bbl. The number of oil wells completed in July, however, showed a drop of 748 wells, as compared with July, 1920.

"District No. 12 (California) reports that 76 new wells, with an initial daily production of 19,675 bbl., were completed during the month of July, but five wells were abandoned. California reports an average daily output of 331,252 bbl. of crude petroleum for July, as compared with 337,625 bbl. in June and 279,169 bbl. in July, 1920. District No. 10 (Kansas City) states that production of crude oil in the Kansas-Oklahoma and Wyoming region showed a daily average production of 419,250 bbl. in July, in comparison to 394,000 bbl. daily production in July a year ago, and production in Wyoming alone has been reduced to less than 50,000 bbl. per day. The number of new wells completed in the district was only about 56 per cent of those that were completed during July, 1920.

"The Midcontinent field exceeded all previous records, with a total production of 25,594,982 bbl., although a decrease in monthly yield and daily average was registered by all Texas fields with exception of the North Texas group. In this district only 251 new wells were completed during the month, in comparison with [illegible] wells in July, 1920. With the price of oil at the present low point, the cost of drilling deep wells, particularly those of low productivity, is almost prohibitive. In nearly all the oil fields the outstanding feature is the continued increase in stored stocks of petroleum."

Russian Petroleum Production

SPECIAL CORRESPONDENCE

Recent reports of Russian petroleum production leave much to be desired. The output in 1921 in the three principal districts of Baku, Grosnyi, and Emba was stated to be as follows:

PETROLEUM PRODUCTION IN THE [illegible]
[illegible]

1921	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]

[illegible] 95 per [illegible]

The total annual production of the Baku district will probably amount to from 150 to 160 million poods.

PETROLEUM PRODUCTION IN THE [illegible]
(In [illegible])

1921	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]

[illegible] 4 per [illegible]

The total annual production of the Grosnyi district will scarcely reach about 40 billion poods.

PETROLEUM PRODUCTION IN THE [illegible]
(In Million Poods)

1921	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
March	[illegible]	[illegible]

These figures, which are given by the Soviet government, show how the production has decreased in Russia. Almost complete lack of means of transportation is adding to the difficulties.

Oil Operations in Western Canada

SPECIAL CORRESPONDENCE

Captain E. J. Edwards, Senior British Trade Commissioner at Montreal, has received from the Winnipeg branch a detailed report on oil operations in western Canada, dealing mainly with the work of the Imperial Oil Co. The fields in which this company is interested are given as follows: In Saskatchewan at [illegible]; in Alberta at [illegible], [illegible], Coal Spur, Irma, Monitor, Nanton, Okotoks and Pincher Creek; on the Great Slave Lake at Windy Point and Pine Point; in the Mackenzie Basin at Fort Norman. A total of about 300,000 acres is reported to have been staked at Fort Norman, 100,000 by the Imperial and 200,000 by other companies and individuals.

In the Peace River fields several wells are being drilled, most of which have struck small quantities of oil. Only three are working at present: the San Joaquin, the Victory and the Peace River Petroleum Co. wells; but the Imperial Oil is believed to be negotiating to take over [illegible] fifteen or twenty miles north of Peace River Crossing. Drilling operations on the British Columbia government were started this summer near Hudson's Hope, close to the Alberta border.

Book Reviews

Mine Accounting and Cost Principles. By T. O. McGrath. Cloth; pp. 260; illustrated; 6 x 9. McGraw-Hill Book Co., Inc., 1921. Price, $4.

Mr. McGrath has already contributed considerable information on the subject of mine accounting through the technical press, and this latest accomplishment will be regarded as a valuable addition to the literature on the subject. By reason of his familiarity with the subject and a careful study of the operative and administrative functions of mine management, Mr. McGrath has had an excellent opportunity to realize the importance of proper accounting procedure, and the arrangement of the book shows careful planning and a logical order that can be easily followed. The edition presents the principles of accounting and costs of mining operations, with sufficient forms, charts, records, and procedure to illustrate how the principles are applied in actual practice. Mr. McGrath has stated in his preface that "the only explanation of the present status of mine accounting is that the great diversity in methods of mining, treatment, and disposal of mine products, as well as the character of the mines themselves, limits the treatment of the subject to a description of individual systems and accounts, unless the fundamental principles underlying all mining operations are recognized." It is in the excellent portrayal of the "fundamental principles" that the strength of Mr. McGrath's book is found. D. E. A. C.

Technical Papers

Transvaal Tin Deposits—The Geological Survey of the Union of South Africa has issued Memoir No. 16, 192 pages, entitled "The Mutue Fides-Stavoren Tin Fields." (Obtainable from the Geological Survey, Pretoria, South Africa; price, 7s. 6d.) This tin field has never lived up to the extravagant promises made some years ago. The reasons have been small, erratic and in some cases complex deposits; the inaccessibility of the region; lack of water; low prices for tin and tungsten and high cost of supplies; and the fact that the district is unhealthful.

Mining in Quebec—The annual report on mining operations in the Province of Quebec for the year 1920 is now obtainable from the Bureau of Mines, Quebec, P. Q. The book contains 140 pages and includes the names of the operators and owners of the principal mines and quarries of the province. Asbestos continues to be the principal product, $15,000,000 worth having been produced last year.

Shaft Lining—R. H. Gillespie has written a comprehensive article, "Lining a Shaft With Concrete and Gunite Without Interfering With Operation," which appears in the Aug. 25 issue of *Coal Age*. (New York, N. Y.; price, 20c.) The article details the methods that were used recently in the construction of a permanent self-supporting lining in the hoisting shaft of No. 1 mine of the Lake Superior Coal Co., at Superior, W. Va. The concrete was machine-mixed on surface and lowered on the cage in wheelbarrows. During part of the "guniting" operation the "Cement Gun" was located on the surface, and during the rest of the work operated in the upper coal bed. Although the work was done in a coal mine, several of the problems and the manner in which they were solved are identical with conditions met in shaft lining at metal mines.

Fluorspar—The Imperial Mineral Resources Bureau has published an eighteen-page pamphlet giving statistics and general data regarding the world's production of fluorspar. It may be obtained from H. M. Stationery Office, Imperial House, Kingsway, London, W. C. 2, for 9d.

Mineral Resources—Recent publications of the U. S. Geological Survey in the "Mineral Resources" series include: "Asphalt and Related Bitumens in 1920," nine pages; "Sand-Lime Brick in 1920," two pages; "Fuller's Earth in 1920," two pages; "Silica in 1919," two pages; "Bauxite and Aluminum in 1920," eight pages; "Gypsum in 1920," ten pages, and "Magnesium in 1920," four pages. Copies may be obtained on application to the U. S. Geological Survey, Washington, D. C.

Manganese Ore Deposits—"Deposits of Manganese Ore in Montana, Utah, Oregon, and Washington" is the title of Bulletin 725-C, 102 pages, just issued by the U. S. Geological Survey, Washington, D. C., and obtainable on request. The bulleting covers the history, production, reserves, and general features of the various deposits in the states named.

Oklahoma Oil—The U. S. Geological Survey has published an eighty-five page bulletin, No. 726-B, entitled "Geology of the Cement Oil Field," obtainable on request. The area discussed in this report is in Caddo County, in the southwestern part of Oklahoma. The production of oil at Cement proves not only that the structure in that region is of the type favorable for oil accumulation, but that there are adequate reservoir beds and a source of petroleum. One of the reasons for this report was the fact that it appeared desirable that geologic reports should be made available covering certain areas because much of the land in Caddo and Kiowa counties is owned by the Kiowa, Wichita, Caddo, and Apache Indians, and it is important that the office of Indian Affairs form some conception of the true value of oil rights.

Differential Flotation—Pamphlet No. 4 of the Bureau of Mines and Geology, Moscow, Idaho, twenty-three pages, obtainable on request, discusses the principles upon which the differential flotation of minerals is based, and outlines the methods to be pursued in experimenting on differential flotation in small test machines.

Chrome Ores—Bulletin 725-B of the U. S. Geological Survey, Washington, D. C., obtainable on request, is a fifty-four page bulletin entitled "Chrome Ores in Pennsylvania, Maryland, and North Carolina." Geological features are discussed, with brief histories of the various deposits which have been worked.

Metallurgy of Zinc—M. André Surny has republished a twenty-page article which recently appeared in *Revue de Métallurgie* entitled "L'introduction et le développement de l'emploi des gazogènes dans l'industrie du zinc aux Etats-Unis d'Amérique." Many illustrations of various types of gas producers are given. The author may be addressed in care of *Revue de Métallurgie*, 5 Cité Pigalle, Paris IX, France.

Talc—Talc is the subject of a recent publication of the Imperial Mineral Resources Bureau, twenty-four pages, obtainable at 9d. from H. M. Stationery Office, Imperial House, Kingsway, London, W. C. 2. The bulletin gives statistics to and including 1919, brief descriptions of the industry in various parts of the world, and a bibliography of important literature on the subject.

South African Coal—The second coal number of the *South African Mining and Engineering Journal* has been published under date of July 31, 1921. (Johannesburg, or 82-85 Fleet St., London, E. C. 4; price, 5s.) The history, present status, and future outlook of the coal industry in South Africa are reviewed, this issue supplementing the first special coal number published a year and a half ago.

Australian Data—The official year book of the Commonwealth of Australia, No. 13, containing statistics and general information for the period 1901-1919 inc., is now available. It is a book of 1,182 pages, with board covers, and may be obtained from the Commonwealth Bureau of Census and Statistics, Melbourne.

Flotation of Pyrite—"Flotation of Pyrite" is the title of a 17-page paper by W. S. Morley, recently published by the American Institute of Mining and Metallurgical Engineers. (29 W. 39th St., New York.) A record is given of tests made at the University of California to determine the action of oils and other reagents on the flotation of pyrites. Those reagents which showed the highest grade of concentrate and recovery were Pentarco Nos. 350 and 400, kerosene acid sludge (Standard Oil No. 1), and a mixture of 3 parts coal tar creosote (G. N. S. No. 22), 3 parts wood creosote oil (Pentarco No. 400), and 1 part of coal tar (G. N. S. No. 28). Sodium silicate exhibited attractive possibilities for differential flotation.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Courses for Vocational Training of Miners Outlined by M. & M. Society

Mitke Committee Reports — Miners, Shift Bosses and Foremen Considered

The Committee on Vocational or Occupational Training for Metal Miners appointed by the Mining and Metallurgical Society of America in the spring of 1919 has published a report under the date of Aug. 31, 1919, which appears as "Bulletin 149" of the society. The committee consisted of Charles A. Mitke (chairman), Stanly A. Easton, and B. F. Tillson. Their efforts were directed principally toward preparing a series of courses dealing with subjects necessary for the education of employees, in order to "fit the practical man for the job." These courses range from elementary types, for foreign-born employees, to practical and technical classes, for shift bosses and foremen.

The first elementary miner's course recommended deals with daily operations in a brief and concise manner. Sample lessons are given covering "Riding on Cages," "Going to the Working Place," and "Mucking Out a Drift," but these are only suggestions. The character of instruction must depend on local conditions, and the material for the lessons and instruction should be obtained from different foremen, in conjunction with the various mine superintendents and the instructor, and should represent the standard practice in connection with the various mining operations at the particular mine in question, correlated with the best mining practice in other camps.

The committee also outlines the topics to be considered in a series of thirty-six lessons in the Miner's Course. These include: Safety; Hygiene; Americanization; Mine Equipment; General Description of a Mine; Rock Drills; Drill Steel; Drilling Operations; Standard Rounds; Explosives; Mine Tracks; Shoveling and Tramming; Timbering; Sinking; Stoping; Waste Filling; Contract or Bonus System; Haulage; Ventilation; Mine Fires; Company Policies; and Citizenship. The mine management may prepare the detailed lessons, suitable for local use, from the outline given.

The second course recommended is to be taken by miners who are ambitious to fit themselves to be shift bosses, and who have already taken the first course. This also embraces thirty-six lessons and covers more advanced topics, as follows: Duties of a Shift Boss; Safety; Citizenship; Mine Equipment; Maps; Drilling Machines; Standard Rounds and Their Determination, Costs and Methods of Drifting, Sinking, Raising, Timbering, and Repair Work; Explosives; Transportation; Drainage; Stoping Methods; Waste Filling; Sampling; Compressed Air; Elementary Geology, Milling and Smelting; Ventilation and Mine Fires.

The third course is for those preparing themselves to become mine foremen. The topics already mentioned, together with some others, are given in more advanced form.

Much information of a general character is also included in the report, covering reasons why work of this nature should be done, benefits to be derived, incentives, character of instruction, and the organization of classes and selection of an instructor.

The committee invites suggestions as to improving the courses outlined.

Chairman Rhodes Defines Federal Aid in Mining Industries

The following is an abstract of a paper read by Representative Marion E. Rhodes, chairman of the House Committee on Mines and Minerals, at the International First Aid and Mine Rescue Meeting, held at St. Louis, Mo., on Sept. 3:

"In 1920, mine products, raw and manufactured, provided 60 per cent of all tonnage carried in carload lots by Class 1 railroads. The raw mine products alone contributed 58.3 per cent of all railroad car-lot tonnage. Manufactured mine products were alone greater in tonnage than all other manufactures. Excluding all shipments of bituminous coal, the mining industry still provided in its raw materials twice as much tonnage as agriculture; two and one-half times as much as non-mining miscellaneous commodities; three times as much as forestry, and approximately twelve times as much as animal industry.

"The mineral resources of the nation are limited. The supply is an ever-decreasing one. Mineral products cannot be grown, like agricultural products, year after year from the same ground. With each year's production of minerals, the point of ultimate exhaustion approaches closer by the amount of that year's consumption. It is the duty of the Federal Government to safeguard the welfare of the nation by requiring that this raw supply must serve for both the present and future needs, the future needs to be far greater than those of the present day.

"It has been the policy of the Federal Government to develop processes for the utilization of low-grade fuels and ores, that they might be made available for use and also that the small operator, unable himself to finance necessary experiments, might share equally with the larger operator in the development of these properties.

"Research by the technical experts of the Federal Government and a proper dissemination of the results achieved does away with the duplication of effort and the attendant increased expense which would ultimately be paid by the consumer if such investigations were carried on simultaneously by the interested states or by individual concerns capable of financing such work.

"But there comes to the Federal Government an appeal which is stronger than those requests which relate to [illegible] of waste elimination. It is the [illegible] of the millions of men working in the various branches of the mining industry. It is the humanitarian appeal for the development of safer and more healthful working conditions in the mines. It comes from the miners themselves, the men who are working under hazardous conditions, and it is a call which the Federal Government has listened to and will continues to listen to.

"The Bureau of Mines, established in 1910, was charged with the specific duty of improving health conditions and increasing safety in mines. Its authority, however, is merely advisory, for in the authority of the states lies the power for the enforcement of mine inspection laws. The Bureau of Mines, and a consulting committee thereto, has prepared what is considered a model mining law.

"The Federal Government advises and the state government enforces regulations, and but little progress could have been made in the past, and little will be accomplished in the future, unless the Federal and state agencies are supported by a spirit of co-operation on the part of the miners and mine owners. Careless workers who regard neither their own safety nor that of their fellow workers are often responsible for accidents of a kind which could easily be avoided by a proper regard for safety suggestions developed through the united efforts of the Federal and state governments and thoughtful mine owners."

Iron and Steel Institute Meets

Great Britain Declared Not Dependent Upon Foreign Ore—Destruction of French Plants by Germans Systematic

[illegible]

Paris, Sept. 6—At the meeting of the Iron and Steel Institute, on Sept. 5 and 6, which was largely attended, Professor [illegible] of Newcastle-on-Tyne, denied that Great Britain is dependent upon foreign iron ore. He said that [illegible]

Monsieur [illegible], at the concluding meeting of the Institute, described the scientific destruction of French collieries and metallurgical works by the Germans. He showed that this was not caused by shell fire but by deliberate explosions by dynamite cartridges [illegible]

MEN YOU SHOULD KNOW ABOUT

Henry M. Payne will arrive in New York from Mexico on Sept. 26.

A. L. Flagg, mining engineer of Phoenix, Ariz., is in Providence, R. I.

Hoyt S. Gale has returned from a transcontinental trip and is now in Washington.

J. E. Spurr and **D. E. A. Charlton** are attending the Institute meeting at Wilkes-Barre.

Paul A. Gow, general manager of the Tuolumne Copper Mining Co., was in Milwaukee last week.

Lewis Sanders, who has recently been on professional business in Arkansas and Georgia, has returned to New York.

Eugene Dawson, who has been investigating mining projects in Ecuador, is expected in New York early in October.

C. K. McFadden has resigned as president of the Colombian Emerald Syndicate and has been succeeded by **J. A. Arroyo.**

L. M. Cockrell, of London, recently arrived at Chihuahua on a general inspection trip of various properties in Mexico.

W. H. North, manager of the Standard mine at Silverton, B. C., was a visitor at Spokane during the first part of September.

F. E. Kurz, of Green Bay, Wis., has been appointed mine superintendent of the Great Eagle Fluorspar Co., of Lordsburg, N. M.

W. F. Eaton, superintendent of the Inglaterra mine, owned by the Compañia Minera de Petroleo, has resigned to accept a position in Colorado.

Vernon Keech, chief mechanical engineer for the iron mines of M. A. Hanna & Co., has returned to Duluth after a month's absence in the Pennsylvania anthracite district.

Heath Steele was recently elected president of the Campañia Minera de Peñoles, S. A. (subsidiary of the American Metal Co., Ltd.), to fill the vacancy caused by the resignation of **Dr. K. B. Heberlein.**

H. S. Mulliken, technical assistant of the U. S. Bureau of Mines, Washington, D. C., has been in Salt Lake City on a tour of the stations of the Bureau, in Arizona, California, Washington, Nevada, and Idaho.

C. E. Drayer, secretary of the American Association of Engineers, was tendered a banquet at the Duluth Commercial Club by a group of professional engineers, at which time Mr. Drayer spoke on the subject of "The Broader Field of Engineering Service."

C. E. Williams, who recently succeeded **Oliver C. Ralston** as superintendent of the Northwest Station of the U. S. Bureau of Mines, is at Berkeley, Cal., conferring with **D. A. Lyon**, chief metallurgist, regarding work on sponge iron now being carried on at the Seattle station.

Henry M. Lancaster, manager of the St. Lawrence Copper Mining Co., Saltese, Mont., is in Pittsburgh to attend a meeting of the directors of the company. It is expected that arrangements will be made at this meeting to resume operations at the mine, which has been idle for two months.

C. W. Whitley, C. A. H. de Saulles, Roy White, and **Kuno Doerr**, officers of the American Smelting & Refining Co., recently made a general inspection of the company's properties in Chihuahua. Accompanied by **Sam G. Long**, A. S. & R. agent at Chihuahua, they will visit the Parral group of properties.

Mining engineers and metallurgists recently in New York included: **Mat Sample**, Chuquicamata, Chile; **David White**, Washington, D. C.; **W. R. McIver**, Cambridge, Mass.; **Arthur Notman**, Bisbee, Ariz.; **Charles W. Goodale**, Butte, Mont.; **Arthur Thacher**, St. Louis, Mo.; **W. M. Small**, Tampico, Mexico, and **John I. Thomas**, Johnstown, Pa.

R. C. Wallace, commissioner of northern Manitoba, whose term of office terminated Aug. 31, was presented with a case of silver and an illuminated address at a farewell picnic held near The Pas, as a mark of appreciation for his services to the community. He is returning to Winnipeg to resume his duties at the University of Manitoba as head of the geology department.

Governor Emmet D. Boyle of Nevada has announced that he will retire from political life after his present term as Governor has expired, and will become associated with **W. E. Hindrey** in a mining engineering firm to be known as Hindrey & Boyle, which will open offices in Reno at once. Until the election to the governorship seven years ago Governor Boyle devoted his time exclusively to mining engineering, having been connected with several of the largest companies and mining operations in the State of Nevada. **W. E.** Hindrey is widely known in engineering circles. At one time he was assistant superintendent of the De Lamar properties in Lincoln County, and later was employed by the Esperanza Mining Co. of London and New York, as general manager of the Esperanza property in Mexico.

SOCIETY MEETINGS ANNOUNCED

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers will hold its first annual convention at Huntington, W. Va., Sept. 20 to Sept. 23.

The Tenth Annual Congress of the National Safety Council will be held at Boston, Sept. 26 to Sept. 30. Meetings of the mining section will be held on Sept. 27, 28, 29, and 30, and include sessions on Underground Transportation, Mine Prevention and Fire Fighting, Maintaining Interest in Safety, and Mine Hygiene, Sanitation, and Safety.

American Electrochemical Society will hold its fortieth general meeting at the Lake Placid Club, in the Adirondacks, Sept. 29, 30, and Oct. 1. The technical program will be featured by two sessions on non-ferrous metallurgy and electrodeposition. Among the papers to be presented are:

"Graphic Control of Electrolytic Processes," by B. G. Worth; "The Influence of the Electric Furnace on the Metallurgy of Non-Ferrous Metals," by H. M. St. John; "Comparison of Electric Furnace Practice With That of Fuel Fired Furnace Practice," by N. K. B. Patch; "Recent Developments in Electric Furnace of the Muffled Arc Type," by H. A. Winne; "Electric Furnace Purification of Zirkite," by J. G. Thompson; "Physical Characteristics of Specialized Refractories—Part IV," by M. L. Hartmann; "Researches on the Electrodeposition of Iron," by W. E. Hughes; "Electrolytic Solution and Deposition of Copper," by T. R. Briggs; "Electrometallurgy of Zinc," by W. R. Ingalls; "Deposition of Zinc From the Zinc Cyanide Solution," by C. J. Wernlund; "Electrolytic Deposition of Lead-Tin Alloys," by Wm. Blum and H. E. Haring.

Plans have been made for recreations and outdoor sports, including a golf tournament for the society championship.

The American Mining Congress, in making further announcement regarding its forthcoming convention at Chicago on Oct. 17-22, states that all delegates will be entitled to a return rate of one-half the regular fare. The headquarters of the convention are at the Congress Hotel, and further particulars may be obtained by writing E. C. Porter, the convention manager, at his address. Delegates are advised to make their reservations for hotel accommodations early.

In the program that has been arranged special attention will be given to the following topics covering different phases of the mining industry: Railroads and the Mining Industry; Cooperative Effort and Government Regulation; Standardization; the Gold Problem; Increased Use of Metal Products; Taxation; the Coal Industry; the National Petroleum Conference; the Educational Conference; and an American Foreign Mineral Policy. Provision has also been made for the entertainment of delegates. On Oct. 19 a luncheon will be given for members of the A. I. M. E. The annual banquet of the Mining Congress is on the program for Friday evening, Oct. 21. There will also be an informal smoker.

In conjunction with the convention will be held the National Exposition of Mines and Mining Equipment. Exhibits from Alaska and from Mexico will be featured. In addition there will be about 200 representative exhibits illustrative of the latest forms of mine machinery and mine equipment.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

Utah Consolidated Co.'s Appeal Heard in Denver

Action Outgrowth of Decision in Utah Apex Case—Hearing Completed

The appeal of the Utah Consolidated Mining Co. from the decision in the Utah Apex case, involving a question of extralateral rights and the ownership of ore valued at upward of a million dollars, came up for hearing in the U. S. Circuit Court of Appeals, in Denver, Sept. 6 and 7. The case originated from the suit brought by the Utah Apex Mining Co. against the Utah Consolidated Mining Co., both of Bingham Canyon, Utah, before Judge Tillman D. Johnson, of the U. S. District Court in Salt Lake City. (See *Engineering and Mining Journal*, Oct. 20, 1920, p. 875). The action involved the ownership of ore mined by the latter company from within the side lines of the Utah Apex company's property, but which was claimed by virtue of extralateral rights. Judge Johnson ruled that the plaintiff have judgment and decree for full value of the ore wrongfully extracted, with interest thereon. An appeal was taken by the Utah Consolidated Mining Co.

The appeal involves title to certain orebodies found in the Bingham mining district, Utah. These orebodies occur in what is commonly known in that district as the Yampa limestone. A companion case, involving orebodies situated in what is known as the Highland Boy limestone, was tried immediately prior to the trial of the Yampa case, in the lower court, and it was stipulated that all testimony which was pertinent in either case could be used by the other. The trial court handed down its decision in both cases, but the Highland Boy case is still pending in the lower court on the accounting phase of that litigation. Two other suits were consolidated with this action for purpose of trial. In each case the Utah Consolidated Mining Co. asserts ownership of the orebodies in question by virtue of an extralateral right resulting from the inclusion within the boundaries of its properties of that portion of the Yampa limestone bed where it outcrops or comes nearest the surface. The company contends that the entire Yampa limestone bed constitutes a lode.

The Utah Apex company denies that the Yampa limestone bed is sufficiently altered or generally mineralized to justify its designation as a vein or lode. It asserts that the orebodies in controversy are closely associated with distinct fissure veins which were the source of mineralization of their particular bodies; and that these veins, together with all their orebodies, including those held in controversy, are situated vertically beneath the surface of mining claims owned by the Utah Apex company. In other words, the Utah Apex company denies that the Utah Consolidated company has extralateral rights which will include the orebodies in dispute, and asserts that they belong to the Utah Apex company by virtue of ownership of the overlying surface.

The great outstanding question upon which the entire controversy turns is whether or not the Yampa limestone bed is sufficiently mineralized to constitute a vein or lode within the contemplation of the mining statute. The lower court found that the Yampa limestone bed does not constitute a lode. The case was completed Sept. 8, and was taken under advisement by the court, decision to be rendered later.

WEEKLY RÉSUMÉ

In Washington the Senate Finance [illegible] charged with [illegible] recently introduced, has been indorsed by the [illegible] Purchases of silver by the Government under the [illegible] 71,500,000 oz.

As to the industrial situation, Ton[illegible] tailed its operations drastically; iron-[illegible] district remain slow, and further [illegible] labor dis-[illegible] recently occurred in the Elizabethtown-Rosiclare fluorspar district of [illegible]

The appeal of the Utah Consolidated Mining Co. from the decision in the Utah Apex case was heard in Denver on Sept. 6-8, the court reserving decision. The Utah Steel Corporation has voted to increase its capital. Freight rates on ore and concentrates between Seattle and Tacoma and the Bunker Hill smelter [illegible] the Interstate Commerce Commission. [illegible] news letter from Johannesburg, South [illegible]

Union Makes Trouble in Illinois Fluorspar District

Threatens To Force Mining Companies at Elizabethtown and Rosiclare To Recognize It — Situation Quiet at Present

Elizabethtown, Ill. — At the end of August there was a gathering of union men at Elizabethtown, Ill., who claimed they were going to make Elizabethtown headquarters for the union in the future, and were going to have five thousand miners come here for an outing and that they would have a barbecue for the visitors. The Rosiclare fluorspar mining companies learned of the gathering and thought it possible that there would again be trouble like that of 1916. Then came the news that the union was going to force the mines to recognize the union.

The Rosiclare and Fairview mines, as well as the Hill Side mines, thereupon secured seven detectives as guards. Four of these remained at Rosiclare and the others at Elizabethtown. [illegible] away. In an attempt to [illegible] out of R[illegible] first fired upon the ex-city marshal from cover, wounding him badly. Four union miners were wounded by the detectives.

Soon after this a man named Ed Carbine, who claimed to be vice-president of the labor union, came to Rosiclare and opened a "local." Later it was reported that the union men had blown up [illegible] and they said that [illegible] At this time [illegible] by the [illegible] Rosiclare, whereupon they moved to Elizabethtown and established the local there. Threats were made against citizens and business men. This matter went from bad to worse. [illegible] brought in arms and [illegible] made threats that they were going to clean up Rosiclare and Elizabethtown and force the mines to recognize them. It is reported that the wife of Carbine went to Rosiclare in the night and told a number of women that the [illegible] were going to shoot up the town and that they should go to Elizabethtown, where it was safe. The chief of police at Rosiclare heard of these [illegible], and as there was no [illegible] requested the marshal to send them back to Rosiclare. This was done the next morning. It is alleged that this move was made in order to get a moving picture of the women and children for propaganda purposes.

After repeated orders to move, finally backed by force, the union men left Elizabethtown, camping that night a few miles out of town, where it is reported that they were responsible for several hold-ups. These men were routed by a sheriff's posse on Sept. 7 and some arms and three automobiles taken. No shots were fired.

A strong guard has been kept on the two roads leading into Elizabethtown and also at the river front, all persons coming in being turned back at night but allowed to come and go in daytime. It has also been reported that union men and their families were ordered out of Rosiclare and Elizabethtown, but this is untrue.

All fluorspar mines have been closed down in this district for from four months to two years on account of the lack of demand for fluorspar. None of the mines have ever recognized the union at any time.

George Graham Rice's Affairs Wound Up in Nevada?

Attorney Sues to Recover Fees—Action Discloses That Promoter's Office Furniture Belongs to Another

George Graham Rice's office furniture in Reno, Nev., does not belong to George Graham Rice, according to a complaint filed in district court Sept. 6 by Ben Barbash, to quote from a Reno paper The furniture is the property of Barbash himself, says the complaint, with which suit is brought against Sheriff J. D. Hillhouse for its recovery.

Sheriff Hillhouse took possession of the furniture recently under a writ of attachment brought by James T. Boyd, who alleges that the Fidelity Finance & Funding Co., headed by Rice, and whose Reno office the furniture now equips, is indebted to him in the sum of $1,917.40.

In commenting on this a correspondent says:

"It appears that James T. Boyd, who is a local (Reno) attorney, to secure for himself attorney fees due him, brought a suit and attachment proceedings against the Fidelity Finance & Funding Co. as mentioned. This has been followed by other complications, as referred to. The very important thing about these transactions, in so far as such concern the mining world and in which the legitimate operators of Nevada are most concerned, is that it is perhaps the wind-up of Mr. Rice, as far as his future operations in Nevada may be connected either as to himself or that of any corporation he might seek to find shelter within. Doubtless, one or two prominent attorneys of Nevada will miss him and the absence of his payment of good round fees for advice, but the people of the mining fraternity will welcome his departure from out their midst and that of his corporation, permanently, as now seems assured from this piece of news announcing the advent of financial difficulties, indicating the end has come at last."

Part of Mines Laboratory at Seattle To Be Dedicated

Will Be Used Jointly by U. S. Bureau of Mines and the University of Washington

By E. N. Patty

The first unit of the mines laboratory of the College of Mines of the University of Washington at Seattle is now completed and will be formally dedicated on Sept. 24. H. Foster Bain, Director, and D. A. Lyon, chief metallurgist, of the U. S. Bureau of Mines; Clyde Williams, superintendent of the Northwest station of the Bureau; President Suzzalo of the University of Washington, and Dean Milnor Roberts will be the principal speakers at the dedication. Speakers will also be present to represent the Northwest Coal Operators' Association and the Northwest Brick and Clay Association.

The present structure represents five-ninths of the projected mines laboratory. This unit will be given over to coal and ceramics laboratory work for the joint use of the College of Mines and the Northwest experimental station of the U. S. Bureau of Mines. The laboratory is so designed that it will be possible to handle efficiently all kinds of experimental work with fuels and ceramics. The capacity of the equipment is such that, when necessary, carload lots of coal can be subjected to coal washing or other tests.

The interior construction is entirely of steel and concrete, and all floors are sloped. The equipment has been well planned, and includes such accessories as water, steam, gas, electricity, compressed air, electric elevator, and automatic fire doors.

The Collegiate-Gothic type of architecture, which has been adopted for all new buildings at the University of Washington, was used with excellent effect on this structure, thus causing it to present a more pleasing appearance than is the general rule with most laboratory structures. The building is well lighted; in fact, the walls are practically a series of columns and windows. The cost of this unit, for the building alone, was $130,000.

When the remaining four-ninths of the laboratory is built it will house all the heavy machinery of the mining and metallurgy department. Mines Hall will ultimately be built just in front of the laboratory building. It will contain the offices, classrooms, and analytical chemistry laboratories.

The new Mines Laboratory was planned by Professor Joseph Daniels, for the fuel work, and Professor Hewitt Wilson for ceramics, and Dean Milnor Roberts, E. A. Holbrook, assistant director of the U. S. Bureau of Mines, and Superintendent Oliver C. Ralston and E. R. McMillian, of the Northwest Station, advised as to the Bureau's needs in the laboratory.

NEW MINES LABORATORY FOR COLLEGE OF MINES, UNIVERSITY OF WASHINGTON, SEATTLE

Iron-Ore Shipments From Lake District Small

Iron-ore shipments from the Lake Superior district show a marked decrease to date in comparison to those of 1920. To date, this season's shipments show a decrease of a little more than half of what was shipped in 1920, being approximately 13,726,000 tons, compared with 28,820,000 tons for the 1920 season. In like manner the monthly shipments for this season are low, as approximately 3,890,000 tons were shipped during August, 1921, against 7,397,000 tons shipped during the same period in 1920.

German Iron Market Active

By Radio from Reuters to "Engineering and Mining Journal"

Berlin, Sept. 6—The activity recently reported in the Rhineland-Westphalian iron market is increasing. Orders are so numerous that the plants find it impossible to execute them within a normal period. Prices are still advancing.

Proposal To Move Hibbing, Minn., In Court

Date Set for Hearing—Neither Side Expected To Be Satisfied With Outcome

Another chapter in the injunction case of H. P. Reed and seventy-five others against the Oliver Iron Mining Co., the Mesaba Railway Co., and the Village of Hibbing is about to be written, as the clerk of the Supreme Court of Minnesota has designated Sept. 22 as the date of the hearing. The case relates to the moving of a portion of Hibbing for mining purposes, as ore underlies the part that is being moved. This ore will be mined by the Oliver Iron Mining Co. and at present is within the proposed extension of the Mahoning-Hull-Rust pit.

The plaintiff seeks to restrain the vacating of the old Hibbing townsite on the grounds of civil conspiracy among the defendants and seeks to enjoin the sale of the village hall, the change in the route of the street railway, and an alleged plan to destroy the North Street bridge. Should any one of the three main points of the plaintiffs be upheld, it would greatly handicap, if not totally ruin, the contemplated mining operations. A new town has been built south of the present village of Hibbing, and nearly all property in the old townsite has been acquired by the Oliver Iron Mining Co. to date. The case is regarded as of great importance.

The plaintiffs were denied a permanent injunction in the district court when the case came up for trial this summer. It is anticipated that a decision will be rendered within a month after the case is heard, but it is assumed that neither side will be satisfied by a decision of the State Supreme Court, and it is likely that the final decision will be rendered by the U. S. Supreme Court.

Replogle and Associates Acquire Interest in Hapsburg Estate

Organize Trust Company To Manage Property of Archduke Frederick—Rene Viviani as Counsel

American capitalists, including J. Leonard Replogle, Charles S. Sabin, Frank A. Munsey and others, have organized a company recently incorporated at Geneva, Switzerland, as the General Real Estate & Trust Co., which will manage the estate of Archduke Frederick of Austria and his family. The capitalization of this company is [illegible]. Two-thirds of the stock is owned by the Hapsburg family and the remaining third by the American syndicate. Rene Viviani has been retained by the latter to effect a release of such properties belonging to the estate as have been confiscated by the various governments of Central Europe.

It is said that negotiations for the control of the estate began two years ago when Mr. Replogle conferred with Eugene Schneider, the French steel manufacturer, to obtain an interest in the Bergenhütten steel plant at Teschen, Czecho-Slovakia. This deal was consummated, Mr. Replogle becoming a director of the company. Later it was proposed to take over additional properties, and finally the aid of other capitalists was enlisted. The estate includes over a million acres, numerous factories, coal mines, miscellaneous real estate, and a valuable art collection.

Mining in British Malaya

Tin Operations in 1920 Profitable—Prospectors Successful in States of Johore and Trengganu

[illegible]

Official reports from the East show that the quantity of tin exported from the Federated Malay States last year was 34,934 tons, as against 36,935 tons in 1919, a decrease of just over 5 per cent. Notwithstanding the lower prices obtaining at the end of the year, and the smaller quantity exported, the firmer position of tin in the earlier part resulted in an increase in value for the whole year of £1,580,261, as compared with 1919, so that the mining community has little cause for complaint on the result of the year's trading.

Prospectors are actively engaged in seeking new tin fields in the adjoining Malay States, and have been successful in Johore and Trengganu. The chief mining areas of the State of Trengganu are at the head waters of the Kemaman River. The Bundi Tin Mining Syndicate has for many years worked lode deposits which are possibly continuations of the lode worked by the well-known Pahang Consolidated, Ltd., in the adjoining territory of Kuantan. Lode formations have also been found on lands now being developed by other companies, the Kajang (Kemaman) Tin, Ltd., Tebak Tin Fields, Ltd., and the Sungei Ayam Tin Mines. In other parts of the state, tin and wolfram have been found. The mining potentialities of the state are considerable. There are large areas of ground absolutely unprospected, which would undoubtedly repay thorough examination.

Development at present is greatly hampered by difficulties of transport and communications, and by the absence of a properly organized land and mining department. These drawbacks will gradually disappear. It is hoped to make an early start on the construction of a system of roads for the development of the interior, and it will not be long before the state has telegraphic communication with its southern neighbor, Pahang, and with Singapore and the Federated Malay States. A telegraph line is in course of construction between Kuala Trengganu, the state capital, and Kemaman, in Pahang.

Many applications are being made for prospecting licenses in Johore. In the northern state of Kelantan, there has been some prospecting for gold and tin, but so far as is known officially it has not yet met with success.

Development of Water Power Planned in Arkansas

Project Expected To Benefit Mining Industry in Northern Part of the State

By [illegible]

The proposed development of the available water power in the White River and its tributaries in North Arkansas by the Dixie Power Co. has caused mine operators and owners of mineral property in the North Arkansas zinc field and the Batesville manganese field to take a more optimistic view of what the future holds for the industry in these parts. The development of this power holds out the promise of lower operating costs, water transportation for a large part of the zinc district, and possibly a ferromanganese plant at Batesville and a zinc smelter at some point in the zinc field.

The Dixie Power Co., which has a core drill in operation at present testing the foundations for a gigantic power dam, is completing the preliminary work on the project. This work has been in progress a large part of the time since the fall of 1919, when the first survey of the basin was made. Colonel [illegible] Allen, of Chicago, a former member of the last Panama Canal Commission, who is consulting engineer for the project, states that it ranks fifth among water-power projects of the country.

Two sites are under investigation, one of which will be chosen after the drilling is completed and the final figures are computed. One, known as the Wildcat site, is situated eight miles above Cotter; the other, known as the Cotter site, adjoins the town of Cotter on the east bank of the river.

The greatest benefit the mining industry will derive from the project, in my opinion, will be that of water transportation, which will be available to sections that now have to drag their ore for long distances over nearly impassable roads. The lake created by a dam at Cotter will afford transportation to a large part of the northern section of the zinc district in Marion, Boone, and Baxter counties. The construction of a dam on the Buffalo River, near the mouth, will afford such transportation for the entire Buffalo River district, from which the greatest tonnage of the field has been produced.

Freight Rates on Ore Advanced In Northwest

Freight rates on carload shipments of ore and concentrates from Seattle and Tacoma, Wash., to the Bunker Hill smelter at Kellogg, Idaho, and on copper matte and lead bullion from Bradley and Kellogg, Idaho, to Seattle and Tacoma are to be increased sharply under a decision recently made by the Interstate Commerce Commission. The commission [illegible] the position of the Oregon-Washington Railroad & Navigation Co. and connecting lines in establishing [illegible] rates based on the value of the [illegible] instead of on [illegible].

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

New Federal Blue-Sky Measure Approved

Denison Bill Indorsed by National Association of Securities Commissioners

The Blue-Sky bill, introduced by Representative Denison, of Illinois, has received the unanimous approval of the National Association of Securities Commissioners. That organization held its fourth annual convention in Washington, D. C., Sept. 6 to 8. The principal subject of discussion at the convention was Federal blue-sky legislation. The security commissioners from forty states are members of this association. They pledged their support to the Federal Trade Commission and commended that body for its efforts to protect the public from the sale of worthless or fraudulent securities.

The Denison bill, which was indorsed by the convention, would make it unlawful to deposit in the United States mails any communication or printed matter tendering for sale any securities to a person residing in a state having a law against the sale of such securities. The same inhibition against the procurement of advertising of such securities is provided. Another section of the bill prohibits the handling of such communications, or printed matter, by express or other interstate transportation agency and precludes the interstate transportation of such information by telegraph or telephone. A penalty clause provides a fine of $2,000, imprisonment for not more than two years, or both. For subsequent offenses, both the fine and imprisonment must be meted out. Any sale or contract for sale of such securities is declared illegal, and each person participating in the benefits or proceeds of these transactions is to be jointly and severally liable to the purchaser for the full amount paid by him and for the costs of any action taken to recover such a loss.

Appropriation for Alaska Inadequate

Despite the urgent need for stimulating mineral mining enterprises in the territory tributary to the Alaska railroad, this year's appropriations for such investigations are declared to be entirely inadequate. This situation will be brought to the attention of Congress by the Alaskan delegate and by the chairmen of the committees on Mines and Mining of the Senate and of the House.

Purchases of silver by the Bureau of the Mint totaled 1,145,000 fine ounces during the week ended Sept. 10. This brings the total purchases under the Pittman Act to 71,592,430 fine ounces.

Finance Committee Besieged With Tariff Briefs

Pleas Made for Tungsten, Magnesite, Manganese, Graphite and Other Minerals—Mining Congress Compiles Tariff Data

Numerous briefs have been filed with the Senate Finance Committee covering various phases of the metals schedule of the tariff bill. A brief submitted on behalf of the tungsten producers of Colorado, California, Nevada, and Arizona emphasizes the fact that the tungsten industry in this country is inoperative in all its branches. This includes mining, refining, and the application of this metal to steel making. Attention is called to the fact that the British control absolutely the markets in this country for ferrotungsten, tungsten powder, and high-speed tungsten steel. It is predicted that this control will continue until protection is afforded each branch of the industry by levying duties sufficient to equalize costs as between this country and China on the production of tungsten ore and as between this country and England on the cost of producing the manufactured products of tungsten.

There is some objection to the action of the Ways and Means Committee in changing the method of levying duty from the unit basis to the pound basis. The tariff bill, as it passed the House, provides a duty of 45c. per lb. of metallic tungsten contained in ore. The domestic producers of tungsten prefer the unit basis, but if the pound basis is to be maintained they ask that the duty be increased to 57c., which equals $9 per unit of tungstic trioxide. The rate prescribed by the House equals $7.14 per unit.

A particularly comprehensive brief has been filed by Roy N. Bishop for the Northwest Magnesite Co. and for the Western Magnesite Association. The principal points made in the brief are as follows:

A tariff of $15 per ton on calcined magnesite and $10 per ton on crude magnesite will add 3 to 5c. per ton to the cost of steel. Only 2c. worth of magnesite enters into the cost of making 500 lb. of tool steel. The domestic industry is asking a tariff which will do no more than will make it possible for American mines to compete with Austrian mines. It is assumed that importations sufficient to supply 50 per cent of the American consumption will continue.

The domestic magnesite producers criticise the steel interests for advocating "a duty on all articles they produce in order that they may have 100 per cent of the steel business in the United States and be able to export their surplus, but do not want a tariff on the articles which they buy that enter into the cost of their product."

It is also pointed out that the present price of magnesite will not be increased $15 a ton if a $15 tariff is enacted. Even with a $15 tariff, it is stated, it will be necessary to reduce costs and sell magnesite for less than it is bringing today.

That numerous consumers of plastic magnesite favor the $15 tariff has been made very clear to the committee. It is claimed by the builders who use that material for exterior stucco that the quality of foreign magnesite is far from constant and that it is necessary to secure these supplies from the domestic producers, who have standardized their product, and furnish a plastic magnesite of uniform quality entirely adapted to the needs of builders. The committee was informed that exterior stuccos now have reached a state of perfection that is resulting in a great increase in its use.

There is no cessation in the efforts of the domestic producers of graphite to impress the Finance Committee with the need for a duty. They believe that they have proved that American graphite makes the best small and medium sized crucibles and that it only is advantageous to use an admixture of Ceylon graphite for the very large crucibles.

The Finance Committee has had printed for its own use and for the record a very comprehensive table prepared by Herbert Wilson Smith for use in connection with his appearance before the committee as the tariff representative of the American Mining Congress. This table gives the following information for each of the minerals for which a tariff is asked: Present tariff classification; unit of measure; imports for foreign countries, pre-war, during war and at present; imported from; labor costs in those countries; relative trade balance of those countries with the United States; present exchange rates of those countries with the United States; nature and extent of ore deposits, foreign and domestic; foreign cost of production; domestic cost of production; pre-war prices; war-time prices; present prices; annual production in the United States before and during the war and at present; states in which produced; number persons dependent on the industry for support; amount invested; present condition of industry; relative percentage of foreign and domestic product that would be consumed under tariff asked; tariff requested; tariff prescribed in bill passed by House. Information under each of the foregoing heads is shown for antimony, arsenic, asbestos, barytes, bismuth, cadmium, chromite, feldspar, fluorspar, graphite, gypsum, kaolin, lead, lime, manganese, magnesite, marble, mica, molybdenum, monazite, thorium, pyrites, pumice, potash, quicksilver, talc, tungsten, and zinc.

American producers of ferromanganese have submitted a brief in which they call attention to the wisdom, from a business standpoint, of fostering a ferromanganese industry in a country which is the largest producer of steel in the world. They call attention, however, to the fact that the tariff bill, as it passed the House, carries a duty on manganese ore as well as on ferromanganese. It was stated that this protection is in the proportion of two-thirds for the ore and one-third for ferromanganese. From that they point out that 66 per cent of the duty objected to by the steel producer would be eliminated if the ore be permitted to remain on the free list.

George H. Crosby, of Duluth, urged that a tariff on manganese ore be provided, so that it might stimulate the exploration and use of manganese-bearing ores. If proper protection were granted, [illegible] that the Cuyuna Range could produce 75 per cent of the manganese that is consumed in the steel-making trade for many years.

A striking statement made in connection with the plea for a duty of $4 per ton on iron pyrites was that pyrites can be loaded at the mine in Spain, hauled 125 miles to the seacoast, shipped across the Atlantic and unloaded in the port of New York and its sulphur content sold for one-half the freight rate on the ore from Virginia pyrites mines.

NEWS BY MINING DISTRICTS

London Letter

The Return on Mining Ventures—Rich Gold Finds Reported From Hampton Field—Otavi Mines & Railway Co. Reorganized on Sterling Basis

BY W. A. DOMAN

London, Aug 29—Mining, and especially base-metal mining, is admittedly risky, and the people who find the money for such ventures are entitled to a suitable return upon it. Only when annual reports reach them do they realize the extent to which other people have had a finger in the pie—people who incur little if any risk—before any profits remain for division. Two annual reports will illustrate the point. The Broken Hill Proprietary Co., a combined mining and steel manufacturing undertaking, earned a net profit during the twelve months ended May 31 last of £351,331. Taxation, which the directors say is "proving a very heavy burden," required no less than £242,584, or almost 70 per cent. The other company, the Ropp Tin, Ltd., is mulcted by the Nigerian Government Railways in mileage of £11 per ton for the carriage of tin ore. In another colony similar mineral can be conveyed for the same mileage at a rate of 14/2 per ton. Extravagance and inefficiency on the railway, which is a government monopoly, can be made good out of the mineral industry. But the Ropp Tin has another grievance. Previous to the war the returning charge was £6/5/0 per ton. For the calendar year 1920 it was £15. As with the railways, the mining companies are unable to protect themselves, for export duty from Nigeria is recoverable only by the producers on their satisfying the local customs that the tin concentrates have been dealt with by a firm in Great Britain.

It may seem right to the Nigerian government to confine the smelting of the locally produced concentrates to Great Britain, but it is unquestionably penalizing the companies, and forcing them to send business where it would not otherwise go. Governments are entitled to tax, though the demands should be moderate.

Just when the public was beginning to imagine that the recently discovered Hampton gold field was about to go out of existence because the reefs opened upon were too patchy to be worked profitably, comes another cable dispatch from the Hampton Gold Mining Areas stating that prospectors are working "rich alluvial" and that there is "rich reef gold." Presumably there is some connection between the alluvial and the reef, and the discovery now, after the field had been tested and abandoned years ago, is rather surprising. Ounce nuggets are making their appearance again. This new gold field, one of so many in Western Australia, has been proclaimed the "Transfind." The province sadly needs a new find, as gold production has fallen to a very serious extent. The government is fairly liberal in its treatment of prospectors, and there is generally some kind of expedition under way for the purpose of making new discoveries of gold.

The Otavi Mines & Railway Co., originally a German undertaking with a mark capital, of which a portion had been introduced to the London market, is to be reorganized with a sterling capital. The mark capital is 4,000,000, and conversion is to be effected at the rate of 20 marks to the pound with a cash amount of 20 marks per share. Initially, then, the new capital is £200,000. But there are 200,000 *genussscheine* and they are to be exchanged for the £1 shares, making £400,000. As, however, the company required funds for prosecuting operations, the nominal capital is to be £800,000. The new working capital is needed to repay loans contracted during the war, to extend machinery and sink a new shaft. Apparently the [illegible] for 100,000 tons of new ore has been opened up. The "exportable ores" of the [illegible] and the next financial year have been sold firm.

No improvement in the business depression in China is expected until there is a revival of [illegible] exports, says reliable advices to the Department of Commerce.

Johannesburg Letter

Engineering Societies of South Africa Now Housed Under One Roof—The Arc Diamond of Gong Gong—The Wage Situation on the Rand

BY JOHN WATSON

Johannesburg, Aug. 2—A Scientific and Technical Club, with suitable rooms for the holding of meetings, has now been opened in this town under the aegis of the Associated Scientific and Technical Societies of South Africa. The building is centrally situated at No. 100 Fox St., and was formerly occupied by the Johannesburg Club. The purchase has been effected largely through the generosity of the Transvaal Chamber of Mines. The joint housing scheme for the local scientific societies has been discussed for a number of years, and in November, 1919, ten societies accepted the idea and elected a joint committee.

In the past, the scientific societies have been holding their meetings at the Chamber of Mines, the University College buildings and elsewhere. Among the ten societies mentioned above are the South African Institution of Engineers, the South African Institute of Electrical Engineers, the Chemical, Metallurgical and Mining Society, the Transvaal Architects, the Geological Society of South Africa, and others, all of which are now housed under the one roof.

South Africa has produced several of the world's largest and finest diamonds. The "Star of South Africa," found half a century ago, was purchased by the Earl of Dudley for £25,000. The "Excelsior," found in 1893 at Jagersfontein, weighed 971 carats. The Cullinan diamond, found at the Premier mine in 1905, weighed [illegible] carats. It was divided into nine large stones, the first and second being still the largest brilliants in existence. W. S. writing in *The Star* of July 2, describes the interesting finding of a fine alluvial diamond at Gong Gong, near Barkly West, in June of this year. It was found to weigh [illegible] carats and was sold for several thousand pounds sterling to Messrs. Allan, Russel and Crudgington, whose initials spell the word "arc."

Government official figures show that the average miner, machine-stoping on day's pay, was earning 27s. 4d. per shift in June, 1920, compared with an average of 18s. 5d. per shift in June, 1914. The underground fitter was earning 30s. 7d. per shift in June, 1920, as compared with 20s. 6d. in June, 1914. The mine carpenter on the surface was earning 28s. 2d. per shift in June, 1920, whereas in June, 1914, the average was 20s. per shift. The amount of pay for other trades had increased in similar proportion.

Owing to the premium on gold in London and to the increased cost of living, increases of pay were made by the Transvaal Chamber of Mines during the war.

On Aug. 1, 1915, miners received an increase of 7s. per week, and the following month mechanics were paid "time-and-a-quarter" for overtime. In 1916, the hours of mine mechanics were reduced to forty-eight per week at the standard rate of 2s. 6d. per hour. In August, 1917, the war bonus to mine employees was again increased on a sliding scale, and mechanics received an increase of 3d. per hour. The Chamber of Mines at that time also granted twelve days' holiday per annum on full pay without any demand from the workers. In September, 1918, a fresh sliding scale of war allowances was brought into force. A further readjustment was made in December, 1918, to accord with the rise in the cost of living. From Nov. 1, 1919, a flat rate increase of £2 8s. per week, in lieu of the war bonus, was given to all employees other than officials, improvers, apprentices, and learners. The price of fine gold in London on July 27 was 114s. 10d. per oz.

It has been pointed out here that when the price of gold reverts to the normal pre-war figure (84s. 11d.) about one-third of the gold mines now crushing on the Rand will have to close down. Some economists, of course, maintain that the cost of living will fall and wages will come down to the old pre-war rates.

The Chamber of Mines, in *The Star* of yesterday (Aug. 1), points out that in 1914, £7,140,000 was paid to Europeans in wages and salaries. In 1920, £11,350,000 was paid.

In 1914, holiday privileges for white workers cost the industry £27,000; in 1920 over £600,000. In 1914, phthisis contributions cost the mines £580,000 and the men £73,500; in 1920 they cost the mines £800,000 and the men *nothing*. Other items bring up the total additional cost of white workers to the industry to more than £5,000,000 per annum. The Chamber is now asking for a reduction of about £250,000 per annum, that is, about one-twentieth of the additional cost. The local cost of living has been falling during the last eight months, according to the official figures of the Government Director of Census. In this period it has dropped from 57 per cent above pre-war rates in October, 1920, to 31 per cent in June, 1921.

AUSTRALIA

Victoria

Interest Reviving in Walhalla Field

Melbourne, Aug. 9—Walhalla, one of the famous mining fields of Victoria, has been practically deserted since the Long Tunnel and Long Tunnel Extended mines ceased operations. Considerable interest has been stimulated in the field recently by the results of prospecting undertaken by the Overseas Exploration Syndicate, which holds a part of the old areas held by the companies mentioned but never worked. The Syndicate's £10 shares have sold as high as £50, and enthusiasts are talking wildly regarding the "revival" of Walhalla.

CANADA

Ontario

Dome Mines Announces New Ore on 7th Level

Porcupine—It is officially stated that new ore has been discovered on the 7th level of the Dome Mines, the extent and values of which have yet to be determined. It is not known whether this find is connected with the orebodies on the 10th level. The workings below the 10th level are being deepened, but it has not been decided to what further depth the shaft will be put down.

Kirkland Lake—At the Queen Level, where a number of gold-bearing veins have been found on the surface, camp buildings are being erected, and an extensive plan for development has been laid out.

MEXICO

Coahuila

Peñoles Smelter at Torreon Closed Down

Torreon—The Cia. Metalurgica de Torreon, smelting plant operated by the Cia. Minera de Peñoles, which has been running one copper and three lead furnaces, closed down early in September. Some of the American employees have been transferred to Monterrey, where they will be employed at smelter No. 2, owned by the same company. In the meantime the Torreon plant is to undergo general repairs. A large amount of machinery and other equipment is to be taken from the old Mapimi smelter and placed in use here to increase the capacity.

New platforms and loading stations are being constructed at Bermejillo, where the ores from the Peñoles mines are transferred from the narrow-gage line belonging to the company, to the standard-gage of the National Railways of Mexico. After completing this work and the repairs at the Torreon smelting plant, all of the ores from the Mapimi camp will be brought to this city for treatment. The Mapimi smelter will remain idle indefinitely.

CHOSEN

Oriental Consolidated's Stope Fire Apparently Out—New Mine Sorting System Introduced

Unsankinko—The manager of the Oriental Consolidated Mining Co. writes his home office under date of Aug. 4 as follows:

"There has been no sign of gas, smoke or fire in the Tabowie mine since April 25. We therefore think that the fire has been put out.

"We ran sixty stamps most of the time in the Tabowie mill during July, but had eighty stamps dropping for a few days. Since Jan. 1, 1921, we have instituted a rather thorough sorting system in the Tabowie mine. The Koreans object to the system, as it means more work and more care for all stope contractors. We do not have enough men yet to break ore for eighty stamps, but we hope to have enough willing workers before long, as we expect the natives will realize that the sorting system has come to stay.

"The rainfall since the morning of July 16 has enabled us to operate our hydro-electric plants at full capacity, and everything has been driven electrically with the solitary exception of the Tabowie mine steam surface hoist. Since July 24 we have had dry weather, and this unusual condition at this time of the year led us to fear that we had another year of drought in store. Fortunately it started to rain last night. As it costs us over $250 per day to drive our two mills only on steam, the importance of plenty of rain is apparent."

CALIFORNIA

Tailings Dump of Kennedy Company's Chlorination Plant Sold to Selby Smelting Works

San Francisco—Conditions in gold mining continue to show gradual improvement. Strikes appear to have been settled and more mines are getting into line for production.

A. J. Pillsbury and Will J. French, commissioners of the State Industrial Accident Commission, completed ten years of service as commissioners on Sept. 1, 1921. Employees of the commission tendered them an impromptu reception.

During August 776 ft. of a 11-ft. diameter tunnel was driven from a single heading at Priest's Portal of the Hetch-Hetchy aqueduct. This is a remarkable record, and credit is given to R. C. Dennis, subcontractor, for the achievement. Our informant stated that the men at the tunnel face worked like a college football team. Team work and incentive to better existing records are responsible in a measure for the excellent work.

Randsburg—The Randsburg district is booming, and a recent traveler stated that many are sleeping in the streets, as rooms are unobtainable.

Jackson—The Kennedy Mining and Milling Co. is clearing out the bottom of its shaft, following the recent unwatering of the property. Production is expected to be resumed by the end of September. The tailings dump of the chlorination plant has been sold to Selby Smelting Works. The iron content is in excess of 50 per cent, making the material a desirable basic flux. A low gold and silver content is also present.

Portola—The Plumas Eureka Annex, north of the Plumas Eureka, is driving a prospecting adit to cut the extension of the old Plumas Eureka vein. The Walker Mining Co. is expected to curtail operations further at its copper property. For some time only development work has been in progress.

NEVADA

Bluster Consolidated Sold to Los Angeles Company—West End Consolidated at Tonopah May Cut Wages Soon

Jarbidge — It is reported that the Bluster Consolidated mine has been purchased by the Bonanza Gold Mining Co., of Los Angeles, and that operations will be started soon. The Bluster mine has produced over $100,000 in gold and silver. There are several thousand feet of underground workings, mostly drifts, with a considerable tonnage of milling ore blocked out. Previous owners were unable to handle this grade of ore because they could not finance the construction of a complete cyanide plant, so that only ore of shipping grade was mined.

Mina—The West End Consolidated Mining Co., of Tonopah, has bonded the Mabel group of claims, about twenty miles northwest of Mina, and development work is to be started at once. This group adjoins the Garfield mine, a famous producer of high-grade gold and silver ore many years ago, and contains the extension of the Garfield vein system to the west.

Silver Bow—The Blue Horse Mining Co. has made the third payment on the Silver Bow group of claims, situated about forty-five miles east of Tonopah. The company has had the group under option for more than a year and has spent over $80,000 in development work. Conditions are favorable, and development is to be continued.

Tonopah—Operating conditions in the Tonopah district are good. Mines and mills are running at capacity, small development properties have resumed work, business in the district has improved, and the entire community appears prosperous. The labor problem is not entirely a dead issue as yet, as in two of the principal mines of the district very few old employees have been re-employed on account of personal friction between them and the imported men. It is to be hoped that all parties concerned will soon bury the hatchet, so to speak, and work on friendly terms. The few remaining state police will probably be withdrawn. The West End has not as yet reduced wages, but it is likely that a reduction will be made in the near future, thus putting the camp and district under a single wage scale.

No discoveries of importance have been reported recently, although development footage is about normal and underground conditions are satisfactory.

Klondyke—The Golden State Divide Mining Co., controlled by the Knox Divide Mining Co. and operating the Golden State mine, in the Klondyke district, is reported to have purchased the entire surface equipment of the Mutual Divide Mining Co. This equipment is first class, and its purchase is indicative of a broader development policy. The southeast drift on the 130 level, which is the lowest level in the mine, has been connected by a short raise to the winze sunk from the 60 level. The vein has been cut on the 130 level, and shows some good spots and a variable width of low-grade quartz. Conditions are regarded as encouraging, and work is being pushed at two faces on this level. No ore is being broken, as the stopes are full, but shipments to the Tonopah Mining Co.'s mill at Millers will be resumed soon.

Gold Hill—The United Comstock Mines Co. has completed its railroad spur, has erected a tower for concreting at the mill site, and has started work on the mill foundations. Freight is being delivered at the mill site.

Virginia City—An excellent showing is being made in the new stope opened by Con. Virginia on the 1,650 level, 250 ft. south of the shaft and under the old bonanza stopes. The stope is four sets wide and five sets long and shows ore faces on the north, south, and west sides. The mill has operated to capacity. Experiments in flotation treatment are being conducted, and the results are promising. The production for August is estimated at approximately $40,000. At the Savage mine No. 2 raise, 60 ft. north of the No. 1 raise on the Sutro level, has been started. Encouraging assays are reported.

Pioche—Deep development work has been temporarily suspended at the Prince Consolidated mine. The decision was reached after several breakdowns in the power plant and after the heavy cost of operation had made it evident that larger equipment would eventually have to be installed before the water could be economically handled and the mining operations pushed without delay on the 833 level. The last work done in the East drift was most satisfactory, and every effort will be made to install heavier pumping and power equipment as soon as possible.

UTAH

State Industrial Commission Orders Accident Payments—Furnaces in Blast—Utah Steel Corporation to Increase Capital

Salt Lake City—The State Industrial Commission has ordered a number of Utah mining companies to make payments to employees suffering injuries, as follows: The Utah Copper Co., through its insurance carrier, has been ordered to pay John [illegible] $[illegible] as a lump sum as a complete settlement for permanent disability suffered through his left shoulder and arm. The Tintic Standard Mining Co. or the state insurance fund is ordered to pay to James Burriston compensation of $16 per week from Dec. 23, 1920, to Jan. 3, 1921, as a result of injuries suffered while employed by the company at Dividend. The Peerless Coal Co. must pay to the state treasurer $750 as a result of fatal injury to Frank German, an employee of the coal company at Peerless, Utah. The action was brought by the state treasurer on behalf of the state insurance fund to determine whether or not the decedent left any dependents. No dependents presenting themselves at a hearing before the State Industrial Commission, the sum will be paid into the state insurance fund as required by law. A number of applications for compensation were denied.

Lead furnaces in operation at the Salt Lake valley plants at the end of August were as follows: the United States company at Midvale had three lead furnaces and one furnace on matte concentration. The A. S. & R. at Murray had three lead furnaces in operation, as compared with four furnaces during the first half of the month. There were no furnaces in operation at the International Smelter at Tooele.

Stockholders of the Utah Steel Corporation, which has a plant at Midvale, have voted to increase capitalization from $2,500,000 to $5,000,000. Extensive additions to the company's plant at Midvale, and a twenty-one mile railroad from Lund, on the Salt Lake route, are planned, if the projects obtain local support. It is said that if Utah people come forward, a large amount of Eastern capital will be available. The present capacity of the works is 6,000 tons of steel monthly and it is planned to bring this up to 25,000 tons monthly. The company began operations sixty years ago, starting with a monthly output of 400 tons. M. S. Rosenblatt is general manager.

Arrangements have been made to open at greater depth the Victor property in the south fork of Big Cottonwood Cañon near the Cardiff.

Park City—Shipments for the week ended Sept. 3 amounted to [illegible] tons. Shippers were: Silver King Coalition, 771 tons; [illegible], [illegible]; and Ontario, [illegible]. At the Silver King Consolidated there is [illegible] ft. of ore showing in the raise from the [illegible] a short distance above the [illegible] level. Water coming in has interfered with the work.

Eureka—The shipments from the Tintic district for the week ended Sept. 3 amounted to [illegible] cars.

WYOMING

Electrolytic Copper Co. Now Shipping Copper Ore

Holmes—Shipments of copper ore are being made from the Electrolytic Copper Co., operating the [illegible] group of claims in the Medicine Bow Mountains. A contract has been let to haul [illegible] tons, and it is expected to continue shipments at the rate of three tons daily.

NEW MEXICO

Great Eagle Fluorspar Co. Changes Management

Lordsburg—A change has been made in the management of the Great Eagle Fluorspar Co. Carl F. Schaber will be in charge, with F. E. Kurz, of Green Bay, Wis., as mine superintendent. New ground will be opened up at once, and extensive changes made in the mill, which is not as yet complete. A series of tests in connection with the milling of this product will be carried out at Salt Lake City, Denver, and El Paso.

The Last Chance mine is preparing to install a compressor and complete air equipment at once. Development work is being pushed with satisfactory results.

MONTANA

Nature of Butte & Superior's Copper Strike Still Doubtful—West Butte Mining Co. Begins Operations

Butte—Locating of copper ore on the 2,200 level of the Black Rock mine of the Butte & Superior company was a feature of the week's news in the Butte district. Reports of the development, however, were somewhat exaggerated, and it will require further development work to determine the worth of this ore, which is bunchy and scattered. The belief obtains that what was found is not the downward extension of the shoot had on the level above, the 2,050 level, as the ground is broken up. Doubt also is entertained as to the identity of the vein in which the copper was found on the 2,050, whether it is a "northwest" fissure or a branch of the Rainbow vein, in which the large tonnages of silver-zinc ore have been mined. If it is a "northwester" the importance of the development undergoes considerable of a decrease, as in the Elm Orlu mine adjoining the northwest veins have been found to carry copper at depth, as they have throughout the Butte district, and such a development was not unexpected. But if the copper vein is a branch of the Rainbow, indicating a change in its metal content with depth from high-grade zinc-silver ore to copper, the development is one of much consequence, as showing a change in the large veins of this character at depth.

The West Butte Mining Co. has started operations in the western part of the Butte district on three claims located about 3,000 ft. west of the Nettie of the Anaconda and the Hibernia of the Davis-Daly, and a shaft, which now is down 25 ft., will be sunk to the 200 level and three veins crosscut. These fissures on the surface show strong croppings, with assays of silver running in various amounts. A headframe and engine house have been completed, and a 50-hp. electric hoisting engine and a 680-ft. air compressor are ready to be installed. It will be necessary to construct a power line a quarter mile long. New York interests have financed the West Butte, which is a new corporation to enter the Butte field.

COLORADO

Colorado Fuel & Iron Co. Curtails Operations

Pueblo—The Colorado Fuel & Iron Co. will close down several units of its steel plant, and reduce its working force from 7,500 to about 1,500 men. The company's iron mines in Wyoming and the coking coal mines in the Trinidad district will be closed. The curtailment is the result of deferred orders and overproduction.

Montezuma—Development in the Jerry mine has opened a vein of high-grade silver ore at a depth of about 1,200 ft. The vein is from 12 to 18 in. wide, and carries considerable ruby silver. Selected streaks assay from 400 to 600 oz. silver a ton. H. E. McCray is manager.

Cripple Creek—Lower levels of the Dante mine are being prospected with a diamond drill, and some promising veins have been located.

The Heck Gold Mining & Leasing Co. will resume development on the bottom level of the Empire State property in the near future with the view of prospecting the Maloney vein at depth. Work will also be resumed on the third level. Charles P. Heckler is manager.

The Hardwood property is being developed and operated by the United Gold Mines Co., which has resumed shipments of ore recently.

The LeBrun Mining Co. is performing development work in the Acacia Gold Mining Co.'s property, through the South Burns shaft, under an extension of lease running to November, 1923. Drifting is in progress on the 3d, 13th, and 16th levels.

The Hull City property is being developed under lease by Phillips & Co., who are planning extensive exploration in the near future. At present, the lessees are producing about two carloads of $40 ore per month from development.

Leadville—The Best Friend property will be reopened and operated by a pool of local capitalists. It is planned to advance the main tunnel, which has already been driven about 2,000 ft.

Twin Lakes—The Yale Mining Co. has resumed operations at the Texas Creek property. The Harland mill has been purchased, and is to be remodeled and equipped with new machinery.

SOUTH DAKOTA

Homestake's New Mill Building Nearly Completed — Clover Leaf at Roubaix Working

Lead—The new 1,800-ton mill structure that the Homestake Mining Co. is erecting is nearly completed. The equipment will be installed as soon as the building is inclosed. The company is now operating at full capacity. The station at the 2,150 level of the Ellison shaft is about finished.

Hill City—Work at the Tin Boom mine of the National Tin Corporation continues, and work has also been started at the Cowboy. The work is in the nature of development, and in all probability the concentrator will not be placed in operation this year.

Deadwood—The tunnel of the Eagle Bird company on Squaw Creek has been driven over 700 ft. and will be continued to 1,500 ft. It will cut a ledge of ore found on the surface and will give a depth of about 400 ft.

Roubaix—Work has started at the Clover Leaf property, at Roubaix. Arrangements are being made for active work, and in a short time diamond drilling will be begun. It is also probable that the shaft will be unwatered and repaired, which will be followed by underground development.

MICHIGAN

Future of Copper Depends on Use for Purposes Requiring Large Quantities

Houghton—While innumerable uses for copper are being suggested, as part of an extensive campaign to popularize the product, it is the belief in mining circles here that the future of the metal depends largely on its employment more generally for purposes requiring a larger volume of the material. This involves it is said, the necessity of standardization of parts. The building trade particularly, it is believed, holds out much hope in this direction. With standardization of parts in effect the country over, it is argued that a great deal of copper would be used for roofs, skylight frames, window frames, gutters, cornices, doors, panels, ventilators, sash, fronts, pipes, and ornaments. Architects then, it is contended, would be more inclined to specify the use of copper to a far greater extent than now. This, it is asserted, will be part of the work of the recently organized Copper and Brass Research Association. It is a field which has been neglected and pioneering is necessary.

MINNESOTA

Mesabi Range

Biwabik Mine Shuts Down—Stripping Stopped at Buffalo-Susquehanna Pit

Hibbing — The stripping operations at the Buffalo-Susquehanna pit of the Rogers-Brown company have been suspended. This work was being carried on by the Winston-Dear Co. About 115 men have been laid off.

The large coal dock which supplied the engines and steam shovels of the Hull-Rust pit, the largest open pit property of the Oliver Iron Mining Co., was totally destroyed by fire last week. Operations were delayed for a short period.

Biwabik—The Biwabik mine, operated by the Biwabik Mining Co., a subsidiary of the Tod-Stambaugh Co., has suspended operations indefinitely. Ore shipments from this property have been heavily curtailed this year. Normally they would have totaled about 500,000 tons a season, but only 140,000 tons have been shipped to the docks this season. This was the only mine remaining in operation at Biwabik. About seventy-five men are affected.

THE MARKET REPORT

Daily Prices of Metals

Sept	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
8	11.875	26.50	27.00	4.50	4.30	4.20
9	11.875	26.00	[illegible]	4.55@4.60	4.30@4.40	4.20
10	11.875	26.00	26.625	4.55@4.60	4.40	4.20
12	11.875	26.125	26.75	4.55@4.60	4.40	4.20
13	11.875	26.25	26.875	4.60	4.40	4.175
14	11.875	26.125	26.50	4.60	4.40	4.175

*These prices correspond to the following quotations for copper, "delivered": 12.125c. for the week.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
8	67[illegible]	68[illegible]	72	159	161[illegible]	23[illegible]	22[illegible]	25[illegible]	25[illegible]
9	67[illegible]	[illegible]	72	156[illegible]	158[illegible]	23[illegible]	22[illegible]	25[illegible]	25[illegible]
10		...	.	....					
12	67[illegible]	68[illegible]	71[illegible]	156	158[illegible]	23[illegible]	23	24[illegible]	25[illegible]
13	67[illegible]	68[illegible]	72	156[illegible]	158[illegible]	23[illegible]	22[illegible]	25	25[illegible]
14	67[illegible]	68[illegible]	72[illegible]	155[illegible]	158	23[illegible]	22[illegible]	25[illegible]	25[illegible]

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Sept.	Sterling Exchange "Check"	Silver			Sept.	Sterling Exchange "Check"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
8	372[illegible]	99[illegible]	63[illegible]	38[illegible]	12	373[illegible]	[illegible]	[illegible]	[illegible]
9	372	99[illegible]	63	38[illegible]	13	372	[illegible]	[illegible]	[illegible]
10	372[illegible]	99[illegible]	64[illegible]	[illegible]	14	370	[illegible]	65[illegible]	[illegible]

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, Sept. 14, 1921

Excepting satisfactory sales of lead, the metal markets were quiet during the last week, with prices steady. Fundamental conditions are reported improving in some lines of industry, particularly in New England, but no radical changes are taking place, and the recovery of the metal markets is likely to be a slow process.

Copper

The week has been particularly quiet, demand for both domestic use and export being weak. The fact that domestic consumers have not been tempted to buy [illegible] at an advancing market indicates that, regardless of price, they continue to be interested only in current requirements. The decline of foreign exchange has affected sales abroad. Germany has bought a small tonnage from dealers in London, but practically nothing from American producers during the last week. Japanese demand has also quieted down. Most all of the producers are optimistic, however, and almost every one is quoting from [illegible] to [illegible], delivered. By diligent shopping, however, it has been possible to secure copper at [illegible] delivered for September, and small lots have been sold at that price. One buyer is reported to have been in the market for 1,000 tons in the past day or two, and to have [illegible] up the market of all copper held at less than 12.25c. Prices for the coming week will depend upon whether there is sufficient demand to take care of the metal offered by those producers who make a practice of selling current production.

Lead

On Friday, Sept. 9, the American Smelting & Refining Co. advanced its official contract price from 4.50 to 4.60c.

Inquiries and sales have been numerous during the week, and though confined mainly to one- or two-hundred-ton lots, at least one sale of 1,000 tons was made. Most of the business has been for points east of Chicago. The St. Louis market has been quiet, with chemical lead freely offered at our prices, with few takers. Desilverized is somewhat scarcer and might command a slight premium in St. Louis, though obtainable in Chicago at the customary freight differential of 10 points from the St. Louis price. Practically all of the business has been for September delivery or shipment, though it is reported that November or December delivery might be had at about 10 points premium. Manufacturers of lead, with the exception of cable makers, report business to be improving. Corroders will be kept busy for the winter in catching up with their orders and laying in stocks, so that the demand for paint, which is seasonal, should not react unfavorably on the market for corroding lead.

Zinc

The recent advance in zinc to 4.20c., with some producers quoting 4.25c., was not what might be called a violent one, yet it seems to have been more than the market could stand, and the price has again shown a tendency to ease off. August shipments were reported to be about 7,000 tons over those for July, and production was close to 1,000 tons less. High-grade zinc continues to be quoted at about [illegible] per lb. delivered.

Tin

Tin has been even duller than usual during the last week, with most of the sales confined to five- or ten-ton lots. London interests are holding firm and apparently think well of the market. [illegible] and other 99 per cent grades have been [illegible] during the last day or two, but as the demand for [illegible] [illegible]

Arrivals of tin, in long tons: [illegible]

Gold

Gold in London: Sept. 8th, 110s. 1d.; 9th, 110s. 1d.; 12th, 110s. 2d.; 13th, 110s. 3d.; 14th, 110s. 4d.

An analysis of the gold movement to the United States, made by the National Bank of Commerce, shows that present European gold reserves are not being drained to swell America's holdings, but that the increments to this country's hoard since the first of the year, in so far as shipments from European points are concerned, are chiefly accounted for by three great streams of the metal, consisting of newly mined supplies from Africa coming by way of London; of gold yielded up by India, also coming by way of London; and of metal thought to have originated from Russian sources, eventually coming to America through various European countries.

Foreign Exchange

The principal feature of the exchange market has been the violent decline of German marks. The end is apparently not yet in sight, and there is considerable speculation as to a German financial crisis and non-payment of reparation demands. It is estimated that it would take half the world's stock of gold to redeem the outstanding German paper. Other European exchanges have inclined toward weakness, but sterling has held generally steady. Cables continue to be quoted at one-half cent premium over checks as given on page 475. On Tuesday, Sept. 13, francs were 7.17c.; lire, 4.2925c.; and marks, 0.925c. New York funds in Montreal, 11 3/16 per cent premium.

Silver

Prices in both London and New York have advanced considerably in the last week, and the market has broadened. Owing to the improvement in Eastern exchanges, China has again become a buyer, with the result that business in San Francisco has been done at higher levels than in New York. Today, however, with the reaction in sterling exchange, buyers are less keen.

Mexican Dollars—Sept. 8th, 49; 9th, 49; 10th, 49; 12th, 49⅝; 13th, 50¼; 14th, 50¼.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 18@20c. per lb.; 18½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 4.45@4.50c.; market dull. W.C.C. brand, 5.25c. per lb. Cookson's "C" grade, spot, 9c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6@7c.

Bismuth—$1.50@$1.55 per lb.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb., black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $160@$170 per oz.

[1]**Molybdenum Metal**—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb. f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominally, $52@$55 per oz.

Platinum—$72@$78 per oz., according to quantity.

Quicksilver—Market weaker at $42.50 @$43 per 75-lb. flask. Largely a jobbing business. San Francisco wires $42. Slow.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $25@$27; ground, $28; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—20@22c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 50c. per lb. of contained sulphide, New York. Quotation purely nominal.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70 @$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 10—Zinc blende, per ton, high, $23.30; basis 60 per cent zinc, premium and Prime Western, $20; fines and slimes, $19@$17; average settling price, all grades of zinc, $21.68 per ton.

Lead, high, $56.30; basis 80 per cent lead, $55; average settling price, all grades of lead, $51.37 per ton.

Shipments for the week: Blende, 4,169; lead, 1,560 tons. Value, all ores the week, $170,510.

No change was made in price offerings, but 4,600 tons less blende was purchased, the sales being 3,600 tons, against 8,200 tons last week. Lead ore price continues upward, another dollar being added to the basis price this week. Competition is sharp, and the higher lead prices are accelerating the production of blende in an effort to enlarge the output of lead, owing to the close association of the ores.

Platteville, Wis., Sept. 10—No sales of lead or zinc ore. Shipments for the week: Lead ore, 40 tons. Shipments for the year: Blende, 8,461; lead ore, 1,171 tons. Shipped during the week to separating plants, 546 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,500@ $2,000; No. 2, $850@$1,250; spinning fibers, $350@$850; magnesia and compressed sheet fibers, $225@$350; shingle stock, $95@$150; paper stock, $55@ $70; cement stock, $16@$27.50; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $23@$24 in bags, carload lots; (off-color) $21@$22 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Borax—Granulated, crystals, or powdered in bags, carloads, 5½c. per lb.; in bbls., 5¾c.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

---

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

China Clay (Kaolin)—Crude, $6.50@$8.50; washed, $9@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $25@$30, f.o.b. New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b. New England points.

Feldspar—No. 1 soap grade, $7@$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, $6@$6.50; No. 2, $5@$5.50. Market dull. Large stocks are available and quotations are nominal. Producers report cancellations of orders. No. 1, Canadian, ground, $26 f.o.b. cars.

Fluorspar—Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; ground, suitable for acid, chemical or enameling purposes, $32@$35; lump, $12.50, f.o.b. Lordsburg, N. M. Ground, acid grade, 97 per cent CaF$_2$, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, [illegible]

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined—Crude, $12@$15 per ton. High-grade caustic calcined lump form, $30@$40 per ton. Plastic calcined, $45@$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead Burned—$33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica—India block mica, slightly stained, per lb.: No. 6, 85c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $[illegible]@$[illegible]. Clear block, No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $4; No. 2, $4.50; No. 1, $5; A1, $6.50@$8.50, extra large, $25; ground, wallpaper grade, $[illegible]@$150 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite**—Minimum of 6 per cent thorium oxide, $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $11.65; 75 per cent, $10.65; 75@74 per cent, $10.15; 70 per cent, $6.25; 68 per cent, $5.75; 68@66 per cent, $5.50.

Pumice Stone—Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 14c.; Spanish lump, 13@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica—Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $7.50@$11 per ton; less than carload, $25, f.o.b. cars. Imported, $30@$40; Canadian, $18@$40 per ton.

Mineral Products

Arsenic—6c. per lb.

Sodium Nitrate—$2.10@$2.30 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $12.50 per ton, f.o.b. in bulk. Western mines, spot and six months' contract; $20@$25 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.25 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 11½c. per lb. of chromium contained; 4 to 6 per cent carbon, 11@12c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $[illegible]@$67, f.o.b. furnace, [illegible], $[illegible], delivered; English, $[illegible]@$67, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $[illegible]@$[illegible], f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal with low sulphur, phosphorus, and arsenic, $2.25 per lb. of contained metal, f.o.b. works. Imported material, $1.70@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $[illegible]@$[illegible]; 50 per cent, $60@$65; 75 per cent, $[illegible]@$[illegible].

Ferrotungsten—Domestic, [illegible] per cent W., [illegible] per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$4.25@$4.50 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 19.50c. per lb.; wire, 13.75c.

Lead Sheets—Full lead sheets, 7¾c.; cut lead sheets, 8c. in quantity, mill lots.

Nickel Silver—[illegible] per lb. for 18 per cent nickel, Grade "A" sheets.

Yellow Metal—Dimension sheets, 16.25c.; sheathing, 15.25c.; rods, [illegible] to 3 in., 13.25c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $50 per ton; 76 per cent, $90@$95 f.o.b. works.

Chrome Cement—40@45 per cent Cr$_2$O$_3$, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—$52@$55 per net ton.

Fire Brick—First quality, 9-in. shapes $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $65@$70 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000: $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Sept. 13, 1921

Demand for steel products seems to be increasing at a slightly better rate this month than in August. Steel-ingot production in August was at the rate of 30 per cent of capacity.

Finished-steel prices have now become relatively steady. Bars, shapes, and plates are quotable roughly at about 1.70c. Sheets are steady at 2.25c. for blue annealed, 2.75c. for black, and 3.25c. for galvanized.

Wire products actually show an advance, the American Steel & Wire Co. announcing an advance of $[illegible] a ton on plain wire and $[illegible] on nails, both wire and [illegible] products. Independents are [illegible]. As [illegible] of the trade [illegible] up for a short time at the old prices. Plain wire is now 2.60c. and nails $2.90.

Pig Iron—After a little buying recently, foundry iron is quieter, but [illegible] Valley, is [illegible] the present [illegible]. [illegible] at $[illegible] and [illegible] at $[illegible].

Steel—Prices are largely nominal, in the absence of actual transactions. Billets, slabs and sheet bars are all about $[illegible]. The leading interest's price [illegible] an advance from $[illegible] to $[illegible].

Coke

Connellsville—Furnace, $[illegible]@$3.25; foundry, $[illegible]@$4.50.

---

[1] Foote Mineral Co., Philadelphia, Pa.

Platinum Market Since 1900 Shows Wide Variations

Prices Now Far Above Pre-War Levels, but a Greatly Diminished World Production, With a Normally Sustained Demand for This Useful Metal, Points to Only a Slow Return to Lower Figures—Russia an Uncertain Element

EDITORIAL MARKET STUDY

PLATINUM is a fascinating metal. Of much rarer occurrence than gold, it possesses valuable characteristics that make its use in certain industries well-nigh indispensable. Were it more plentiful, there is little doubt that platinum would be used for coinage purposes, and that it would be a fitting companion to the two precious metals, gold and silver, in the discharge of their important functions as currency and monetary reserves. Platinum coins once were minted by the Russian government at a time when the metal was less valuable than gold, and only recently announcements were made that the Soviets contemplated the introduction of new platinum coinage. Because platinum is so scarce and its production so erratic, price fluctuations have been wide, a condition which hardly lends itself to the economic use of the metal for coinage.

In 1900, the annual average price of platinum was $18 per oz.; in 1910, $32.70, and in 1920, $110 per oz. The following table, giving the average since 1899, shows how greatly platinum has risen in value in recent years:

1899	$15 22	1911	43 12
1900	18 09	1912	45 55
1901	20 00	1913	44 88
1902	19 00	1914	45 14
1903	18 91	1915	47 13
1904	19 50	1916	83 40
1905	20 34	1917	102 82
1906	28 04	1918	105.95
1907	30 98	1919	114 61
1908	16.32	1920	110 90
1909	24 87	1921 (Aug.)	73.22
1910	32 70		

In appearance, platinum closely resembles a host of common metals such as iron, nickel, silver, tin, german silver, and many alloys. There is nothing distinctive about its color, and were that characteristic the only appeal, little platinum would be purchased for jewelry. However, as platinum is several times as valuable as gold, it is prized for its higher worth. The craze for luxuries, which found its fullest expression during the war, created a great demand for expensive platinum jewelry.

The decline of platinum from its peak price, $155 per oz. in January, 1920, to its present level of from $75 to $80, is partly accounted for by the decreased consumption in personal adornments.

Russia has been the world's greatest platinum-producing country, and, before the war, accounted for about 90 per cent of the world's production, with an annual output of 250,000 to 300,000 oz. During the war and the chaotic period which followed, operations in Russian platinum fields were severely hampered and production declined to about 25,000 or 30,000 oz. annually. As a consequence, another platinum-producing country, Colombia, which ordinarily produced about one-ninth as much platinum as Russia, is now the world's chief producer. Its leadership is only temporary, and will undoubtedly vanish as soon as the Russian platinum dredges again operate in full force. The following table shows the estimated pre-war and post-war platinum production of the world, the figures being given in ounces:

	[illegible]	1916	1920
Russia	[illegible]	63,900	25,000
Colombia	[illegible]	25,000	35,000
New South Wales and Tasmania	[illegible]	250	1,400
Other countries	[illegible]	900	900
Totals	[illegible]	90,050	62,300

The great drop in the Russian output during the war, and the strong industrial demand, caused prices to soar, but the present industrial quietness and the uncertain nature of Russian holdings of platinum have introduced some unstable elements into the situation. Russian supplies of platinum are not accurately known, but are placed at not over 100,000 oz. by people in close touch with the market. In normal times this figure would represent about one-third the world's production for one year, and would occasion no alarm, but this amount is more than twice the present world's production.

Occasionally some Russian platinum has filtered out of the country, and the fear of an imminent deluge has more than once been responsible for some hasty selling of the metal. The drop in platinum which carried the metal recently down to $65, the lowest price in five years, is attributed mainly to the quick disposal of some Colombian platinum by a holder who had become uneasy over the Russian supplies.

The platinum market is exceedingly sensitive, and a small volume of sales has a marked effect in determining the market price of the metal. Being so valuable, it takes but the trading of a few handfuls to run up in thousands of dollars. Rumor frequently works havoc with any market, and platinum has been no exception. Recently, the U. S. Government announced that it had some scrap platinum for sale, but the announcements showing the platinum content of the scrap mistakenly carried the decimal point in the wrong place, making it appear that a larger quantity of platinum was available. As a result those dealers uninformed as to the true situation became uneasy, and the market showed a decided weakness over the prospect of having to absorb a large amount of scrap.

The U. S. Geological Survey estimates that about 115,165 oz. of platinum was consumed in the United States during 1918 and 154,743 oz. during 1919, with the following percentage distribution of consumption:

Industry:	1918	1919
Chemical	41	7
Electrical	25	19
Dental	17	14
Jewelry	12	56
Miscellaneous	5	4
Metal consumed (ounces):		
Platinum	100,810	133,680
Iridium	5,302	7,501
Palladium	9,053	13,562

The use of platinum in 1918 was greatest in the chemical industries, chiefly in the manufacture of sulphuric acid by the contact process, in which platinum is used as a catalyzing agent. Chemical and electrical requirements, being essentially war needs, carried priority over other uses. In 1919 the war was over and the increased use in jewelry became greater than all other outlets combined.

Consumption of platinum in the United States is normally about 150,000 oz. annually, of which about 40 per cent goes into jewelry, 20 per cent into electrical goods, 25 per cent into dental needs, and 15 per cent for chemical purposes. The platinum resources of the United States are slim, and supply only about 8 per cent of requirements.

No extended calculations are necessary to a realization that if the normal requirements of this country are 150,000 oz., and the world supply is less than half this amount, platinum prices have an excellent opportunity to stay where they are until there is some radical change in the Russian situation. The statistical record of platinum points to more or less of a scramble to make the world's supply go around, and indicates that the return to pre-war prices—if there is to be a return—will be long drawn out.

The present outlook for platinum is quite cheerful. Although the market is still far above a pre-war level, and deflation has not had a great effect upon platinum, the situation is utterly different from that which other metals have passed through. There is no overproduction, and surplus stocks, although not definitely known, are not unusually large. Unfortunately, platinum production in the United States is so small that few miners and producers can take advantage of the present market.

Mexico's Silver and Gold Production

The following official table gives data as to the silver and gold produced in the Republic of Mexico for the first six months of 1920 and 1921 respectively.

PRODUCTION OF SILVER
In Troy Ounces

	1920	1921
January	[illegible]	[illegible]
February	[illegible]	[illegible]
March	[illegible]	[illegible]
April	[illegible]	[illegible]
May	[illegible]	[illegible]
June	[illegible],851,718	[illegible]
Total for six months	[illegible]	[illegible]
Difference in favor of 1920	[illegible]	
Value of silver produced, pesos	77,483,701	42,599,405
Difference in favor of 1920	24,884,296	

PRODUCTION OF GOLD
In Troy Ounces

	1920	1921
January	[illegible]	69,380
February	[illegible]	57,709
March	64,975	51,697
April	[illegible]	45,235
May	[illegible]	54,751
June	[illegible]	41,797
Total for six months' period	[illegible]	320,569
Difference in favor of 1920	53,416	
Value of gold produced for six months' period, pesos	15,980,170	13,463,898
Difference in favor of 1920	2,516,272	

VALUE OF SILVER AND GOLD PRODUCED
SIX MONTHS' PERIOD
In Pesos

	1920	1921
Silver	77,483,701	42,599,405
Gold	15,980,170	13,463,898
Total	93,463,871	56,063,303
Difference in favor of 1920	37,400,568	

Zinc Production Declined, Stocks Increased, During First Six Months of 1921

Figures compiled by C. E. Siebenthal and A. Stoll, of the U. S. Geological Survey, from reports submitted by all zinc smelters which operated during the first six months of 1921, show that the production of zinc from domestic ore in that period was 100,781 short tons, and from foreign ore 1,744 tons, a total of 102,525 tons, as compared with 205,269 tons in the last half of 1920 and 258,108 tons in the first half. The stock of zinc held at smelters and in warehouse June 30 was 94,747 tons, having increased from 71,0[illegible] tons at the end of 1920 and 29,892 tons at the middle of that year.

From the foregoing figures, and from the statistics of imports and exports as recorded by the Bureau of Foreign and Domestic Commerce, it is calculated that the apparent consumption for the period was 83,965 tons, as compared with 147,783 tons in the last half of 1920 and 175,268 tons in the first half.

In addition to the zinc produced from ore, 11,950 tons was redistilled from zinc ashes, skimmings, and drosses. Much of this zinc was of grades above Prime Western, and the total, added to the primary output, gives 114,475 tons, consisting of 13,358 tons of "high" grade, 1,106 tons of "intermediate" grade, 17,466 tons of "select and brass special" grade, and 82,545 tons of "Prime Western." Electrolytic was [illegible] to 4,617 tons, as compared with 27,591 tons in the last half of 1920 and with 24,035 tons in the first half.

The total number of retorts at plants at which there were some operations during the first half of 1921 is 123,528, as compared with [illegible] at the end of 1920. The number of retorts in operation on June 30, 1921, was [illegible], as compared with [illegible] at the end of 1920 and 95,000 on June 30, 1920.

The demoralization of the zinc industry during the half year, with imports of 7,405 tons, exports of [illegible] tons, and apparent consumption of 83,965 tons, is strikingly shown by comparison with the two periods of 1919 and the first half of 1920, when imports were nothing, exports from [illegible] to [illegible] tons, and consumption was from 160,000 to 175,000 tons.

The output of zinc by Belgian smelters in the first half of 1921 was [illegible] short tons, as compared to a total of [illegible] tons in 1920. The output in June was [illegible] tons. It is understood that the monthly output has been limited by the Federation of Belgian Zinc Smelters to 5,000 tons.

World zinc stocks have been recently stated as about 160,000 short tons, exclusive of the stocks of sheet zinc, of which Belgium is reported to hold [illegible] tons.

The Bunker Hill & Sullivan Mining Co. has been experimenting with the electrolytic reduction of zinc ores for some time, and has been recently operating a pilot plant, from the results of which it has decided to install a plant capable of handling the zinc of the Star mine and of the Pine Creek district. An experimental electrolytic zinc plant has been started at Rhodesia, Broken Hill, Africa.

ZINC STATISTICS, 1919-1921, [illegible]
In Short Tons

	1919 First Half	1919 Last Half	1920 First Half	1920 Last Half	1921 First Half
Supply:					
Stock at beginning of period	41,241	[illegible]	[illegible]	[illegible]	71,0[illegible]
Production: From domestic ore	247,584	[illegible]	[illegible]	[illegible]	[illegible]
From foreign ore	7,918	[illegible]	[illegible]	[illegible]	1,744
Imports (mostly scrap): Foreign	45	25	16	2	6,674
Domestic returned				8,162	731
Total available	296,788	[illegible]	[illegible]	243,325	[illegible]
Withdrawn:					
Exports, foreign, from warehouse	9,620	2,636	[illegible]	1,442	384
Exports, foreign, under drawback	3,727	806	141	[illegible]	[illegible]
Domestic exports: Slabs	52,989	56,757	55,293	[illegible]	442
Sheets	11,300	8,462	7,628	[illegible]	1,016
Stock at end of period	59,651	36,793	29,892	[illegible]	94,747
Total withdrawn	137,287	105,454	[illegible]	95,542	[illegible]
Apparent consumption	159,501	164,463	175,268	147,783	83,965
Zinc smelted in:					
[illegible]	14,029	17,408	16,523	14,958	8,631
Illinois	(a) 61,701	(a) [illegible]	(a) [illegible]	(a) 47,240	24,676
Kansas	22,434	21,908	21,690	[illegible]	7,824
Oklahoma	65,272	56,716	65,297	45,203	[illegible]
Pennsylvania	37,108	30,413	38,131	36,103	20,690
Other States	32,147	23,312	30,821	14,820	14,746
Electrolytic zinc	23,211	3,845	24,035	27,591	4,617
Total primary zinc	255,502	210,241	258,108	205,269	102,525
Redistilled secondary zinc	7,328	12,420	12,474	8,897	[illegible]
Total	262,830	222,661	270,582	214,166	114,475
Grade A, high grade	30,134	15,223	41,177	39,536	13,358
Grade B, intermediate	25,802	13,371	17,310	16,583	[illegible]
Grade C, select and brass special	43,481	97,436	37,917	[illegible]	17,466
Grade D, Prime Western	[illegible]	96,631	[illegible]	[illegible]	[illegible]
Total	262,830	222,661	270,582	[illegible]	[illegible]
Zinc ore imported	18,570	30,079	45,388	[illegible]	[illegible]
Zinc content of imported ore	6,314	10,695	[illegible]	[illegible]	2,652
Zinc content of ore in warehouse at end of period (b)	10,996	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1,113	[illegible]	[illegible]	[illegible]
[illegible] at end of period	158,988	157,004	[illegible]	[illegible]	[illegible]
Total [illegible] at end of period	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(a) [illegible]
(b) [illegible]

Ontario Gold Production Improving

A report of the Ontario Department of Mines for the first six months of 1921 shows that at the present rate of production the total output of gold in Ontario for 1921 will be about [illegible], as compared with 1920, when it was [illegible]. Details of production for January to June, 1921, however, are given below.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]				
Kirkland Lake	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

MINING STOCKS

Week Ended September 10, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Ahmeek	Boston	45	44½	45	Sept. '20, Q	$0 50
Alaska-Br. Col.	N. Y. Curb	*61	*40	*52		
Allouez	Boston	†19	†17	17	Mar. '19	1 00
Anaconda	New York	38¾	35⅛	38¾	Nov. '20, Q	1 00
Arcadian Consol.	Boston	1¾	1¾	1¾		
Ariz. Com'l.	Boston	8½	7½	8	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*24	*21	*24		
Bingham Mines	Boston	10¼	9⅜	10	Sept. '19, Q	.25
Calumet & Arizona	Boston	..	.	45½	June '21 .Q	50
Calumet & Hecla	Boston	230	224	230	June '20, Q	5 00
Canada Copper	N. Y. Curb	*38	*30	*35		
Centennial	Boston	8¼	8¼	8¾	Dec. '18, SA	1 00
Cerro de Pasco	New York	27⅞	26¼	27¼	Mar. '21, Q	.50
Chile Copper	New York	11¼	9⅞	11⅛		
Chino	New York	24¼	22½	23⅝	Sept. '20, Q	37½
Columbus Rexall	Salt Lake	*19	*16	*18½		
Con. Arizona	N. Y. Curb	. . .		*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1	*90	1		
Copper Range	Boston	34½	32½	33	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*40	*34	*36		
Davis-Daly	Boston	6	5⅞	5⅞	Mar. '20, Q	.25
East Butte	Boston	9½	7½	8¼	Dec. '19, A	.50
First National	Boston Curb	*54	*54	*54	Feb. '19, SA	.15
Franklin	Boston	1⅝	1½	1½		
Gadsden Copper	N. Y. Curb	....	....	*25		
Granby Consol.	New York	18	17	18	May '19, Q	1 25
Greene-Cananea	New York	22	20½	22	Nov. '20, Q	.50
Hancock	Boston	2	1½	2		
Howe Sound	N. Y. Curb	2½	2⅛	2½	Jan. '21, Q	05
Inspiration Consol.	New York	35	32⅞	34⅞	Oct. '20, Q	1 00
Iron Cap	Boston Curb			5½	Sept. '20, K	25
Isle Royale	Boston	†18	†18	18	Sept. '19, SA	.50
Kennecott	New York	20½	18⅛	20¼	Dec. '20, Q	.50
Keweenaw	Boston	1	1	1		
Lake Copper	Boston	2½	2⅛	2⅞		
La Salle	Boston	†2	†1⅞	1½		
Magma Chief	N. Y. Curb			*7		
Magma Copper	N. Y. Curb	*19⅞	*19⅛	*19⅛	Jan. '19, Q	.50
Majestic	Boston Curb	.		*5		
Mason Valley	Boston	1¾	1⅞	1⅞		
Mass Consolidated	Boston	1½	1¼	1¼	Nov. '17, Q	1 00
Miami Copper	New York	21½	20¼	21½	Aug. '21, Q	.50
Michigan	Boston	2	2	2		
Mohawk	Boston	48½	46½	48½	Nov. '20, Q	1 00
Mother Lode Coa.	N. Y. Curb	4¼	4	4¼		
Nevada Consol.	New York	11¼	10½	11⅛	Sept. '20, Q	.25
New Baltic	Boston Curb			3		
New Cornelia	Boston	13½	12½	13¼	Aug. '20, K	.25
North Butte	Boston	9¾	8¾	9¼	Oct. '18, Q	.25
North Lake	Boston	*25	*25	*25		
Ohio Copper	N. Y. Curb	*6	*6	*6		
Old Dominion	Boston	23½	21½	23	Dec. '18, Q	1 00
Osceola	Boston	25½	25½	25½	June '20, Q	50
Phelps Dodge	Open Mar.	†1 50	†1 40		July '21, Q	1 00
Quincy	Boston	37	34½	37	Mar. '20, Q	1 00
Ray Consolidated	New York	13¼	12	13¼	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*20	*15	*20		
St. Mary's Min. Ld.	Boston	36	35	35½	June '20, K	2.00
Seneca Copper	Boston	.		13¼		
Shannon	Boston	1	*90	*90	Nov. '17, Q	.25
Shattuck Arizona	New York	7	6¼	7	Jan. '20, Q	.25
South Lake	Boston	†1½	†*50	1		
Superior & Boston	Boston	1½	1½	1½		
Tenn. C. & C. cfs.	New York	8¼	7¼	7¾	May '18, I	1 00
Tuolumne	Boston	†*45	†*40	*39	May '13,	.10
United Verde Ex.	Boston Curb	23¾	22½	23¼	May '21, Q	25
Utah Consol.	Boston	3½	3¼	3¼	Sept. '18,	.25
Utah Copper	New York	51½	46¼	51½	June '21 Q	.50
Utah Metal & T.	Boston	1⅛	1 1/16	1⅛	Dec. '17,	.30
Victoria	Boston	†1⅞	†1⅛	1½		
Winona	Boston	*50	*50	*50		
Wolverine	Boston	12	12	12		
		NICKEL-COPPER				
Internat. Nickel	New York	14½	12¾	14½	Mar. '19,	.50
Internat. Nickel, pf.	New York			80	Aug. '21, Q	1.50
		LEAD				
National Lead	New York	75¼	73½	75	June '21, Q	1 50
National Lead, pfd.	New York	103½	103½	103½	June '21, Q	1 75
St. Joseph Lead	New York	11¼	11	11¼	June '21, Q	.25
		QUICKSILVER				
New Idria	Boston	†*50		*50		
		ZINC				
Am. Z. L. & S.	New York	8¼	7½	8¼	May '20,	1 00
Am. Z. L. & S. pfd	New York	25	25	25	Nov. '20, Q	1 50
Butte C. & Z.	New York	4¼	4⅛	4½	June '18,	.50
Butte & Superior	New York	15	12¾	13¼	Sept '20,	1.25
Callahan Zn-Ld	New York	4¼	3¾	4¼	Dec '20, Q	50
New Jersey Zn	N. Y. Curb			115	Aug. '21, Q	2 00
Success	N. Y. Curb			*2	July '16,	03
Yellow Pine	Los Angeles	†*48	....	*55	Sept. '20, Q	.03
		GOLD				
Alaska Gold	New York	⅝	½	½		
Alaska Juneau	New York	1½	1¼	1¾		
Carson Hill	Boston	14⅝	13½	13⅝		
Cresson Consol. G.	N. Y. Curb	1⅞	1¾	1¾	June '20, Q	$0.10
Dome Extension	Toronto	*65	*65	*65		
Dome Mines	New York	17¼	16⅞	17	July '21, Q	.25
Florence Goldfield	N.Y. Curb	*47	*33	*42		
Golden Cycle	Colo. Springs	*66	*66	*66	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*7	*6	*7	Dec. '19,	.05
Hollinger Consol.	Toronto	7 37	7.33	7.35	Sept. '21, 4 wks.	.05
Homestake Mining	New York	55¼	55½	55½	Aug. '21, M	.25
Kirkland Lake	Toronto	*40	*35½	*38		
Lake Shore	Toronto	1 28	1.25	1.28	Aug. '21, K	.02
McIntyre-Porcupine	Toronto	2 00	1 94	1.95	Sept. '21, K	.05
Porcupine Crown	Toronto	*18	*16	*17½	July '17,	.03
Porcupine V. N. T.	Toronto	*20	*17½	*20		
Portland	Colo. Springs	*40	*40	*40	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	.	. . .	*4	May '19,	.05
Schumacher	Toronto	*24	*22	*22½		
Silver Pick	N. Y. Curb	*10	*9	*9		
Teck Hughes	Toronto	*17½	*16¼	*16		
Tom Reed	Los Angeles	*70	*65	*70	Dec. '19,	.02
United Eastern	N. Y. Curb	2 7/16	2¼	2⅜	July '21, Q	.15
Vindicator Consol.	Colo. Springs	*25	*25	*25	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*4	*4	*4		
Yukon Gold	N. Y. Curb	*98	*95	*98	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*20	*18	*20	Apr. '20, M	.03
Batopilas Mining	New York	.	.	⅝	Dec. '07, I	.12½
Beaver Consol.	Toronto	*27	*25	*27	May '20, K	.03
Comagas	Toronto	1 60	.	1 60	May '21, Q	.12½
Crown Reserve	Toronto	*11	*8½	*11	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3⅝	3⅜	3½	July '21, Q	.12½
La Rose	Toronto	*28	*26	*27¾	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*19	*15	*19	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.14	1.05	1 13	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4½	4⅜	4½	July '21, Q	15
Ontario Silver	New York	. . .	.	3½	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	.	. .	*11	Jan. '12,	10
Temiskaming	Toronto	.	*18	*18	Jan. '20, K	.04
Trethewey	Toronto	*14	*10	*11½	Jan. '19,	.05
		GOLD AND SILVER				
Barnes-King	Butte	.	. .	*60	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*72	*66	*72		
Cash Boy	N. Y. Curb	*4	*3	*3		
Consol. Virginia	San Francisco	*31	*30	*21		
Dolores Esperanza	N. Y. Curb		.	1½		
El Salvador	N. Y. Curb	*22	*16	*17		
Jim Butler	N. Y. Curb	*8	*8	*8	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	. . .	....	*4	June '16,	.05
Louisiana Con.	N. Y. Curb	.	.	⅛		
MacNamara M. & M.	N. Y. Curb	*17	*12	*17	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.		. . .	4	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 3/16	1⅛	1 1/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*75	*70	*71		
Tonopah-Extension	N. Y. Curb	1 5/16	1 5/16	1 5/16	July '21, Q	05
Tonopah Mining	N. Y. Curb	1 1/16	1 1/16	1 1/16	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	*95	*80	*88	Dec. '19, SA	05
		SILVER-LEAD				
Caledonia	N. Y. Curb	. . .	....	*8	Jan. '21, M	01
Cardiff M. & M.	Salt Lake	....	. .	1 00	Dec. '21,	.15
Chief Consol.	Boston Curb	2⅜	2¼	2¼	Aug. '21, Q	.05
Consol. M. & S.	Montreal	15	14¾	15	Oct '20, Q	62½
Daly Mining	Salt Lake	†2 50	†1 30	. .	July '20, Q	.10
Daly-West	Boston	2½	2	2¼	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	.	.	2	Apr. '21, K	.05
Electric Point	Spokane	*6½	*6	*6	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*31	*27	*30		
Federal M. & S.	New York	.	.	7	Jan. '09,	1.50
Federal M. & S. pfd	New York	22¾	22	22¾	June '21, Q	1.00
Florence Silver	Spokane	*11	*10	*10	Apr. '19,	.01¼
Grand Central	Salt Lake	†*28	†*10	. . .	June '20, K	.03
Hecla Mining	N. Y. Curb	4 1/16	4	4	June '21, Q	.08
Iron Blossom Con.	N. Y. Curb	.	....	*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†3.00		....	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	....	. .	*3	June '21, I	02
Prince Consol.	Salt Lake	*8¾	*7½	*8½	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*2½	*2	*2	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*10	*8	*10		
South Hecla	Salt Lake	†*30	†*20		Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*8	*8	*8	Oct. '17,	.05
Stewart Mining	N. Y. Curb	.		*4	Dec. '15	.05
Tamarack-Custer	Spokane	1 70	1 70	1 70	Jan. '21 K	.04
Tintic Standard	Salt Lake	2 02½	1.85	1.97½	July '21, Q	.05
Utah Apex	Boston	2	1⅞	2	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*2	*2	*2	Nov. '17,	.01
		VANADIUM				
Vanadium Corp.	New York	35⅛	30⅞	34⅞	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	44	42	44	July '21, Q	1.50
Asbestos Corp., pfd.	Montreal	68	68½	68½	July '21, Q	1.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	38	34⅞	38	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	70¼	66	70¼	Sept '21, Q	1.75
Am. Sm. pf. A	New York	69	69	69	July '21, Q	1 50
U. S. Sm. R. & M.	New York	30½	29½	30½	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	New York	39	39	39	July. '21, Q	.87

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
[illegible] M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, September 24, 1921 *Number* 13

Should the Institute Increase?

WE REPEATEDLY FIND among those who are interested in the welfare of the Institute and devoted to its progress, the feeling that the membership should increase, until it is not ten thousand, but twelve, fifteen, twenty thousand; that this is the index of health and the measure of prosperity, and something to be pushed most assiduously.

We wonder why. For yourself as a member of the Institute, will it be of more value to you, can you through it be of greater service, if it has fifteen thousand than if it has ten? We are afraid we miss the point. We remember a boy who gloried in the population of cities; many point with pride to the fact that New York is larger than London; and not a few refer, with the self-satisfaction of having in some way been personally meritorious, to the "hundred millions" of the United States. Yet China has four hundred million, and India teems with the merit of population, if there be any merit there. Athens, as we remember, was remarkable neither for acreage nor population; nor were the passengers on the "Mayflower" more than a hundred and twenty-one.

The ideal of an increasingly large poll of Institute members does not, it seems to us, reflect any desire on the part of the present membership; nor does it offer any hope of correspondingly increased efficiency or results. It must be, then, that the ambition originates in the management, in a desire to make a good showing for their stewardship, and, very likely, in part in the plain need of additional funds to meet the Institute overhead expenses. If it is the desire to make a showing, then we submit the query whether such a showing of increased membership really means much one way or the other; if the drive is for ever-increasing funds, then we believe such a motive is not worthy of a technical society. Let the membership be determined entirely by other than monetary considerations; then fit the overhead expenses to the funds actually in hand. If the society can only keep a jump or two ahead of the sheriff by a constant proselyting with a view to more dues, then the direction of the funds is too ambitious, and the main object of the society and its directors—which is scientific and technical—becomes more and more distorted into that of a commercial organization or a business plant.

The Production of Coal

METAL MINERS are likely to consider the production of coal a dissociated industry, a thing apart, and one which has little in common with the mining or preparation of metals. Little thought is given to the why and wherefore, excepting in general discussions on the efficiency that its use may or may not produce in the boiler room at the mine or smelter. They are apt to assume a blasé air when the subject is mentioned—"Oh, yes; there is probably some work connected with its production, but not at all comparable with our own mining, milling, and metallurgical problems."

But long ago we all learned that the moon was not made of green cheese, and from time to time we find that certain other cherished ideas are more or less mistaken.

Actually, in a period of great depression, such as the metal mining industries are now experiencing, a visit to the coal districts is somewhat of an inspiration, and it was rather with a feeling of envy that we viewed the activities that are present on every side. The towns, mines, and plants have a busy appearance; there are no signs of idleness, and everywhere there is the expression of confidence that comes with the knowledge that conditions are all that they should be.

We expected that some advances had been made in the mining and preparation of coal, but it was somewhat of a surprise when we were given the opportunity to view the operation of the latest thing in the way of a modern breaker, and be initiated into the intricacies of anthracite coal preparation.

The Marvine breaker of the Hudson Coal Co., near Scranton, which was visited by the Institute the morning of Sept. 13, is the newest and most modern plant in the anthracite district. Here one may see operations of conveying, screening, shaking, slushing, jigging, classifying, and tabling conducted in a manner that is not comparable to the practice in the metal field. In metal mining, no attempt is made to prevent the breakage of ore in transit through the mill; in fact, its disintegration is encouraged as much as possible. But with coal the rule is opposite, and a maintenance of continual flowage of the coal is necessary to prevent breakage. So it is that an elaborate system of spirals and curves confront the coal at every turn and prevent unnecessary shocks. The entire operation is one of intense interest, from the time the coal leaves the head house until the final sizes are reached.

The Tacna-Arica Problem

MINERAL NITRATES and copper in South America bid fair to influence world politics quite in the same way as iron and potash in France and Germany, or coal and zinc in Germany and Poland. The German-Polish contest for great coal and zinc resources goes to the world by the name of Upper Silesia; the great iron-potash resources contested for by France and Germany have long embroiled the world in war and devastation under the name of Alsace-Lorraine. The South American nitrates contested for by Chile and Peru go under the name of "Tacna-Arica," the names of the two provinces or departments inclosing the disputed territory.

This territory, before the war between Bolivia, Peru and Chile, was considered Peruvian, but was held of little value, and after the war it was turned over to Chile for ten years, with the agreement that at the end of that period a plebiscite, or vote of the population, should determine whether it should thenceforth be Chilean or Peruvian. The same foolish method of determination, that of a plebiscite, it will be remembered, was fixed upon by the Allied Council for the disposition of the coal and zinc which goes by the name of Upper Silesia; but when it comes to the actual working out of this infantile expedient it has not been found to be satisfactory, and still remains undetermined.

The same unsatisfactoriness developed in the plan for the disposal of Tacna-Arica. Valuable nitrates were discovered in the province and copper mines were opened; but in the meantime Chile had already apparently disposed of her possible ownership by agreeing that if she obtained, by the plebiscite, possession of Tacna-Arica, she would sell it to Bolivia so that that land-locked country might have an outlet to the Pacific through the port of Arica. Mark, then, how the discovery of valuable minerals changed all this. Chile becomes reluctant to give up that possession which is nine points of the law, and quite rivals the later example of the Supreme Council in the Upper Silesian matter in her failure to carry out a definitive plebiscite.

Later Bolivia entered into a treaty with Chile whereby Chile agreed to give the former country free access to the sea through certain of her ports. Argentina meanwhile has become mixed up in this mess, through negotiations with Bolivia. Here is then a pretty kettle of fish, or, better, cauldron of nitrates. Bolivia has appealed to the League of Nations to settle the question, but Chile falls back on the Monroe Doctrine and denies the League right to interfere in matters in the Western Hemisphere. It will be remembered that lately Panama appealed to the League in the Panama-Costa Rica controversy, over the decision of the American State Department as referee, but that the State Department, to put it colloquially, "sat down hard" on Panama.

But the fact that Argentina withdrew from the League meetings spectacularly last year, and that this year eight Latin-American countries are unrepresented in its meetings, as is the United States, indicates unwillingness of the Western Hemisphere nations to submit their troubles to the existing World League, and a tendency of not only the United States but Latin America to conceive of the Monroe Doctrine as a right prior to the World War developments.

Mexico Beginning To Look Attractive

MANY PARTS OF MEXICO are not undesirable places in which to pass a winter, and it is likely that many mining men now unemployed will feel the urge to go there rather than pass the coming season further north in idleness. Conditions continue to improve in our southern neighbor, at least as far as external appearances go, and early recognition of the Obregon government seems assured. Such recognition will go far toward renewing the confidence of Americans who have not kept in touch with what was going on in that country, but who have unjustly supposed that it was overrun with desperadoes and that no mining claim was safe. There are probably few parts of Mexico now where justice cannot be obtained. Increased mineral development of the country will mean greater prosperity for the inhabitants, which will in turn result in more confidence in the government and make for increasingly stable conditions.

More activity has recently been reported at the Mexican smelters, and representatives of large interests, as well as numerous individuals, are beginning to pick up desirable properties, both new prospects and old mines which for one reason or another have been abandoned. There are many desirable small mines which a group with a little capital can make into profitable producers by building a 50- or 100-ton mill and providing simple mine equipment.

Mexico is fortunate in being particularly rich in those metals which it is most profitable to mine at present—silver, lead, and gold. Silver and lead are both above pre-war prices, with no apparent reason why prices should go lower. Gold production costs are coming down, and the mining and extraction of that metal is becoming a profitable operation.

A note of warning must be sounded to those without capital and who have never been in Mexico. They are likely to find employment there as difficult to secure as at home, and there are no gold nuggets lying untouched in the stream-beds, as some newspaper reports would indicate. The country has been pretty thoroughly prospected for several hundred years. The opportunities are more for the man who has the necessary capital and energy to develop known deposits. He who has no knowledge of the country, its language or customs should beware. Opportunities for mining are not to be found everywhere, and success will tend to concentrate on those who know the ropes. It is difficult, in many cases, to determine present ownership.

The United States citizen must not forget that he is a foreigner in Mexico, and not always a welcome one either; and he must be careful of his conduct and bearing if he is to win the confidence and respect of those with whom he comes in contact.

The Mine-Shaft Telescope

NEWS COMES to us through the newspapers that a deep mine shaft in the high altitudes of Chile is to be used as the barrel of a great telescope through which to get snapshot photographs of Mars, from an apparent distance of a mile and a half. In this way "B. McAfee, American scientist and collaborator with David Todd, the well-known American astronomer," expects to prove that life exists on Mars, the planet whose straight line markings, netting over its globe, have been surmised by Professor Lowell and others to be irrigation canals, spreading over the arid equatorial and intermediate zones the water derived from the annual melting of the polar ice-caps, which are plainly visible with the present telescopes.

It is gratifying that some use has been found for a mine shaft which has failed to encounter ore or from which all ore has been extracted. The painful jocularity of the suggestion that the expensive mine shaft be cut up and sold for post-holes may now be replaced by some novel pleasantries.

It makes little difference, of course, as a source for pleasantries, that the report is probably misleading. Already, a Harvard professor of astronomy has declared it "bunk; absolutely bunk." We have, indeed, come to know beforehand that mining news which we read in the newspapers is bunk. Said newspapers, even those which boast of printing "nothing but the truth" or "all the news that's fit to print," have an uncanny instinct for the unreliable when they touch on mining, which is a problem in psychology, and, therefore, we will not pursue it further here.

Governmental Research Through Industrial Laboratories

THE OLD STORY of Mohammed and the mountain has many applications, and the latest is that in which the U. S. Bureau of Mines stands for Mohammed, while the mountain is represented by appropriations for technical research in non-metallic minerals. When, through what may be mildly termed Congressional reserve, instead of a mountain, an appropriation that might be compared with only a fair sized mole hill came at the urgent call of the Bureau, that institution, like the renowned Mohammed, went out to find the obdurate mountain. In other words, when insufficient appropriations were available to conduct adequate laboratory investigations, the Bureau sought some means of conducting laboratory tests without the aid of appropriations. This it accomplished by enlisting the service of various industrial laboratories, where experiments were conducted under Bureau direction.

A pressing problem in the non-metallic field is the development of wider uses for the heavy proportion of waste at slate quarries, a waste that reaches 50 to 90 per cent of gross production. At the Bureau's request about forty-five manufacturers of such products as road asphalt, rubber, plastic roofing, flooring, and ceramics agreed to test pulverized waste slate as a constituent of their products. The Bureau supplied the samples of slate for testing purposes, and reports from the various laboratories were submitted to the Bureau, where the results thus independently obtained were carefully analyzed and summarized. It appears from the conclusions reached that a greatly enlarged field of useful application of a waste product has been discovered.

The Bureau of Mines is not desirous that the success of this mode of investigation should encourage Congress to still further reduce appropriations, for the method has serious limitations. Many technical problems must be solved directly by Bureau men in their own laboratories, and under their direct supervision. Without adequate appropriations such problems may not be undertaken. It would seem, however, that as an alternative method adopted through necessity, for certain types of problems, the work done by industrial laboratories under Bureau direction has a number of points in its favor. In the first place the experiments are conducted by practical men under practical working conditions, and the products are tried out on an industrial basis. If information of advantage to the industry is evolved through these experiments, at least a part of the industry knows of it at first hand, and any resulting innovations are comparatively easy to introduce.

An Expanding News Service

FOR THE LAST YEAR a weekly London letter has been a feature of our news pages that has greatly broadened their scope. In the last issue we published a similar letter from Johannesburg, which we hope will appear hereafter as regularly as that from London. Thus the *Engineering and Mining Journal*, through its correspondents in Canada, London, Australia, and South Africa, as well as at home, is presenting to its readers mining news from all the English-speaking world. "The world is our parish," as John Wesley said, and through the medium of the international news agency that we recently mentioned, and through our correspondents in Mexico, South America, and Continental Europe, whose number is steadily increasing, we hope to make this service increasingly valuable and interesting.

Our news columns are not conducted with the idea of toadying to subscribers, actual or hoped for, by publishing something, whether fact or fiction, about a district or properties in which they may be financially interested. Occasionally a letter is received from someone who apparently does not understand our position in this matter, but such occurrences are rare. To pursue any such policy would be fatal to the reputation of this or any other paper. Nothing is more sickening from a journalistic point of view than a paper that makes a business of publishing "write-ups" and puffs for value received, and the editor who pursues such a course is deliberately misleading his readers.

We believe that the readers of the *Engineering and Mining Journal* are interested in the progress of events in the mining world. Occasionally one meets a specialist who is so devoted to his specialty that he has neither time nor thought for anything else. Such a man probably neglects his wife. His horizon at least is very narrow, and it is safe to bet that he has little interest in news of any kind save that concerning his specialty.

Sometimes we have met others who denied all interest in mining news. These were generally men in minor positions whose attention was concentrated on the details of surveying, assaying, or some other branch of work for a large company. These men might profit, if they only knew it, if they would keep posted on the current news of the industry. They might, possibly, even get indirectly a better position. At any rate they would be better informed as to the industrial conditions which vitally affect them as much as any one else and which will undoubtedly have a bearing on their future.

Broadly speaking, it is our experience and belief that the bigger a man is the greater his interest will be in the current news of the industry. It has for him a significance that the man of smaller calibre has perhaps not yet learned to appreciate. To have this value, news must be prompt, truthful, and exact, and the wider its scope the more valuable it will be.

Desert Ranges in Mexico

A WELCOME ADDITION to our knowledge of the economic geology of Mexico is the little paper of Charles Laurence Baker, presented at the Wilkes-Barre meeting of the American Institute of Mining and Metallurgical Engineers, on the Catorce district in the State of San Luis Potosi. Catorce is an old and important silver camp of Mexico, concerning which we have had too little knowledge. Mr. Baker does not fall into the usual scholastic blunder of describing the mountain range at Catorce as a range due to block faulting. Although the Sierra de Catorce is one of the desert ranges which, at least on the American side of the border, have been sweepingly condemned to this origin, regardless of their individual geological structure. But Mr. Baker exactly explains: "As is usual in desert regions the heavy-bedded limestones are the most resistant to erosive forces. Folded into anticlines they form the mountain ranges, and the intermontane valleys and basins, originally carved out of less resistant shales, clays, marls and sandstones, are covered by detritus, forming a mantle with surface gradually rising upwards toward the hills." A bold, true and welcome description of the desert ranges of northern Mexico, as contrasted with the usual twaddle about block ridges and the chatter of horst and graben.

WHAT OTHERS THINK

Obeying an Impulse

I have only just read your issue of Aug. 6, so that this communication will be late. But I cannot resist the impulse to comment on Mr. Borcherdt's comparative views of you and the *National Geographic*. Your editorial brought me a great contentment, the contentment that comes when someone else puts into effective words what one has always felt and wanted to say but did not know how to. And how utterly Mr. Borcherdt misses the point of what you had to say!

I like the *National Geographic*—so far as it goes. I take it, and my children thoroughly enjoy it. It does no harm, and may do some good. But the point is that to obtain its enormous circulation and conduct its praiseworthy semi-scientific researches it has had to resort to what may justly be termed a cheap game of flim-flam and bunk.

Of course it has seventy subscribers to your one. What does that mean? Is it not that seventy people out of seventy-one prefer amusement to instruction; and is that not about the ratio that anyone of judgment would estimate for our country at large? If you wanted money, wouldn't you rather own the *Saturday Evening Post* than the *Atlantic;* wouldn't you rather be Mr. Lasky and insure your life for $5,000,000, than a college professor with a chance at a Carnegie pension? I should say that just about one person in seventy-one cares anything about finding out the real truth—and he is pretty sure to be an engineer.

One cannot deny that the *Geographic* is an outstanding success in the direction it has chosen. But I am not so sure that Lincoln was right. At least, I fear that you can fool a majority of the people most of the time.

Carmel, Cal. L. O. Kellogg.

The Original Alchemist Challenged

THE CONSALIDATED UN ITED AMERICAN SMELING, MINING & MINERELS RECEARCH
COMPANY.
HOME OFFICES

SILver bell ARiZ, aUgust 2 99 (192i)*

Josiah edward SUSPurr, EDITOR
NEW york City;

I were greetly surprized to read in a resent volumn of ENGINering & MIning journal why sush a edicated maguzine as is yourn will pay so close & valyble attentions to a artikle by ignoranting and un-edicated prospecktors as my Ole frend joSua HARBREN from Lords Burg. my persenel nowlege consarning mister HARbren comprizes facts as demonstraights he aint abul to even spel correckly.;$ 4 years coming this winteri spent 2 months with H arbrin with him tryen to learn me chemicalistry.he was a Rank failyour. WHAts more iI Claims he STILL IS?

THe ignoranse of hisen is surmounted by yourown impudance in claiming him as THE oRIGINAL ALchemist".Such is not facts as i no.not claiming to be no grate litter writer my self i still admits I am somewhat of a chemistis.being red up on all late pulmagations of sceince & your valuble maguzine.NO one aint yet proven to me as yet they possesses the un-dis-puted power & ability of making gold or platnum from bras & iron fileings,I stil claims thier aint no such man in these parts.

when i red your artikle I at once tuck the matter up regardening this Knowledge with mister ALbert KoLer, who is watchman of the IMPERIAL MINE at that point & to my own knowledge & his own admissun one of the best chemistis and mining experts i knows of.he has dramatically re-footed the entire ellegation.both of us being readers of your valuble maguzine we constitutes ourselfs a chapter and holds a meeting of THE AMERICAN inStITUTE of MINING & METELLOGOCAL eNIGINERS cundemming this knowledge.(by the way let me mention that as yet eigh er of us has received our surtificats uniforms or badges and we have benn reading your valuble maguzine most on to a year nowO)

I cares nohing about mr Harbrens *secret*(NOT sekret) formulelet being as his hole thery is non-practikal.elusive & has no bearings ins sceince.Your valuble maguzine will do well to avoid publication & indorsemeants of such in-sceintific persons as aassume on the public by getting there faulse dockrines pulmugated in highly refuted and valuble sceintific maguzines as yourn.i aint written much in my day but if your valuble maguzine is to continue mis-forming the publik and loaning yourselfs to the properganda of un-ethercal principlas of sceince such as the heritical assumption of mister Josua HarBren(AN ignorunt NO-NUTHIN) i shall sereciously consider the publication of our own periododdical here.

I,mister Koler,and myselfs will expect a apoligy to the sceintific world in the next vlumn of your valuble maguzine.

respectivly
Adolph Groheigher

Concerning the Licensing of Engineers

Your patience is remarkable and your magnanimity excessive in reading over and printing the outpourings of our friend from Arizona. I had the pleasure, as a consequence of the above-mentioned eruption, to read again your admirable comment on the licensing of engineers in the July 30 issue. There is nothing in the licensing idea. In reading the criticism of that editorial by F. B. Smith in the *Journal* of Aug. 27 I failed to discover any new point—or old one, for that matter. In fact, all the reasonable arguments generally put forward in favor of licensing the engineers were successfully refuted in your treatment of the question. I would suggest that your communicant from Arizona read his article as well as the one to which he objects once again and inform us wherein he has contributed to the discussion of the licensing of engineers or to the decorum of technical writing.

Djevad Eyoub.

Brooklyn, N. Y.

American Institute of Mining and Metallurgical Engineers Meets at Wilkes-Barre to Celebrate Fiftieth Anniversary

Mining Engineers Visit Wyoming, Lehigh, and Southern Regions of Pennsylvania Anthracite District—Visitors Inspect Modern Coal Breaker—Interesting Technical Sessions Cover Coal Mining and Preparation, and Include Joint Meeting With Society of Economic Geologists — Summary of Papers and Discussions

THE One Hundred and Twenty-Fourth Meeting of the American Institute of Mining and Metallurgical Engineers opened on Sept. 12 at Wilkes-Barre, Pa. It seems fitting that this gathering, which marks the fiftieth anniversary of the founding of the organization, should have been held at Wilkes-Barre, where, on May 16, 1871, the first meeting was held. In consideration of this fact, it might have been expected that the attendance would have been larger, but taking into account the dullness that is now prevalent in the metal-mining field, and the fact that coal mining has but a limited interest for the metal-mining members, the showing was an excellent one. As it was, the registration for the first day was light, but this improved rapidly, and the final figures reached about 500 toward the end of the meeting.

Certainly no effort was spared by those who had the meeting in charge to make the stay of the visitors a pleasant one, and the arrangements for each part of the program were carried out in detail. It was an engineering job, planned by engineers and executed with a precision that is typical of Institute meetings. The absolute lack of confusion, the orderly regularity and the dispatch with which each affair moved, was admirable. The New York contingent are, of course, familiar with the "Follow the Green Line" idea, and necessarily require prompting from force of habit, but it was noticeable that comments on the "arrow" plan, used by the committee, were also made by those from other sections.

Headquarters were at the Irem Temple, and here most of the technical sessions and the dinner and dance were held. Monday morning was given over entirely to registration.

The programs, issued by the local committee, were most attractive and served as a complete guide throughout the entire meeting. These were provided with an attractive panneled cover—white and terra cotta—with suitable lettering in black. We were informed by one of the committee that the color scheme used represented the coal (black), the white ash (white), and the red ash (terra cotta) of the district. The most valuable feature of this souvenir was the arrangement (Blue Book fashion) of the three tours made through the district. By means of this coal-district Baedeker, with one eye on the speedometer and the Blue Book, and the other one on the passing landscape, it was possible for each member to obtain an excellent idea of the nomenclature of the points of interest.

ENTERTAINMENT OF THE LADIES

A special program was arranged for the entertainment of the visiting ladies by a committee of which Mrs. R. V. Norris was chairman. This included, together with the regular program—excepting the technical sessions—a number of special automobile trips and functions. On Monday afternoon the visitors were taken to the Wyoming Country Club, where tea was served. Tuesday, following the luncheon at the International Correspondence Schools, Scranton, a visit was made to the Woman's Institute of Domestic Arts and Sciences of the I. C. S., and this was followed by an automobile drive by the way of Elmhurst Boulevard around Lake Scranton and to the Scranton Country Club, where tea was served. At a meeting held Tuesday evening at the Irem Temple, the suggestion of forming an Anthracite Section of the Woman's Auxiliary of the Institute was made, but this was not formally acted upon, although it was decided by the local women to take the matter under consideration. Wednesday morning a visit was made to the Duplan Silk Mills, at Dorranceton.

"THE ASHLEY PLANES"

The technical meetings began Monday afternoon. R. V. Norris, chairman of the general committee, introduced W. J. Richards as chairman of the first coal session. H. D. Kynor, of the Hudson Coal Co., presented an interesting paper, "Mechanical Mining of Anthracite," in abstract, and made use of several cross-section and plan diagrams to show the scraper method and the long-wall method with face conveyor as used in the anthracite district. In mechanical mining, in this district, as contrasted to hand methods of mining, use is made of undercutting machines, jackhammer-type drills, long-wall conveyors, mechanical scrapers, short-wall and long-wall machines, and shoveling machines. The advantages of mechanical mining, as applied to thin veins, are much greater in the case of thick veins. The paper was discussed by Cadwallader Evans, Sidney Jennings, W. J. Richards, and George S. Rice.

Secretary Sharpless read the paper "The Ashley Planes," by C. H. Stein. These planes are operated by the Central Railroad of New Jersey, and consist of a series of three inclines or planes up which the coal cars are raised from Ashley to Solomon's Gap, a total rise of 1,026 ft. The object of the planes is to overcome the small tonnage movement at low speed over heavy main-line grades for a distance of twelve miles by a rapid movement of large tonnage over a distance of only two and one-half miles over grades in excess of those upon which a locomotive could operate. This is accomplished by installing hoisting engines of large capacity at the head of each plane, which, by means of large cables, haul the cars to the respective point. The loaded cars are taken from the receiving yard, close to the foot of the planes, in trains of six and placed over a truck pit at the foot of plane No. 3. The footman at this point, by means of a bell, signals the engineman at the head of the plane, who applies his power and draws a truck, or "barney," from the truck pit behind the cars. As soon as the engineman feels the "barney" go against the cars he speeds up his engine and the cars start their ascent of the plane.

On each plane there are two parallel tracks and at the foot of each there are two parallel truck pits. The cable from one "barney" passes up the plane over sheaves about 22 ft. apart, then three times around drums 20 ft. in diameter, and out through the bottom of the power house over a large sheave, which returns the cable to a "barney" on the parallel track. As a result, when one "barney" ascends, drawing up the cars, the "barney" at the head of the plane descends, drops into the truck pit, passes under the six loaded cars that have been placed by the engine, and is ready for its ascent. When the cars reach the top of No. 3, the train is cut in two, as only three cars at a time are drawn up planes Nos. 2 and 1. The cars may be drawn up the planes at speeds of from twelve to thirty miles per hour.

The most interesting feature of this plant is the manner in which the "barney" passes into the truck pit, underneath the cars, and then out of it again behind the cars. This is accomplished by an ingenious arrangement of the wheels of the "barney" and of the track devices. Each wheel has its own axle, which slides in its own sleeve independently of the others. The "barney" weighs seven tons. Discussions of this paper were given by Douglas Bunting, Graham Bright, Mr. Jennings, Mr. Norris, C. H. Strange, and Edwin Ludow.

"ANTHRACOAL"

Donald Markle presented a paper, "Anthracoal: A New Domestic and Metallurgical Fuel," in which he detailed the composition, properties, and manufacture of the mixture, known as "anthracoal," and composed of small particles of anthracite coal and a matrix of practically pure carbon, formed from the distillation of coal-tar pitch or other suitable bitumen. It is a hard, dense, homogeneous mass, with a silvery luster, and in color varies from silvery to grayish black. When pushed from the oven, it develops only partly the finger-like structure of coke; but, unlike coke, it has a tendency to remain in blocky masses. When struck with a hammer or passed through crushing rolls, it breaks with an irregular fracture, similar to anthracite, but with very little fines. Owing to its density, "anthracoal" is harder, tougher, and stronger than coke. Discussions of this paper were give by Mr. Ludlow, Charles Dorrance, William Griffith, E. M. Chance, E. W. Parker, George H. Ashley, and Mr. Rice.

John Griffen, manager of the anthracite territory for the Dorr Co., presented "The Slush Problem in Anthracite Preparation." This paper deals with coal washing and the disposal of silt or slush which results from the mixture of coal, slate, pyrite, and clay with water. The present methods for disposing of slush in dams, as mine fillings, or delivered to settling tanks; the types of equipment used, and the utilization of the fine coal recovered from breaker slush were outlined.

In the evening a second coal session was held. E. W. Parker, director of the Anthracite Bureau of Information at Philadelphia, gave a general description of the anthracite fields and illustrated his talk with lantern slides showing cross-sections and the extent of the various fields comprising the anthracite region, together with diagrams showing the methods of mining. Howard N. Eavenson, in presenting his paper, "The Lynch Plant of the United States Coal & Coke Co.," made use of several lantern slides and gave a very complete talk on the work which has been done and is now being conducted at this company's plant in Harlan County, Ky. An elaborate system of housing has been established, together with the necessary plant buildings and equipment, and the undertaking represents a modern advance in industrial development. The meeting of the Metal Section, originally planned for Monday evening, was not held.

THE AUTO TRIP TO SCRANTON

Tuesday morning the visitors left headquarters by automobile for a trip[1] through part of the Wyoming Valley to Scranton. The route taken parallels the Susquehanna River to a point about opposite Pittston, and then swings over to the east side of the Lackawanna River. An excellent opportunity was afforded to view the outcrops of several of the coal beds, other interesting geologic features, and the numerous collieries and breakers. A stop was made at the Marvine colliery of the Hudson Coal Co., and here the visitors inspected the several buildings and equipment. In the office a number of charts, showing the placement of men, mules, and motors in the various workings of the mine, were shown; also cross-sections, maps, and other data. Another interesting exhibit was a model showing the operation of the breaker at that plant.

An outstanding feature of the entire meeting was the inspection of the 5,000-ton steel breaker at the Marvine plant. We are indebted to the Hudson Coal Co. for the following complete description:

A scraper conveyor is used to convey coal from No. 2 shaft head house to the inclined conveyors leading into the breaker. This conveyor line is 800 ft. long, and is underground, a concrete tunnel having been built to allow for its passage from No. 2 shaft to its point of dumping; the conveyor passing under the center of breaker, at which point all material which has to reenter the breaker (such as lip screenings, product from slate shakers and slush shakers, and also egg rolls when in use) enters the conveyor line and goes back into the breaker. Run-of-mine coal is dumped from railroad cars into this conveyor line, and the coal fed into the conveyor by means of an automatic feed shaker. The wet method of preparation is used and the breaker itself is as nearly fireproof as is practicable.

Another feature is the crushing of the coal on the ground before it is taken into the breaker. The only crushing being done in the breaker is that of grate or broken coal when there is no market for this size. This crushing of the coal on the ground has two added features, namely, the elimination of heavy crushers at the top of the breaker, which causes heavy strain on the structure, due not only to the heavy crushing rolls, but also the vibration caused by the heavy bull shakers, and also a considerable reduction in the height of the breaker which would be necessary if crushing was done at the top of the breaker.

There are four sets of double-deck shakers at the top of the breaker, which size steamboat and broken sizes. Two sets of No. 2 rolls, size 30 in. x 36 in., are so situated in front of these shakers as to break the product from these shakers to egg and smaller sizes. Broken coal from the bottom deck of these shakers can be either sent to jigs and prepared for market, or else sent to rolls. Four sets of shakers sizing from egg to birdseye are located below these shakers. Each battery of jigs has its own slate shaker for removal of breakage from the slate. There are also three slush shakers, two for removal of slushings from the jigs, and one for reclaiming all slushings from lip screenings.

---

[1] A résumé of the three tours planned by the local committee appeared in *Engineering and Mining Journal* of Sept. 10.

Forty-four Delaware jigs are in this breaker. This jig is similar in its action to the Lehigh jig, being of the piston type. It differs, however, in that its coal compartment is one foot longer, allowing for an increase in depth of coal bed carried in the jig, and also giving the jig greater capacity. Another important feature is the coal-lifting plunger, which removes the coal from the jig with a minimum amount of breakage, and does away with the coal-discharge conveyors as used on the Lehigh Valley jigs. These jigs have a jigging capacity of from twenty-five to thirty tons per hour. The jig is the invention of S. V. Tench, superintendent of preparation.

A Dorr separator plant is located on the northerly side of the intake conveyor lines. This plant contains a 34-ft. diameter Dorr thickener, which will bypass all water and fines which pass through a 100-mesh screen. The thickened material will pass over eight concentrating tables to reduce the ash content in the silt, and silt will then be treated in six Dorr separators for the removal of water, after which the product will be conveyed to a storage pile.

The breaker is electrically operated, the main switch and control boards being located above jig floor. There are eleven motors, separately controlled, which operate the various mechanical units, such as jigs, shakers, rolls, and other apparatus. The breaker is so designed that one-half of the plant can operate independently of the other half, thus insuring steady operation when a breakdown or other trouble occurs.

Water is supplied from the Lackawanna River by means of electrically driven pumps.

Correspondence Schools Visited

At noon the International Correspondence Schools at Scranton were reached, and there the party was tendered a luncheon in the dining room maintained by the I. C. S. for the school's employees.

Following an inspection of the various departments of the International Correspondence Schools, two technical sessions were held. At the coal session, which was held in the auditorium of the I. C. S., William Griffith presided. Douglas Bunting, general superintendent of the Lehigh & Wilkes-Barre Coal Co., read a paper on mine fires in the anthracite regions, and the following men took part in the discussions: H. H. Otto, who read a paper by J. D. Warriner on the Panther Creek Valley fire; E. M. Chance, Edwin Ludlow, J. A. C. Ritson, George S. Rice, R. D. Hall, and R. V. Norris.

The Session on "Americanization"

The Americanization session was held in the auditorium of the Scranton Y. M. C. A., and was presided over by Arthur Notman, in the absence of Robert Linton. E. E. Bach, in his paper, "Americanization in Mining Communities of Pennsylvania," outlined the state program of Americanization as contemplated by the Department of Public Instruction. This was followed by "Americanization of Foreign Labor in the Pennsylvania Anthracite Fields," by F. E. Zerbey. S. C. Weber in his paper, "Americanization—What Is It?" made a plea for the public school as the preparation for citizenship. In speaking of the Americanization activities of the Y. M. C. A. in industrial centers, Dr. Peter Roberts referred to the work as the "blending of the best that the world knows," and told of the excellent strides that have been made in the upbuilding of citizenry. The teaching of English is the first step, said Dr. Roberts; then naturalization, lectures, and entertainment. The remaining papers that were scheduled for this meeting had to be omitted on account of the lack of time.

Upon the completion of the sessions, members embarked in the cars parked at the International Correspondence Schools and made the return trip to Wilkes-Barre.

A technical session, which was presided over by R. A. Quinn, was held at Irem Temple in the evening. H. A. Reichenback read J. M. Fuller's paper, "The Application of Pulverized Coal to Boilers," and stated that, although experiments had been made in the use of this type of fuel for the last twenty years, it was not until 1916 that the first successful commercial application was made. The various steps in the preparation of the coal, from the raw material to the pulverized state, were shown by means of slides. The chairman emphasized the importance of the paper, stating that the subject was of the greatest interest to anthracite operators, and there was considerable discussion by George S. Rice, H. M. Chance, George H. Ashley, C. M. Latz, T. E. Fisher, and others.

A paper by Dever C. Ashmeade, "Advances in the Preparation of Anthracite," which was scheduled for the meeting, was omitted, as was also J. L. Bruce's paper, "Octagonal Ventilation of the Davis-Daly Copper Co." The omission of the latter paper was a disappointment to the metal-mining men. The remaining paper, "Determination of Electric Equipment for a Mine Hoist," was read in abstract by the author, Graham Bright, and occasioned considerable discussion. Methods of hoist calculations and the various factors entering into the design and selection of electrical equipment were features of the paper.

Geologists' Meeting

On Wednesday morning two technical sessions were held at Irem Temple, the general joint meeting conducted by the Society of Economic Geologists and the session on mine accounting.

The meetings of the Society of Economic Geologists, which met for the first time with the A. I. M. E., were very successful and well attended. This society, which is international, meets twice yearly, once with the Institute and once with the Geological Society of America. The morning meeting was presided over by Professor J. F. Kemp.

An interesting paper on the occurrence of lead and zinc in Pennsylvania was read by Professor Benjamin L. Miller, of Lehigh University. Although Pennsylvania, so renowned as a coal state, is not known as a metal producer, lead and zinc in small quantities have a wide distribution and occur in all formations from the pre-Cambrian to the Triassic. In a few localities, mines have been worked from time to time, and the first brass made in the United States was made in part from Pennsylvania zinc. Doyle's mine, in the Triassic near Doylestown, produced galena in 18[illegible]-64, and in Lancaster County there were several producers in the 60's and 70's, one of which was bought for

$100,000 in 1873 and equipped at a cost of as much more, under the direction of E. G. Spilsbury.

Near Phoenixville, zinc was mined in 1835. Here there are several lodes or fissure veins, with a gangue of calcite, dolomite, and ankerite, a width up to 4 to 6 ft., and continuous as far as 1,000 ft. Much pyromorphite was found near the surface. In Blair County, near Birmingham, lead and zinc ores were worked as early as 1778. The most important Pennsylvania deposits, however, were two miles from Bethlehem, at Credensville, which were described in the first volume of the Institute *Transactions*. These mines were first mentioned in 1830, and at the surface were calamine ores, which changed to sphalerite in depth. There was no lead. In 1853, furnaces for making zinc oxide from these ores were built, and in 1859 it was possible to produce spelter at a profit. These mines were actively operated up to 1893, and produced 90,000 tons of spelter and 50,000 tons of zinc oxide, valued at $20,000,000. Since 1893 there has been only exploration work. The New Jersey Zinc Co. has drilled the property, and there is a possibility of renewed activity. Professor Miller believes that the lead and zinc ores of Pennsylvania have been leached from the various sedimentary strata by circulating artesia waters, and deposited in concentrated form, as Siebenthal supposes to be the case for the Joplin ores.

F. L. HESS PRESENTS PAPER ON BOLIVIAN TUNGSTEN

The paper of Frank L. Hess, "Some Unique Bolivia Tungsten Deposits," was read by Prof. J. Volney Lewis, secretary of the Society of Economic Geology, in the absence of the author. This paper is presented in full in this issue, having been submitted by the author to *Engineering and Mining Journal* for printing, the Society of Economic Geologists having so far no fixed method of publication. This paper, which contains a description of some novel geological features, will be found to be very interesting.

Mr. Hess' paper was commented on by Professor Miller, who recalled that in the Bolivian highlands the ores were worked for silver only for 400 years, beginning with 1544; but in the early 90's cassiterite was recognized in the rejected portions, and later the Great War stimulated the demand for tungsten, and also for bismuth, all contained in this group of ores. This metallogenetic province, containing tin, tungsten, silver, bismuth, and antimony, is practically confined within the political boundaries of Bolivia.

C. L. BAKER'S PAPER ON THE CATORCE DISTRICT

The paper on the "General Geology of the Catorce Mining Distruct," by C. L. Baker, was read by Secretary Lewis. It follows in part:

"The district of Catorce, San Luis Potosi, ranks among the first half-dozen silver-producing camps of Mexico. The Sierra Catorce is the highest range of the region, the summits reaching altitudes of over 11,000 ft. With the exception of a few cliffs of the erosion escarpment of the lower limestone and the canyon walls below the main town of Catorce, which is the highest town in Mexico, the gently rounded slopes are characteristic of a maturely eroded mountain range composed of folded sedimentary rocks. As is usual in desert regions, the heavy bedded limestones are the most resistant to erosive forces. Folded into anticlines, they form the mountain ranges; and the intermontane valleys and basins, originally carved out of less resistant shales, clays, marls and sandstones, are covered by debris, forming a mantle with surface gradually rising upward toward the hills. In time, the debris buries, in deposits formed from their own ruins, all but the highest summits of the original mountains; some of this region has already nearly reached this stage. In vegetation, topography, and prevailing hues of the desert landscape, the Catorce region greatly resembles parts of Nevada and the Mohave Desert.

"Metamorphic rocks are exposed in the canyon from the main town of Catorce westward to near the canyon's mouth, and are divided into two series. The relationships between the two are unknown. The age of the metamorphics is not known; they might in part be as old as pre-Cambrian or as young as Jurassic. Rocks very similar to both series have been described by Dr. Carl Burckhardt, as the lowest exposed at Zacatecas. The youngest of the two metamorphic series at Zacatecas has been shown by Burckhardt to be marine Upper Triassic, but the age of the older series, of the sericitic schists, at Zacatecas is unknown.

"The sedimentary rocks overlie the metamorphic rocks with strong angular unconformity. From the base upward a generalized section of the sedimentary rocks follows:

"1. Conglomerate, purple, green or brown, coarser below and finer above; the water-worn pebbles are chiefly quartz, of the underlying metamorphic series, and crystallines.

"2. Sandstone, argillaceous, below, and shales, arenaceous, above; irregularly colored green, purple, brown or yellow.

"3. Shales, marly, below, and calcareous marls with thin interbeds of limestone above; grades upward into limestone; color gray, weathering pinkish or yellowish.

"4. Limestone, heavy bedded, dark gray or dove colored, fine-grained (as are all the limestones); has nodules and lenses of dark chert. Fossils are probably of lower Upper Jurassic (Oxford). All the more productive ore deposits appear to be in this limestone. Its thickness is at least 900 to 1,000 ft.

"5. Marls and thin limestones interbedded, with nodules of phosphatic (?) limestone.

"6. Limestones, dark gray, medium to thick bedded, with nodules and lenses of black chert; ammonite fossils.

"7. Limestone, thin bedded, with layers of marl, blue-gray, and nodular chert. Members 4 to 7, inclusive, apparently give a complete section of all the Upper Jurassic.

"8. Limestone, medium to heavy bedded, dark blue-gray, with chert nodules. Basal beds of this member may yield lowermost Cretaceous fossils. There may be higher Cretaceous strata to the east, but they do not appear to outcrop within the area of the mining district.

"In general, the upper sedimentary series is folded into a rather broad dome. There are a number of minor flexures in the broad domical structure and also quite a number of faults of only medium amounts of displacement. All faults noted are of the gravity (normal) type. Most of the upper town of Catorce lies on a sunken block at or near the summit of the dome, the sides of the sunken block having been primarily formed by means of faults.

"The igneous rocks are basalt or basic andesite which forms a plug about one mile northeast of the upper town of Catorce. It is found on the top of the ridge. The intrusive cuts the highly colored shales and sandstone member on the southwest and the limestone on its other sides.

"Porphyry dikes, probably of quartz-monzonite or a related rock, cut the sedimentary series in a general north-south direction. The dikes vary in width from at least 1,000 ft. almost to the size of stringers. They may possibly be offshoots of one main dike. There was not the slightest trace of contact metamorphism visible to the unaided eye at contacts of the dike rock with any of the sedimentaries.

"Spurr and Garrey have described two bodies of quartz-monzonite-porphyry near a large fault with at least 1,500 ft. displacement at the eastern base of the Cerro del Fraile, about nine miles east of Potrero. At this place is situated the Dolores mine, a contact-metamorphic deposit of copper minerals. There is a possibility that a deep-seated intrusive igneous mass underlies the Catorce district and that the dikes may be apophyses of this mass.

"The primary gangue minerals of the mineral deposits are calcite, quartz, rhodochrosite, and possibly some others, including anhydrite. The primary ore minerals are mainly sulphides of iron, iron and copper, lead, zinc, arsenic, antimony, and bismuth. Mercury sulphides are found south of the main district. Subsequent alteration of the sulphides formed, principally in the oxidized and leached zones, the haloid silver minerals, the double salts of silver and possibly even more complex silver minerals.

"The main deposits are fissure veins in the lower limestone. The intersections of veins were the sites of rich bonanza oreshoots. The fissure veins are probably not all along fault lines. Some of them may follow joint planes. There are also quite a number of pocket deposits, as in the other regions of limestones in northeastern Mexico. Most of these pockets occupy the sites of former solution channels and cavities. No deposits appear to have been found in the shale, in which, from the incompetent nature of the rock, there probably could not have existed open fissures or channels. However, mineralizing gases may have penetrated these arenaceous shales and encountered more favorable conditions (physical, chemical, or both) in the overlying limestones. Judging from the physiographic history of the region, the primary ores were originally deposited probably about 10,000 ft. beneath the surface."

D. H. NEWLAND DISCUSSES "RELATION OF GYPSUM SUPPLIES TO MINING"

A paper, "The Relation of Gypsum Supplies to Mining," read by the author, D. H. Newland, proved interesting and is here reproduced in part:

"Certain observations from the field and laboratory suggest the need for recasting some of our ideas about gypsum as a rock-forming mineral and in relation to supplies for industrial use. Until about twenty-five years ago, the use of gypsum was confined almost entirely to agriculture. During the last quarter century, though, its usefulness has been greatly developed, particularly in the building trades, which now absorb most of the gypsum produced. In 1919, according to the U. S. Geological Survey, the output of crude gypsum was 2,240,163 tons, a gain of 912 per cent in twenty-five years. About one-half of this production was mined in New York, Ohio, and Michigan, where the proved supplies can hardly be regarded as over large when viewed in relation to the rapid expansion of industrial requirements.

"The two calcium-sulphate compounds, gypsum ($CaSO_4.2H_2O$) and anhydrite ($CaSO_4$), are the more stable forms of a series that includes at least two other members, so-called half-hydrate ($CaSO_4.\frac{1}{2}H_2O$) and soluble anhydrite ($CaSO_4$). Each of the latter readily takes up water to recrystallize as gypsum, and consequently is incapable of existence under ordinary geological conditions; also each can be prepared from gypsum by the application of heat within certain temperatures, the process on which is based the manufacture of commercial plasters. If the temperature limitations are not observed, the result of the calcination process will be insoluble anhydrite, which compared with the soluble form, takes up water very slowly, so as to be of no practical use, although actually it is soluble and in time is convertible into gypsum like the other forms.

"The association of anhydrite with gypsum is rather common in deposits that have been mined or explored beyond the outcrop zone; that is, to a depth of over 100 ft. A study of these occurrences would indicate that the form which calcium sulphate takes depends on environment; that is, the combination of physical and chemical conditions that pertains to any particular region above or below ground. There is nothing unusual about such relation in the occurrence of minerals in general, but its probable bearing on the question of gypsum supplies justifies some effort in the investigation of the details.

"It appears that the deposition of gypsum and anhydrite at atmospheric pressures is not simultaneous, but each substance crystallizes during a separate range of temperatures, which is lower for gypsum than for anhydrite. It requires only moderate temperatures to expell the combined water of gypsum.

"In view of the considerable change in volume (30 to 40 per cent decrease) that accompanies the transformation, it is reasonable to suppose that pressure lowers the temperature of dehydration wherever there is opportunity for the released water to find escape. The inference to be drawn from the information at hand is that gypsum becomes unstable under conditions of moderate temperature and permanent load that characterize all deeper deposits in the extensions of the outcrops.

"On the other hand, anhydrite represents the unstable sulphate at atmospheric pressure and average surface temperatures. The prevalence of gypsum at the surface, its deposition by ground waters or in open cavities below the surface (veins), and the actual process of hydration which can be followed in samples of anhydrite exposed to the atmosphere witness this fact. The change of anhydrite to gypsum in connection with some of the Western deposits was described by A. F. Rogers, who seems to have been the first to note the occurrence of the former as a rather common mineral in this country. The process of hydration has been in progress, no doubt, wherever anhydrite by erosion, faulting, or other agency has been brought to the surface or so near the surface that the pressure developed by the 50 per cent or so increase in volume could find relief against the counter effects of load.

"There is considerable information at hand to show that the range of stability for gypsum under vertical load is so small that it will have to be given serious consideration in connection with the question of future mine supplies. The most circumstantial evidence comes from the mines in the East, where operations have been in progress the longest time. In western New York, where the deposits may be followed from the outcrop under an increasing cover in the direction of the dip, anhydrite begins to appear at 150 ft. or less and within the next 100 ft. becomes the predominant mineral. It is a fair inference that 250 to 300 ft. marks the limit beyond which gypsum cannot be expected in any considerable quantity, that is in its usual form of occurrence as seams under permanent load.

"Drill records generally are not of much service, as they are likely to show all the calcium sulphate in the form of gypsum, on account of the similarity in appearance of the two minerals in a granular condition, like the drillings made by oil-well rigs, which have generally been used. It is quite probable that some of the reported discoveries of thick gypsum beds in the salt mounds of the Gulf coast at depths of 1,000 ft. and more are to be explained on this ground. Error in identification may be held to be largely responsible for the impression, more or less general, that anhydrite is an uncommon mineral. It may be said that the domes of the Gulf region probably come within the class of structures that are an exception to the prevailing methods of occurrence where pressure is regarded as a direct factor of depth."

DR. LOCKE: "GEOLOGY APPLIED TO ORE HUNTING"

Dr. Augustus Locke presented a thoughtful paper on "Geology Applied to Ore Hunting." He pleaded for a recognition of the difference between the science of economic geology and the technique of ore finding, or a determination of the criteria between favorable and unfavorable indications of the existence of orebodies. With existing treatise on economic geology only, Dr. Locke likened the geological engineer to the bridge builder with only books on physics to refer to, or to the physician armed with only books on anatomy and physiology. He described an interesting experiment whereby the gossan covering an area of ore, and another covering worthless pyrite, were made the subject matter for a test examination by six geologists, to select the favorable from the unfavorable gossan. Of the six, only one guessed right, the others guessing right or wrong according to chance. This indicates the great difference in observing and reasoning powers in different men. Dr. Locke viewed the function of the Society of Economic Geologists as in part the building up of an ore hustling technique. He also thought that the society might criticise court testimony in apex cases; and lastly that it might give advice to the younger geologists.

THE "MINE ACCOUNTING" SESSION

R. V. Norris, presiding over the session on mine accounting, introduced John B. Dilworth, who read an abstract of his paper, "Underground Mine Development, Its Definition and Valuation." This paper relates to the room-and-pillar system of mining horizontal coal seams in bituminous coal mines, but as certain similar features of classifying expenditures and valuing mine development exist in both coal and metal mines, the subject was of considerable interest to the metal men, although their attendance was in the minority. H. B. Fernald, in the discussion following, called attention to the fact that the Treasury Department is very anxious to secure the opinion of Institute members on the subject of mine costs and valuations, and also told of the activities of the Institute's committee on mine accounting, of which he is chairman. Other discussion was presented by J. H. Allport, R. D. Hall, Mr. Norris, and Edwin Ludlow.

Other papers read at this session were as follows: "Advances in the Preparation of Anthracite," by D. C. Ashmeade; "The Automatic Substation for Coal Mines," by R. J. Wansley, and "Electric Power a Factor in the Anthracite Field," by W. A. Thomas, these papers having been omitted at earlier sessions.

INSPECTING "WYOMING RED EDGE" SHOVEL MAKING

Following the technical sessions, members were taken on the second of the three automobile tours planned by the committee to the plant of the Wyoming Shovel Co., at Wyoming, and there given an opportunity to see the various stages of manufacture of "Wyoming Red Edge" shovels and picks. This plant is complete in every detail, and the several steps of operation were watched with great interest. Through the courtesy of this company an elaborate luncheon was served on the upper floor of the main building. Each guest found at his place a novel souvenir in the form of a "trench" shovel; the assumption being that every one should "fall to," which was done with little delay. After luncheon, President Ludlow, on behalf of the Institute, extended a vote of thanks to the officials of the Wyoming Shovel Works, to which H. T. Potter, of the company, replied.

Owing to the interest shown in the geology session, which was resumed upon the return from Wyoming, the general technical session was called off. One of the papers, "Relation of Gypsum Supplies to Mining," by D. H. Newland, and scheduled for this meeting, was presented at the morning geology session, as noted. The two other papers, "Queen Mine Hearth Roaster," by J. Moore Samuel, and "Flotation of Pyrite," by W. S. Morley, will appear in the *Transactions*.

PROFESSOR KEMP: "THE STRUCTURE OF THE ANTHRACITE REGION"

The afternoon session was presided over by H. M. Chance. A paper by Prof. J. F. Kemp on "The Structure of the Anthracite Region," illustrated by lantern slides, was of extraordinary interest, showing that during faulting and folding the shales, clays, and coals flowed freely, like putty, so that the faults and folds may disappear in an extraordinary short distance. Many unique examples were presented. Comments on the paper were made by H. M. Chance, W. S. Ayers, Dr. George H. Ashley, and J. V. Lewis. Dr. Ashley, state geologist of Pennsylvania, presented an interesting economic study on "Deep Seated Oil and Gas in the Appalachians." Dr. Ashley finds that only hope of new discoveries of oil or gas in Pennsylvania is in depth; and believes the Oriskany sandstone in depth to be a possible source of gas and less possibly of oil. E. De Golyer read a paper, "The Coming of Water in the Mexican Gulf Coast Wells."

VULCAN IRON WORKS AND HAZARD WIRE ROPE PLANT VISITED

Excursions were made to the Vulcan Iron Works and the plant of the Hazard Wire Rope Co., both in Wilkes-Barre. At the former plant the visitors were shown through the shops and then taken to the casting plant, where a twenty-ton "pour" was made, the molten steel being poured into molds. At the Hazard plant, the visitors were shown the methods of winding various sized wire ropes. In the laboratory special tests were made of separate strands and wire rope.

The dinner and ball which were tendered the visitors by members of the local section were held at the Irem Temple on Wednesday evening. During the dinner the Brunswick Quartet gave a number of vocal and instrumental selections, and this part of the program was supplemented by a local monologist, who gave several clever imitations, most of which related to the coal miners of different nationalities. R. V. Norris, general chairman of the local committees, spoke briefly of the work done by them and also called attention to the fact that the meeting celebrated the fiftieth anniversary of the Institute. He read several telegrams from absent members, including Herbert Hoover and William Kelly. He then introduced the toastmaster, J. F. Kemp. Professor Kemp, in happy vein, sketched the early existance of the Institute and then introduced Henry S. Drinker, who spoke of his early associates and the men who, with himself, have done so much for the organization. President Ludlow, the next speaker, told of the association of the society with the coal regions and also sketched briefly the progress of the district and its economic importance. Colonel Arthur S. Dwight related experience during his recent visit to Europe as a member of the delegation representing the Founders Societies. Lieutenant Colonel J. A. S. Ritson, a British mining engineer, was the last speaker. Colonel Ritson is at present making a study of American coal-mining methods and will remain in this country for some time.

THE TRIP THROUGH THE COAL FIELDS

On Thursday, an all-day excursion was held, starting from the Irem Temple at 9 a.m., and covering parts of the Wyoming, Lehigh and Southern anthracite coal fields. On this trip an excellent opportunity was given to observe the outstanding geological features as well as many other interesting points. The Ashley Planes, which were described at the technical session on Monday afternoon, were passed en route, and it was possible to get a general idea of their operation, although no inspection of the planes was made. The first stop was made at the Hauto power plant of the Pennsylvania Power & Light Co., in the Lehigh district, and here the 60,000-kw. plant was given a hasty inspection.

At Greenwood Park the party was served luncheon through the courtesy of the Lehigh Coal & Navigation Co. After the luncheon, President Ludlow, in tendering a vote of thanks to the officials of the company for their hospitality, spoke briefly on the history of the region and told of the development of the coal industry. J. B. Warriner, general manager of the Lehigh Coal & Navigation Co., replied to Mr. Ludlow's speech, and then called attention to a first-aid demonstration that was given by three of the company's teams. After the demonstration, the visitors returned to the cars and the trip continued. At the water shaft of the Tamaqua colliery a stop was made to inspect the surface equipment. Here pumping, or hoisting of water, is done by means of 3,600-gal. buckets from a shaft 800 ft. deep. The hoist used is one of the largest induction-motor hoists in the world.

After leaving the Southern field and re-entering the Lehigh field, several of the older strippings were passed. Near the Harwood colliery the party left the cars to inspect the stripping pit now being used in connection with mining the Mammoth and Four-Foot veins by the Harwood Coal Co. Several blasts were exploded while the visitors were viewing the stripping operations. After passing through Hazelton, the next stop was made by the party at the old Milnesville stripping. Here the overburden has been removed for a depth of 300 ft. The old Hollywood stripping, on the opposite side of the road at this point, is one of the oldest in the anthracite field, and affords an unusual opportunity to see the folding of the anthracite measures. Wilkes-Barre was reached at about 6 o'clock. Most of the visiting members returned to their homes that evening or on Friday morning, although a few remained for special trips that were arranged by a special committee.

A New Nine-Hearth Roasting Furnace

A modification of the ordinary McDougall roasting furnace has been developed at the Copper Queen smelter at Douglas, Ariz., and is described in a paper prepared by J. M. Samuel for the American Institute of Mining and Metallurgical Engineers, entitled the "Queen Nine-Hearth Roaster."

The following assumptions were made in the development of the design of the new plant: (1.) Outside diameter to be 18 ft. (limited by size of building). (2.) Sulphur elimination to be 30 lb. per sq.ft. of hearth area per twenty-four hours (standard practice at the Calumet and Arizona smelter). (3.) Outgoing gases to contain 5 per cent sulphur dioxide by volume. (Higher content of sulphur dioxide has been found to result in decreased capacity.) (4.) Gas velocity through ports not to exceed 10 ft. per second. (With low gas velocity a given draft will draw more air through the furnace, and also less trouble will be had from accretions.)

Conservation of heat was obtained by building the bottom hearth of Kieselguhr insulating brick and providing space for a reasonable bed of roasted ore. Lateral radiation losses were taken care of by backing the walls between skewbacks with a layer of insulating brick and also by reducing the distance between hearths to a minimum. The close hearth spacing was obtained in the following ways:

1. A conical arch with a rise of 1½ in. per ft. was used, fire brick of special shape being used in the construction. In addition the arches were tapered from 8 in. thick at the outer end to 4 in. thick at the inner.

2. The arms were set parallel to the arches and were made of 6-in. steel casing.

3. The clearances were reduced to 3½ in. as the minimum allowance between the rabble teeth and the hearth; also between the top of the arm and the underside of the hearth roof.

The top hearth was made of cast-iron plates, to allow a minimum transfer of heat from the outgoing gases to the incoming ore. Six rabble arms were used on this hearth, with 12-in. blades set at between 20 and 30 deg.

Inasmuch as probably 40 to 50 per cent of the sulphur oxidation takes place as the ore drops from one hearth to the next, special attention was paid to securing a proper amount of air at the drop holes. Also, oxidation is promoted by frequent stirring. For that reason the roaster was equipped with a variable speed motor so that any speed between one revolution in twenty seconds and one in fifty-five seconds could be obtained.

Tests of the new roaster showed considerably increased capacity, especially with a feed low in moisture. Low moisture also results in increasing the temperature of the product and increasing the sulphur dioxide content of the outgoing gases.

THE EASTERN DESCENT FROM QUIMSA CRUZ (TRES CRUCES) PASS ALONG THE QUIME RIVER
The old trail to Pacuni climbs the hill to the right. The trail along the stream leads to Quime and the interior of Bolivia.

Some Unique Bolivian Tungsten Deposits

Tin and Tungsten Occur in and Around Quartz Monzonite and Porphyries, the Metals Being Deposited From Watery Solutions Given Off by These Rocks on Cooling—Tungsten Is Deposited Further From Source Than Tin Minerals—Mining and Milling Methods

By Frank L. Hess*

OF THE BOLIVIAN TUNGSTEN DEPOSITS that came into operation and produced notable quantities of tungsten ore during the Great War, three near Oruro, the Jorge Quinte, Ascencion, and San Antonio, are not far apart, but are greatly different from one another, and, so far as I have been able to learn, each is unique in its characteristics. Besides these three, other tungsten deposits with unusual characteristics and to which further reference will be made have been found at Pacuni, Quime, and near La Paz.

All three of the deposits near Oruro are situated in the western range of foothills of the eastern cordillera of the Andes. The Jorge Quinto and Ascencion mines are in the Condeauque district, about twenty-eight miles northeast of Oruro and eleven or twelve miles from Paria, a station on the Ferrocarril de Oruro a Cochabamba. The San Antonio mine is about nineteen miles north of Oruro.

The mines are reached by roads that are good during the winter or dry season, but which are so abominably bad during the summer or wet season that they become impassable for wagons or carts. Although the area is well within the tropics, the weather is always cool. There are no hot days, even in summer, and a fire in the evening is at all times a pleasurable luxury. In the winter, water sometimes freezes several inches thick during the night, though the middle of the day is usually warm and pleasant.

The Andes in this region are, in general, smoothly rounded, and have long, even slopes thinly sprinkled with angular pieces of quartz and quartzite over a skin of soil. Here and there are occasional bold crags of quartzite, and along the slopes are less prominent outcrops of quartz veins or of shale or sandstone hardened by silica. The outcrops run in various directions, but my time did not permit an unraveling of the systems, even were it possible, and no common strike could be determined. None of the peaks are snow-clad, and none show the effect of more than incipient glaciation, though forty-five to sixty miles to the south peaks of equal height have the western side of their crests hollowed out by glaciers. From the foot of the range great gravel plains slope gently to the ancient lake bed surrounding Oruro. Through the gravels have been cut shallow channels by streams that during glacial time were much larger than they are now.

---

*Paper presented at the joint meeting of the Society of Economic Geologists and the American Institute of Mining and Metallurgical Engineers, Wilkes-Barre, Pa., Sept. 11, 1921.

GEOLOGY OF DEPOSITS NEAR ORURO

In its broader lines the geology is comparatively simple, but in its details it is complex. The Andes were apparently formed by the crumpling of a great thickness of sandstones and shales (in much of the cordillera hardened to quartzites and slates) and the simultaneous or later intrusion of an enormous mass of quartz monzonite that occupies the center of the range. The sediments lie on the quartz monzonite and in general dip away from it, but show great variations in local dips and strikes. Molten rocks closely related to the quartz monzonite burrowed their way up into the sediments, cooled more quickly and under less pressure, and so developed a different texture. These are the quartz porphyries and similar rocks. There are also numerous "basic" dark-colored dikes.

In some areas the original thick covering has been eroded from the quartz monzonite, as in large parts of the area lying between Quimsa Cruz (Tres Cruces) Pass, probably thirty miles north, and Huayni-Potosi, thirty or forty miles farther, but no granite is known to outcrop for many miles south of the pass, though the porphyries are to be seen at many places, as at Oruro, Morococala, Negro Pabellon, Huanuni, and others. The folding and adjustments due to mountain-making caused a great deal of cracking, jointing, and faulting, so that not only may dips and strikes not be continuous, but the different beds are in many places faulted past each other.

THE JORGE QUINTO SCHEELITE DEPOSIT

The Jorge Quinto scheelite deposit is near the summit on the west side of a smooth ridge, and the main level is at an elevation of about 14,650 ft., about 2,000 ft. above and in plain sight of Oruro. From the crest of the ridge jut prominent quartzite masses reaching perhaps 100 to 200 ft. in height. The quartzite governs the direction of the ridge, which here runs northwest. At the foot of the ridge on both sides are small streams. The rocks are clay shales, sandy shales, and sandstone partly hardened to quartzite, and these are cut by several rather basic dikes.

The quartzite that forms the top of the ridge is about 300 ft. thick, and above the surface is very hard, but below is mostly comparatively soft, though some parts are hard. The beds are practically vertical and strike northwest. On the southwest side of the quartzite is a bed of clayey shale of uncertain thickness but probably between 50 and 100 ft. This bed is succeeded by sandy shales in which are interbedded sheets of sandstone, and at the foot of the hill, more than a half mile away, are thick beds of carbonaceous shale. On the northeast side of the ridge the quartzite gradually grades into sandy shale, which in turn is succeeded about three hundred feet from the quartzite by carbonaceous shale of unknown thickness.

Breaking through the shales near the top of the ridge on the northeast side, perhaps 200 yd. from the tungsten deposit, is a mass of dark, greatly altered, fine-grained, basic rock that was possibly a diabase. There are other outcrops lower down the slope, but they are mostly covered by débris. Another altered basic dike was cut in an adit about 100 yd. from the lode.

FAULTING EXTENSIVE AND RECOGNIZED BY CRUSHED MATERIAL

The rocks of the area are everywhere greatly broken by faulting, and wherever they are hard enough to preserve the marks, or where there has been enough infiltration of silica to make a hard surface, slickensides are common, especially along the quartzite outcrop on the crest of the hill. But most of the faults are to be recognized only by crushed material, for unless there was no movement for a considerable time along cracks in shales, solutions could not percolate through to deposit quartz, as with very little movement the fine material would be ground to a mud that would effectually stop up the openings. How much faulting and crushing there has been in this area is graphically shown by a crushed zone on the road about halfway between the top of the mountain and the creek on the northeast side, where shale and sandstone are mixed in a heterogeneous mass more than 150 ft. wide.

GENERAL DESCRIPTION OF THE ORE DEPOSITS

The tin and tungsten deposits of Bolivia are found in and around both the quartz monzonite and porphyries and are deposited from the watery solutions given off by these rocks on cooling. No other source is known for either metal, and it is fair to suppose that if the igneous rocks are not visible it is because they have not yet been uncovered by erosion. In general, the tungsten minerals are deposited farther from their source than are the tin minerals, which means that they are deposited at lower temperatures and usually nearer the surface than tin deposits, and so probably will not be found at such great depths. However, the zones of tin and tungsten deposition grade into each other, and not only can no line be drawn between them, but they may be coincident, for erosion may have removed the upper part of the veins where tungsten alone was deposited and the more highly heated zone may have progressed beyond that in which tungsten minerals were already deposited, and cassiterite then have been deposited on the tungsten minerals. Such an association of minerals is common and has caused much disagreement as to depths and temperatures of deposition.

THE JORGE QUINTO MINE

The Jorge Quinto mine is in an area of tungsten deposits, most of which are small wolframite veins. There are also a number of antimony deposits within a mile or two, and a little copper is found in veins close at hand. No tin mines are operated within a number of miles of the property. The only other known scheelite deposit of workable size in the vicinity is the [illegible] mine, about three miles south.

The Jorge Quinto lode is a deposit of scheelite in a brecciated zone following a fault that cuts the quartzite and at the surface strikes N. 50 deg. W. and dips 45 deg. S. 40 deg. W. The lode cuts across the mountain through a saddle and ends rather abruptly on the west at the edge of the quartzite. On the east the lode rather gradually loses its richness and character as it enters the shale, into which the quartzite grades. At the summit the lode has a very smoothly slickensided foot wall, above which is six to thirteen feet of brecciated material of all degrees of fineness from powder to pieces a foot or more across. The breccia is cemented by white ankerite, a carbonate of calcium magnesium and iron, and in a few places the ankerite is six inches thick. It is harder than calcite, and was mistaken in the field for adularia.

The fault is fairly straight and the breccia is hard and solid. On the levels below, however, the fault is not straight, but has numerous curves, and the breccia is broken to a mass of fine material from sixteen inches to sixteen feet thick. This fine material is known as *yampu*, said to be an Aymará word. The coarse ore is known as *broza*. Where the lode is narrowest it is said to be very rich, 40 to 50 per cent WO_3.

The slickensided part of the fault cuts through the crushed material at many places, so that part of the ore is above and part below, but by far the larger part is above. The fault is in most places lined with ankerite that has taken a glassy polish. At the surface the trace of the striæ on the fault is S. 43 deg. E., and the ore shoots run in about the same direction. At the west end of the principal or *cancha* level the lode stops at the shale as it does above. On the next level below it ends in hard sandstone a little before the shale is reached, or at least it becomes too lean to work profitably. On the east also the lode becomes lean, and as the quartzite becomes shaly there are only occasional good bunches of ore.

There appear to be three principal shoots dipping with the striæ on the fault and each 100 ft. or more wide, but the lode between them is by no means barren. The ore has been followed down in the sandstone more than 300 ft. below the highest outcrop, and still retains its width and richness.

ORE UNUSUALLY FREE FROM IMPURITIES

As has been said, the ore is a mass of angular fragments cemented by ankerite, and it is, in my experience, unique in this feature. The fragments are made up of quartzite and pieces from an older lode that was also a breccia. Some of the fragments of the old lode are quartzite with a coating an eighth of an inch or more thick of calcite carrying more or less iron and probably a little manganese. On the calcite is deposited gray scheelite so fine grained that it is unrecognizable to those not acquainted with the ore. Other pieces of quartzite have scheelite adhering directly to them. Some fragments are merely skeletons of iron rust and silica and were apparently originally either siderite or ankerite. Still others are nearly pure scheelite, and scheelite is found only as broken pieces of the original lode. The ankerite is apparently of a later generation and shows little or no weathering. The earlier carbonate seemed to carry much more iron, and weathers to soft iron oxide. The ore as mined is thought to have averaged 5 per cent WO_3, and is extraordinarily free from harmful impurities.

From the observations noted the history of the lode appears to have been about as follows: The quartzite was cut by a fault extending into the shales on each side, but on the west was dissipated in the thinly bedded clay shales, and enough mud was made by the movement to prevent the circulation of solutions in the shales. On the east the fault became progressively dissipated as the sandstone graded into thinly bedded sandy shales. Solutions from some igneous rock below brought up iron-bearing calcite, probably carrying some manganese, and this was the first mineral to precipitate in the cracks made by the fault. Calcite was followed and probably in part accompanied by scheelite and a remarkably small quantity of quartz—few metalliferous veins deposited from hot waters carry so little. Probably soon afterward there was another considerable movement along the fault, by which the rocks were broken finer and the carbonate scheelite vein was broken with them. The movement was followed or accompanied by solutions carrying a great quantity of ankerite that cemented the broken rock. After cementation, movement again took place along the fault, probably a more diagonal movement, as shown by the slickensides, and the ore was crushed to the condition in which it is now found.

As has been shown, the lode crosses the quartzite at an acute angle, the quartzite striking NW. and the lode N. 8 deg. W., leaving an angle of 35 deg. between them, so that the lode should have a length of about 580 ft., measured in a straight line, within the quartzite, and this corresponds closely to the surveyed length of the workings. Apparently little extension is to be looked for on the west, but it is possible that the shaly sandstones on the east may have held cracks sufficiently open for some deposition of ore.

MINING CARRIED ON BY MEANS OF ADITS

The location of the deposit, on a ridge, makes the working of the mine by adits the easy and natural method, and, except along the lode, the rock holds up well. The *yampu*, or crushed ore, does not, of course, hold up, and must be supported. Some dry-wall work is used and some timbering. One *pique*, an incline following the lode, is lined like a well. For timbers eucalyptus from Cochabamba is used, and it gives excellent satisfaction. Some Oregon pine is used to lay on eucalyptus stulls.

Owing to bad engineering advice, the mill was located on the Rio Paria, at Paria, eleven or twelve miles away, for the sake of the water supply. Four auto trucks were purchased with which to transport the ore, and they did the work well during the winter, but when the rainy season came on they mired hopelessly, and it was impossible to move ore while others were selling at phenomenal prices. Had the plant been built near the mine it would have been necessary to move only concentrates, about one-fifteenth of the weight of the ore, to Paria, and this could have been done with llamas that would have picked their way across the slopes easily. An *ingenio*, or milling plant, was started in the valley on the northeast, a road was made across the ridge, laborers' houses and a dam were built, and a large quantity of machinery and supplies was moved to the top of the hill. Just at that time news came of the signing of the Armistice, and tungsten mining in Bolivia was dead!

THE ASCENCION SCHEELITE MINE

The Ascencion scheelite mine appears to be a second Atolia, and is probably now the largest tungsten mine in Bolivia, but I did not sample the mine, and so cannot give an accurate idea of its richness. Placer scheelite was discovered here in 1909, and the vein was discovered in 1915. The mine is just over the crest of the first range of foothills, and thus out of sight of Oruro, and three miles south of the Jorge Quinto mine. In its mineral composition the vein is quite as unique as the Jorge Quinto. It is at almost the same altitude as the Jorge Quinto, and, although not a high mine for Bolivia, the main drift (about 14,400 ft. high) is about as high above sea level as the summit of Mount Whitney, the highest mountain in the United States. The uppermost part of the vein is several hundred feet higher.

The country rock is a yellow sandstone, probably the same as the quartzite at the Jorge Quinto mine, but here altogether too soft to be so designated. The sandstone is interbedded with the same shales, and there is also a dark-brown rock that from a hasty field examination seemed to be an arkose. The rocks are more or less crumpled, but strike approximately north, with very high dips.

DUMP AND BUILDINGS AT THE ENCARNACION MINE NEAR ORURO, BOLIVIA

Standing on the hill 300 ft. or so above the portal of the mine, the positions of the Negro Pabellon, Llallagua, and other tin mines can be made out some miles to the south. Close at hand are numerous meager copper and wolframite prospects, and at a point a mile or so east stibnite was mined during the war. At numerous places along the foot of the hills are hot springs, and on cold winter mornings the vapors can be seen for many miles across the *altaplanicie*. Despite so much mineralization and thermal activity, the sandstones show a surprising lack of silicification, but they are, however, seamed with innumerable veinlets of hydrous iron oxide, with here and there a little magnetite. Faults are numerous, but the soil covering the hills prevents their recognition until they are exposed by excavations.

DESCRIPTION OF ASCENCION DEPOSIT

The scheelite deposit of the Ascencion mine is in the form of a nearly perpendicular forked vein, the main part of which has a strike a few degrees east of north, and the branch a strike about northwest. The parts of the vein are very tortuous, and the curves are of comparatively short radius. A great deal of faulting has taken place along the vein, so that the vein itself and the country rock alongside are much crushed. Along most of the vein the country rock is sandstone, but along a part of the vein it appears to be sandy shale, for shale has been dragged in by the faulting. The shattered vein has been in part recemented by an infiltration of barite and a small quantity of quartz, but is still so soft that most of it can be worked by pick and shovel.

In general the vein is probably between thirty-two and forty inches thick, but in one place it appears to be thirty-six feet wide. This place, however, has not been crosscut, and may contain a horse of country rock. In another place the vein is only five or six inches thick. The average width is probably about forty inches. Apparently the vein was originally composed of barite, a little quartz, and more or less siderite or iron-bearing calcite that is now represented by friable iron-stained material. No pyrite has so far been found in the mine, but were it the original iron-bearing mineral some would now be found even in the oxidized parts of the vein. After the vein had been formed it was crushed by faulting, and scheelite, probably accompanied by a little quartz, filled cracks and spaces in the barite, recementing the vein just as the Jorge Quinto lode was recemented by adularia. There was probably also a later deposition of a little barite and quartz. As in the Jorge Quinto vein also, movement again took place after the recementation, so that the vein was crushed a second time, and as it is very crooked, the crushing is both fine and general over the extent of the vien.

The scheelite is white and mostly fine granular. In places it is from two to eight inches thick, but is generally broken to bits and thoroughly mixed with barite. In most places barite forms much the larger part of the vein. A little stibnite has been found with the scheelite, than which it is apparently later. The ore is said to carry an average of 5 to 6 per cent WO_3, but if the figures given for the results from the *ingenio* are correct, the percentage should be larger. It is impossible to judge the quality of the ore accurately in the mine, because the scheelite and barite are so alike in appearance. Unless the barite is in comparatively large clear particles, the two minerals cannot be distinguished.

LOW AND NARROW DRIFTS THE RULE AT ASCENCION

The ore is so soft that most of it can be mined by pick and shovel. The saving in dynamite, however, must be largely if not wholly spent in holding up the roof and walls. Timber is exceedingly expensive and must be brought either from Washington or Cochabamba. Cochabamba is, geographically, near, being only fifty or sixty miles away, but commercially it is about as far away from the Ascencion mine as our northwestern state. There, the only timber obtainable is eucalyptus planted and grown in small quantity and shipped at high freight rates, so that there is little difference in price. Recourse is often had to stone walls and arches, which the miners build remarkably well. However, it happens that Bolivian miners in general are short, and neither of the owners of the mine is much over five feet tall, so that by the time the average Yanqui (Yankee) has gone through the mine he has a "kink" in his neck and a "crick" in his back. Not only are the stopes low, but the passages are very narrow. The vein averages perhaps a yard in width, and little wall rock except what must be broken is removed, so that when a wall five to six inches thick is built up on each side, the passageway left is only about thirty inches wide, and one is likely to have the sense of oppression that he gets in the crowded passageway of a Bolivian sleeping car. I saw but one ladder in the mine, and that had only six rungs. Instead of ladders, inclines and spiral stairways cut in the rock connect the various levels.

At the mine the ore is sorted by Indian women, and all large pieces are broken to a diameter of two inches or less. The ore is then transported by llamas to the concentrating plant on the west side of the hill and about a mile and three-quarters nearer Oruro, at a point where water is available all the year. The plant is simple, and the following process is used: The ore is crushed under *quimbaletes* (rocking stones or semicircular steel shells filled with rocks). From the *quimbaletes* the ore goes to a hand jig, the bottom of which is a screen of about ⅛-in. mesh. The undersize goes to a second jig with a screen of about $\frac{1}{20}$-in. mesh, from which the undersize goes to buddles, of which there are seven, with a diameter of about two yards and a slope from the center to the circumference of about 8 deg. From the buddles the concentrates forming the inner third of the radius are sent to the *levandos*. The middlings, a ring outside the concentrates and about one-quarter of the radius wide, are re-run through the buddles and the remaining outer ring is thrown on the tailings dump.

The *levandos* are the Cornish kieves—tall, stout tubs about 39⅓ in. high, about 32 in. broad at the top, and 24 in. across at the bottom. On the side are three stoppers about 3½, 7 and 11 in., respectively, from the bottom. The *levando* is gradually filled with water, and at the same time concentrates from the buddles are shoveled in and kept well stirred. Meanwhile a boy jars the *levando* with an iron bar, helping to keep the lighter particles suspended while the scheelite settles to the bottom. Tailings are drawn from the top hole, and middlings from the second, but the third hole is apparently used only to drain the water from the concentrates, from which the middlings are carefully scraped and the rich material is removed by hand. The middlings are run through a *lavadore*—a trough with a bottom a foot or fourteen inches wide made of a close turf or some similar substance and with a curved grade that is much steeper at the top. A stream of water runs through it as in a sluice box, and a man keeps pushing the sand up the slope against the current, and the water gradually washes out the impurities. All water from the plant goes to a series of four settling tanks. The concentrates, or *barilla*, are dried in pans heated by *yareta*, a plant that grows in low, rounded masses in these high hills and valleys and that has little in its appearance to suggest that it might be used for fuel. The *yareta* found here, however, is small and dirty, and must be washed. This is done in a tank dug in the bank of a small stream from which the water for the *ingenio* is obtained.

A LEVANDO OR KIEVE. THERE ARE NO CHILD LABOR LAWS IN BOLIVIA

BUDDLES. THE ONE ON THE RIGHT HAS BEEN EMPTIED

The capacity of the plant is said to be from ten to fifteen tons a day for one shift of nine hours, from which is produced twenty to thirty quintals (the Spanish quintal of 100 lb. is used in Bolivia) of concentrates carrying from 50 to 58 per cent WO$_3$, but mostly nearer the lower figure, and the tailings are said to carry 3 per cent WO$_3$. These figures indicate that the heads carry nearly 9 per cent WO$_3$, which, judging from the general appearance of the hand-picked ore, seems reasonable.

HEAT SEPARATION SUGGESTED

The high specific gravity of the barite gangue prevents the making of very high-grade concentrates without an excessive loss of scheelite in the tailings, and were it not for the barite the tailings would in most places be considered ore of good grade. Sr. J. F. Aguilar Revoredo suggested that as the barite decrepitates on heating, and the scheelite does not, a separation might be made by coarse crushing, decrepitation, and fine screening. There would, of course, still be the same loss in the fines. The process has not yet been tried on a large scale.

Some concentrates that had been shipped to New York are said to have been raised to more than 70 per cent WO$_3$ by electrostatic treatment. The presence of barite (BaSO$_4$) is, of course, objectionable, on account of the sulphur it contains, and for the presence of which buyers exact penalties.

The barilla is packed on llamas to the railroad at Oruro for about 43c. per quintal, $9.63 per long ton. Freight to the United States is about $125 per long ton. There is now in New York a considerable quantity of the concentrates.

Miners were paid B s3 to B s4 per day in 1920. The boliviano is equal to about a third of a dollar, exchange ranging during the first five months of the year 1920 from B s2.80 to B s3.30 for a United States dollar—and that is another of the Bolivian miner's troubles!

THE SAN ANTONIO MINE

The San Antonio mine, owned by Sr. Rafael Taborga, was one of the phenomenal tungsten mines that were developed as a result of the high prices for metals brought on by the war. Unfortunately, circumstances kept me from visiting the mine, so that I have only information obtained from others, largely, however, from Sr. Revoredo, who successfully operated the mine for Sr. Taborga. Like the other deposits described, the San Antonio mine is in the outer range of foothills, and the country rocks are the same as those of the Condeauque district, but the lode matter is siderite, in which are "bolsons" or pockets of ferberite, the iron tungstate.

When the high prices for tungsten came during the war, the San Antonio lode had been known for some time, but was not thought to be particularly promising. Tungsten prices were so high that it was worth prospecting almost any kind of a deposit that showed a particle of a tungsten mineral, but Sr. Taborga, at that time a poor bank clerk, had some trouble in raising money enough to operate the claim. Sr. Revoredo was put in charge of the work, with an assurance of salary only if he found ore in sufficient quantity to pay. It was not long before a large bolson of very high-grade ferberite was struck, but it was a pocket only in a mass of siderite forty feet wide. By exploratory work other pockets were found, but no channels, stringers, or other connections between the pockets were ever discovered. Sr. Revoredo's system was to follow one wall of the siderite vein with a drift and then to run crosscuts at short intervals to the other wall.

Near the surface the ore carried a considerable quantity of tungstite that varied in color from light lemon-yellow to deep orange. Some distance below the surface stibnite in considerable quantity was found with the ferberite, so that the ore had to be carefully sorted to make it marketable.

Probably a full million dollars in profit was made from the mine during the war, most of it in the first six months of operation, and from the profits have arisen the best office building in La Paz—a smaller edition of the fine buildings of cities in the United States—and other investments. When operations ceased, little or no ore was left in sight, and whether there are other pockets or not cannot be known without further work.

Without having seen the deposit it is, of course, difficult to form an opinion about its genesis, but some of the analogies suggested by the description as given are striking.

Iron-bearing calcites are known in a number of scheelite deposits. The Atolia deposits make a notable example—and it has been mentioned that ferriferous calcite occurs in the Jorge Quinto deposit and that in depth it seems probable that it may be found in larger quantity. Where iron entirely displaces the lime in the carbonate, scheelite is no longer found, but the iron tungstate, ferberite. The carbonate is ordinarily deposited before the tungsten mineral, and it does not seem too wild a hazard to guess that the ferberite may be a replacement of the siderite, just as scheelite has replaced calcite at Atolia and in a number of the Nevada scheelite deposits.

PACUNI DEPOSIT WORKED BY AN AMERICAN

A fourth tungsten deposit with unusual characteristics is situated at Pacuni, in a magnificent glacial valley on the east slope of the Andes, at about 17 deg. south latitude, sixteen miles northwest of Quimsa Cruz (Tres Cruces Pass), and seventy-five miles southeast of La Paz. Until 1920 it could be reached only by horseback over a trail sixty-five miles long from Eucaliptus, but now an automobile road goes past it to the Caracoles tin camp. This deposit was held during the war by C. Dillon, an American, and a considerable production was made during the years of high prices. The large glacier that once filled the valley to a depth of perhaps a thousand feet has receded, and only the comparatively small tributary hanging glaciers are now left, like the streams that flow from the mountains in our arid west and are lost in the desert sands. One of the small glaciers is situated directly over one part of the vein and at irregular intervals pushes masses of

[illegible]

ice over a precipice onto the trail below. Four or five years ago several men were killed by such a mass.

VETA BLANCA VEIN CARRIES BLACK SCHEELITE

On the north side of the valley tungsten-bearing quartz veins cut quartz monzonite close to its now eroded contact with quartzite. The lower end of the exposed part of the principal vein, known as the Veta Blanca, is at the top of the large débris slope, at an altitude of about 15,500 ft., whence it may be followed straight up the steep mountain side to a height of perhaps 16,300 ft. The vein is about two feet wide, and carries masses of wolframite with scheelite that is nearly as black as the wolframite. The most noticeable mineral in the vein, aside from the quartz, is a green chlorite of the variety prochlorite. The prochlorite seems to be original in the vein, and not a replacement of the country rock. There are places in the vein where the chlorite appears to be a replacement of brecciated granodiorite; however, as none of the granodiorite along the walls is chloritized, it seems probable that the prochlorite of the vein may have been brecciated by later movements. The fact that most of the tungsten minerals are in the prochlorite also seems to indicate its vein formation. Besides the minerals named, the vein carries considerable white apatite, in irregular masses, some of which are two inches in longest dimension; some pyrite; a little chalcopyrite, and at some places a little magnetite and brown tourmaline. Assays of the ore have shown as much as 6 per cent of tin, though some assays show only a small fraction of a per cent; but no cassiterite is visible.

Owing to its black color, no one seems to have known of the occurrence of scheelite in the ore, and it seems always to have been mistaken for wolframite. In thin section, the scheelite shows black particles along planes parallel to the crystal faces. These spots are probably small particles of wolframite, though their shape is exceedingly irregular. The only other black scheelite that I have seen occurs in very small quantity on Monte Solitario, near Las Vegas, N. M. In many specimens the scheelite is intergrown with, and has grown around, pieces of wolframite. In lamp light the scheelite has a purplish tint, and I supposed it to be a fluorite, but when I got the specimen out to daylight there was no hint of purple, and I could not at first think what had become of my specimen of supposed fluorite.

The cleavage of the wolframite and scheelite is, of course, very different. The wolframite breaks with rather broad cleavage faces, and the scheelite in much smaller faces, appearing somewhat hackly, but where the wolframite is finely crystallized this difference is not so apparent; however, the light-colored streak quickly identifies the scheelite.

In the quartz monzonite on each side of the Veta Blanca the feldspars and part of the quartz are replaced by sericite for a distance of three to four feet, giving the rock a dark gray color, and in places it is more or less porous. The vein is regular in its width and dip (nearly vertical), but at one place it is cut off by a replacement lode carrying tin. The ore taken from the vein is said to have averaged 8 per cent WO_3.

In one of the upper drifts three to six inches of ice is frozen on the floor for 125 ft. from the portal, and icicles had grown from the roof to the floor during the summer following its operation. The mountain side is so steep that few beings other than a mountain goat or a Bolivian Indian can wholly enjoy traveling over it, especially during the "tropical" summer, when snow frequently covers the rocks.

Concentration was carried on in much the usual Bolivian way, by first crushing and then passing through jigs, over Wilfley tables, and thence to buddles. The crusher and tables were run by a small waterwheel.

Other veins with somewhat similar characteristics occur on each side of the Veta Blanca, but are smaller. Besides wolframite, black scheelite and prochlorite, one vein carries needles of bismuth carbonate replacing bismuthinite. In the quartz monzonite near the Veta Blanca narrow crevices contain a network of small pyrite crystals, with here and there a crystal or aggregate of small wolframite crystals, distributed with astonishing regularity. They are, however, of no economic importance. The veins are included in the great tract of tin-bearing property taken over by Guggenheim Brothers. They were merely incidental to the property and have not been worked since they were acquired.

CLIMATIC CONDITIONS OF VETA BLANCA DIFFICULT

The altitude is 1,000 ft. higher than that of Mount Whitney, and is trying to North Americans. The climate is cold, snowy, foggy, rainy, and disagreeable. Winds in the winter are very severe, and I was told that in 1919 two men were blown over one of the precipices along the vein and were killed on the sharp rocks below. Food for man and mule, and fuel, must be brought in from considerable distances, and building material, except stone, sticks, mud, thatch, and plaster of paris, comes from the United States or Europe.

The Indian miner has heretofore lived in cold, squalid, muddy misery, lightened or at best temporarily forgotten in flirtations with ethyl alcohol during fiestas, but he is, considering his circumstances, an excellent workman. Better housing, better food, and better clothing will undoubtedly make a better man of him, and Guggenheim Brothers have been furnishing these things for their workmen. When speaking of the Indian it must be remembered that his wife is about as good a man as he himself. She lugs a baby on her back, shovels ore, and cooks their modest stew, and I have seen a ten- or twelve-year old girl carrying the small brother or sister on her back for miles along the trails at a gait that my mule could not equal. The Guggenheims brought in a good doctor, and probably for the first time many of these natives had the benefit of competent medical attention.

The property is about sixteen miles from Quime, a little mountain town situated in the broad, verdant head of a narrow valley at an elevation of only about 10,000 ft. On approaching Quime after a few months in the high, bleak Andes, it appears altogether charming, with its eucalyptus trees and corn fields. After a closer acquaintance, some enchantment due to distance must be admitted, but the climate is fine, even if efforts at sanitation are scant.

For 400 years the trade of Quime and the country beyond has been carried wearily back and forth across the 16,000-ft. Quimsa Cruz Pass, and no wheeled vehicle or modern agricultural implement has reached it, but the Guggenheim auto road is only about ten miles away, and the Marta Company, half way to it, has planned a five- or six-mile extension of the road to its tin mine, and the little gap of four or five miles left may soon be graded so that that greatest modern civilizer since the telephone, the Ford, will roll down into Quime's cobbled provincialism. During the war Quime acquired considerable note on account of the wolframite mines situated near it.

The mines were all closed, and for that reason I did not examine them, but I saw the most wonderful wolframite crystals from them that it has ever been my pleasure to look upon—groups of crystals 2½ in. long, with apparently perfectly square cross-sections, truncated by single dome faces, all as if artificially polished, and set in groups of clear quartz crystals. Other crystals of fine symmetry reached a size of 2 by 3 by 4 in. I tried in vain to buy some for the United States National Museum, and finally extracted a promise from an owner that he would send me some, for which I left money to cover packing and postage. They have not yet come, but neither have several hundred pounds of specimens that I left for forwarding with the principal commercial house of the country. They may all come, *Poco tiempo*.

Probably the only tungsten mine from which tungstite, the hydrous tungsten oxide, has been shipped as an ore, is that of Easly and Inslee, a day's journey (eighteen or twenty miles—more or less) east of La Paz. This mine was leased to the French government during the war at a high monthly rental, which was scrupulously paid. I did not see the property, but I have seen numerous specimens from it, and have had descriptions from both the owners and the French representative, M. Mollard. The vein was said to be eight inches to a foot thick, and was greatly oxidized. Specimens show large crystals of wolframite cut by numerous flat cavities evidently representing the spaces once occupied by barite crystals. From the vein were taken several tons of tungstite in pieces many of which were larger than a man's fist. No mine anywhere else in the world is known to have produced so great a quantity of tungstite.

Excellent specimens from each of the deposits described were donated by the owners to the United States National Museum, which is building up a collection of constantly increasing value to the miner, engineer, or other student of ore deposits, and probably has the best collection of tungsten minerals to be found in the world.

A New Mode of Prospecting

The faithful work horse and plow seem fast replacing the picturesque burro as a prospecting medium in northeastern Washington. Last spring, Gust Maki, a farmer near Northport, Wash., while plowing in his field unearthed float boulders of smithsonite (zinc carbonate). He traced these a short distance and discovered a deposit of zinc ore, which in the past year has produced enough ore to make him independent of farming. Now comes Edwin Seaman, a farmer near the town of Valley, in the same county, who has discovered in a similar manner a quartz vein carrying appreciable mineralization in the form of gray copper and chalcopyrite. From rich surface float Seaman has collected nearly a carload of selected samples for shipment. The vein that the plowshare uncovered is now being prospected, and it is reported that it has considerable promise.

The Electrolytic Recovery of Zinc In Tasmania

In the treatment of zinkiferous ores such as the complex ores containing zinc and other metals which are mined in Broken Hill, the electrolytic method of treatment as carried out by the Electrolytic Zinc Co. at Risdon, Tasmania, is becoming more generally applied, and a smaller proportion of zinc ores is now smelted, according to a writer in *Chemical Engineering and Mining Review*.

In the electrolytic method of treatment, the concentrates are first roasted and then leached with sulphuric-acid solution. The residue left after the leaching operation contains a certain amount of zinc, together with lead and other metals, and it has been customary to treat this residue for the formation of fume by mixing the same with a reducing agent, such as coke, and subjecting the mixture to a blast of air on a Wetherill grate or some such suitable furnace. This fume is sometimes sold as a leaded zinc pigment, but is often leached with sulphuric acid to produce electrolytic zinc.

The method of fuming as applied to the residue from the leaching operation has also been applied directly to the ore, either roasted or unroasted.

Various patents have been taken out for processes aiming at the conversion of zinc into fume, and its collection therefrom. In 1904, J. C. Clancy proposed blowing sulphide ore into a highly heated chamber to transform the zinc sulphide into oxide, which would be condensed and leached out with H_2SO_4. In 1907 Hommel and Sulman patented an elaborate process in which the sulphide ore is roasted and mixed with coal and suitable fluxes, placed in a furnace on heated fuel, and air blown through. The zinc is recovered from the condensed fume by leaching with sulphuric acid. J. H. and P. M. Gillies in 1916 proposed to fume lead and zinc, leaching the zinc from the condensed fume with H_2SO_4. Laist, of Anaconda, patented a process in 1917, in which the residues are dried, mixed with fine coal, and smelted to produce a matte, slag and fume containing the lead and zinc, which is collected and leached with dilute H_2SO_4 for the recovery of the zinc.

In all these methods, however, the expensive means of collection by baghouses or electrical precipitation have been involved. Experiments have accordingly been carried out by the Electrolytic Zinc Co. at Risdon with a view to evolving a process by means of which the fumes may be directly leached without the intervention of a baghouse or other means of collecting the valuable constituents of the fume.

The resulting new treatment, which it is planned to put into operation on a large scale, consists in passing fume from the Wetherill furnaces upwardly through a tower checkered with suitable packing to give a large area of contact and to prevent accumulations of the insoluble portion of the fume. Down this tower H_2SO_4 solution (spent electrolyte) is caused to flow against the current of the fumes so as to be brought into intimate contact with them, causing the soluble constituents, which consist principally of zinc compounds, to be dissolved in the descending solution, which is run into a receptacle at the bottom of the tower. The solution and solid residue thus collected are treated by known metallurgical methods for the recovery of their valuable metal contents.

War Problems in Minerals

Introductory

BY J. E. SPURR

THE SERIES OF PAPERS which is begun by the article by Mr. Westervelt in the present issue is intended to record a consecutive series of events in the handling of the mineral situation in Washington, during the war, by agencies specially mustered or drafted for this specific purpose, and operating without any agreed or premeditated organization. Although these agencies worked, of course, through fixed and organized Government departments, they availed themselves, for their information, for their powers, and for the scope of their work, of all the pre-war departments and also of the specially created war boards. Even the pivotal point of operations shifted according to opportunism and necessity.

The War Minerals Committee headed by Mr. Westervelt operated under the ægis of the Interior Department, but only semi-officially; the Committee on Mineral Importations had its origin and source of instructions from the Shipping Board, together with the War Trade Board and the War Industries Board; and the subsequently developed unofficial interdepartmental organization trailed between the War Industries Board and the Interior Department, till it centered more and more in the latter; and the post-war aftermath of the campaign rested, of course, with the Interior Department. Yet the files of no one, nor, in fact, of all of these organizations taken together, will afford any consistent report of the story of the effort to regulate the supply of minerals for war purposes during 1917 and 1918. It is a story which should go on record, as part of the history of the mineral industry, and, in our special field, as a record of an important detail of war history, covering a subject which it is still our business to study and to try to solve.

I have felt that the series would be incomplete without articles covering the work of the Geological Survey and the War Industries Board; and I hope to be able to present special papers on these later. Unquestionably, the Geological Survey rendered greater war service as regards mineral policy than any other organization in the Government and outside. The knowledge of the mineral situation which its experts possessed, and their detached judgment as to the preferred mineral policy, was the solid foundation on which rested the decisions and movements of the other agencies which had to deal with the mineral problem. I shall hope that the Director will contribute an article frankly setting forth these facts in detail. The Geological Survey was a bureau, however, possessed with little or no executive authority; and the advent on the field in Washington of various boards and committees suddenly empowered, under the necessity of war, with peculiar and vast executive responsibilities, furnished the combination of special knowledge and executive responsibility which prepared for and justified prompt action on vital problems which came up in swarms for decision.

It is fortunate that those who were then charged with responsibility for action were engineers and geologists, with long-established personal contact with the Geological Survey and the Bureau of Mines, and that all fitted together with the alacrity of war volunteers in no time at all. But it was not an official organizathen, and the higher officers of the Government had no conception of how the problem was being handled—and still have not—and this includes to a large degree the heads of the departments and of the war boards. Altogether, while the fundamental idea of these papers was to show the machinery of this rough group of vigilantes, and expose the lack of organization as an argument for a better organization against present and future necessities, yet, after all, looking back, one is finally thankful that it was no worse, as it might easily have been, and that the major problems of mineral supply were solved with at least a fair degree of correctness and promptness and were handled by qualified experts.

The record of war activities in Washington would also be fragmentary without a setting forth of the special and vastly important work of the War Industries Board, most powerful and most responsible organization of all —work which was in charge of Mr. Pope Yeatman and others. I further hope that we may be able to publish a special article on this phase of war mineral history, and setting forth the problem from that vantage point.

In these articles no attempt at co-ordination is made. Each contributor has written his article without consultation or conference with the other. Thus the individuality and the different points of view are left as they exist, and if there is any slight suggestion of Browning's "Ring and the Book," it will not detract from the effort at maximum frankness and clarity and historical value, except in so far as the view is just that the actors in a historical episode are utterly incapable of recording it fairly and accurately; and this we cannot well eliminate.

I.—The War Minerals Committee, 1917-1918

BY WILLIAM YOUNG WESTERVELT

THE WAR MINERALS COMMITTEE was organized early in July, 1917, and was constituted in personnel and representation as shown in the table on the following page.

The need of a war committee to determine the possibility of replacing imported by domestic minerals essential to the prosecution of the war, and to foster such replacement, was realized in the spring of 1917 by Mr. Hotchkiss, who then went to Washington to urge the formation of such a committee. He interested in his proposal Mr. Philip N. Moore, then President of the American Institute of Mining Engineers, and Mr. De Wolf, and, by the combined efforts of the three, the listed national organizations related to the mineral in-

Organization Represented	Representative	Connection with Organization
U. S. Geological Survey	David White, Chief Geologist	
U. S. Bureau of Mines	[illegible] Mineral Technologist	Secretary
Association of State Geologists, Geological Committee of National Research Council	W. O. Hotchkiss, State Geologist of Wisconsin	
American Institute of Mining Engineers, Mining and Metallurgical Society of America	William Young Westervelt, Consulting Mining Engineer, New York	Chairman
	Harvey S. Mudd, Mining Engineer, Los Angeles	Assistant Secretary
	F. W. DeWolf, State Geologist of Illinois	[illegible]

dustry of the country became interested and nominated their respective representatives. Subsequently, Mr. Mudd, who volunteered to come from Los Angeles to Washington for service, was appointed Assistant Secretary.

The first work of the committee consisted in receiving reports of mining engineers and geologists of the Geological Survey, of the Bureau of Mines, of its own members, and of others in private practice, as to the possibility of stimulation of domestic production of the principal imported minerals to meet the usual and war needs of the country. From these, and from subsequent examinations and reports made expressly for the committee, it was evident that, having due regard to the time required for domestic mineral development, a very considerable tonnage of deep-sea shipping could be made available, for the all-important transportation of munitions to Europe, by gradually withdrawing shipping from mineral importations. The largest ship tonnage so available was found to be employed in the importation of sulphur as pyrites. It was also found that by adaptation of steel metallurgical practice to meet domestic ore limitations, accompanied by sufficient development of domestic sources, a somewhat lesser ship tonnage might be secured by withdrawal from manganese ore importations. A still smaller ship tonnage, it was found, might be secured by withdrawal from the importation of ores of chrome and other minor minerals.

By this means not only could shipping, of which the Allies stood in such dire need, be secured, but the United States could be made just that much more self-sustaining in case of long-continued success of the German submarine campaign. The Council of National Defense, the Shipping Board and the mining public were accordingly advised of the circumstances, urged to increase domestic production of these minerals wherever economically practicable, and to allocate the steadily dwindling, high seas shipping with these facts in view.

But as the work of the committee progressed, the necessity became more and more evident of a legally constituted central authority capable of understandingly adjusting to mining and metallurgical needs the ever increasingly drastic war effects on labor, supplies, and transportation, manifested through the purchasing and commandeering powers of the Army and Navy. If the war was to be indefinitely prolonged, as then seemed to all possible or even probable, power to appoint and the necessity of appointing some great captain of the mineral industry as Minerals Administrator became more and more apparent. Provision of funds and authority for the Government to stimulate the development of feasible but ordinarily unprofitable domestic deposits of heretofore necessary imports was also advisable.

Accordingly, after consulting with various authorities, including Mr. Hoover, who was by then well started on his brilliant demonstration of what a proper war administration can accomplish in fostering and developing a great basic industry, the committee became convinced that a War Administration law should be secured as quickly as possible. No other means offering, the committee itself drew up a War Minerals Administration Bill, including all minerals and the products therefrom (other than fuels, which had already been provided with an administrator), and submitted it to the Mines committees of the United States Senate and House of Representatives.

From then on the committee devoted itself primarily to securing support for this bill, which, after considerable modification to meet various views of those concerned, was finally enacted into law the following autumn.

One of the most important features of this legislative work of the committee consisted in getting the situation sufficiently clearly before the membership of the national mining, metallurgical and geological societies to secure their indorsement; an indorsement unstintingly and most effectively given as soon as the situation was clearly understood.

The indorsement of the Army, of the Navy, of the Treasury Department, of the Department of the Interior, of the Council of National Defense, of the Food Administration, and finally of the President himself had also to be secured, the committee working largely through its bureau connections in the Department of the Interior.

The interest of the non-technical leaders of the mining industry was also sought and ultimately gained. But being keenly alive to the necessity of limiting as much as possible governmental interference with business conditions, at first these leaders were inclined to oppose the bill as more likely to increase than to desirably modify Government influence. To meet this objection the major mineral industries were dropped from the bill, for, though regretting it, the committee felt it futile to delay the passage of the bill by attempting to avoid this omission and was convinced that the imperative need was the appointment of a suitable Minerals Administration under whatever conditions were practical. A mining man was felt to be needed in the high councils of war, of such knowledge and eminence as, when given authority, he would be able so to modify the inevitable regulations and restrictions of war to the essentials of mining and metallurgical industries as would best fit these industries to support the war and to emerge therefrom reasonably ready for peace.

As the inevitable welding of the entire nation into one gigantic war machine began to be more obvious with the prolongation of the war, it was believed that each specific mining industry would seek and would then, through this Minerals Administration, receive, in the high councils of war, recognition of its necessities for proper development under both war and subsequent peace conditions. In fact, even though the war was [illegible] after America's entrance on the battlefield, and though the War Minerals Bill became law too close to the time of signing the Armistice to admit of even final determination of the personnel of the Minerals Administration, some of the industries that had been omitted from the bill at their own request were already striving to be included under its protection. The situation, as summarized in a letter written in May, 1918, by the chairman of the committee to the members of the Mining and Metallurgical Society of America, was:

> "Though this bill grants no powers over any but the minor minerals enumerated therein, I believe it offers the best opportunity the mineral industry is likely to have of securing adequate representation in the high councils of the War Administration. With our transportation and fuel supply in the hands of Government, and with labor and supplies all rapidly coming under Government control, do you not agree that it is most urgent that we quickly secure the appointment of some prominent member of our profession to such high position in the Government councils as would be held by a Minerals Administrator? Some one in constant attendance at Washington must be in a position to see to it that the Government control necessitated by the war is directed toward fostering rather than suppressing the mineral industry, or the war itself may be lost through lack of essential raw materials."

With the signing of the Armistice, practically immediately after the passage of the War Minerals Administration Bill, the work of the War Minerals Committee, like that of all other purely war activities, automatically ceased.

From the beginning, the committee was greatly assisted by its sponsor organization. The Government bureaus supplied quarters, organization, services of government engineers, and other facilities in Washington, and the National Societies supplied funds, publicity of the committee's needs through their publications, and services of officers and members. In all instances response to requests to members of the profession for services, information, and assistance was unstinted as soon as the need for war purposes was made plain.

Directors Smith and Manning, of the Survey and the Bureau respectively, promptly sent their various experts on matters in hand to report both verbally and in writing to the committee, and, in so far as was feasible, both directors relieved their respective representatives to the committee of other duties during the more confining part of the committee's work. In spite of their best efforts, however, the Government members of the committee inevitably gave a large amount of time to the committee's work under conditions which meant spending a corresponding amount of overtime attending to essential parts of their regular responsibilities. The other members of the committee, being in Washington exclusively for the purpose, were able to give their entire time while there to committee business, but being unable entirely to neglect their responsibilities as private engineers, could not be in Washington continuously, as were the Government members. Between the two classes of members, however, the committee was able to function fairly consecutively so long as the work so necessitated, and Mr. Mudd, entirely abandoning his private practice, moved to Washington and devoted himself exclusively to the work of the committee until after the signing of the Armistice.

In response to a general appeal, many private engineers sent in reports on mining prospects in which the committee might be interested, thus supplying much valuable data. At the instance of the committee, special examinations of various properties were made gratis by various prominent engineers, among whom might be mentioned Messrs. J. Parke Channing, F. Lynwood Garrison, J. E. Johnson, Jr., James W. Malcolmson, Philip N. Moore, J. H. Rogers, and others.

Idaho Bureau of Mines Issues a Bulletin on "Testing Ores For Flotation"

The Bureau of Mines and Geology of the State of Idaho has recently issued Pamphlet No. 3, "Testing Ores for Flotation," by A. W. Fahrenwald. In preliminary testing work, it is recommended to grind from 75 to 100 lb. of the ore to pass 65 mesh. Wet grinding in a small ball mill is advised, inasmuch as it gives 5 to 10 per cent better recoveries and grades of product than dry grinding. After the best conditions for the treatment of the original sample have been determined, other samples should be ground to pass 48, 100, and 200 mesh for further testing to determine the degree of fineness desirable.

Flotation testing machines should conform to the following specifications:

1. The capacity should be not less than 500 g., preferably 1,000.
2. They should be capable of being easily charged, discharged and cleaned.
3. They should preferably be of the centrifugal impeller type, which allows the aeration to be controlled, and makes easy the use of gases such as SO_2 and H_2S.
4. The sides should be of glass to facilitate the observation of results.
5. There should be no circulation pipes.
6. The impeller shaft should enter from the top.

After adding a 1,000 g. sample to the machine, it is diluted with 1 liter of water, and the controlling agents added, if used, followed by the flotation agents. After thorough mixing, the pulp level is raised to within 2 in. of the overflow lip and the removal of the flotable minerals is effected by agitation and frothing. This should last from three to twenty minutes, depending upon the character of ore being tested. Testing work is usually done with a pulp dilution of 4 of water to 1 of dry solids, but other dilutions should be tried. Low pulp dilution, 2.5 or 3 to 1, is usually best for differential flotation.

Among flotation agents, all of the pine oils are good, steam-distilled being among the best. Pine-tar creosote and wood turpentines are used a good deal, as are hardwood creosotes. Coal tars are used in conjunction with pine or other frothing oils. Coal-tar oils lower the surface tension of water less than the more soluble pine oils and therefore require more agitation and mixing. Hardwood oils have a low oil-water interfacial tension and spread rapidly on water. They are exceptionally good flotation agents for this reason.

Sulphuric acid, salts, or alkalies may be used as controlling agents. Small amounts of the acid are often beneficial in keeping down the percentage of gangue in the concentrate. The kind of controlling agents to be used and the amounts depend entirely on experiment and experience. Also the time of agitation with the controlling agent is of great importance, and tests should be made in which this time is a variable, especially in differential flotation work.

The time required to remove all of the mineral should be noted, as this will give an idea of the number and length of cells necessary in large-scale work.

If testing be done with care and knowledge of the influence of all details and factors, the test results can almost always be duplicated in a mill, in the opinion of the author.

Mining Engineers of Note

Stanly A. Easton

IN SEEKING Stanly Easton at Kellogg, Idaho, one is most likely to find him in the mine, in the mill, or in the mine surface plant talking over some detail of the work with one or more of his men. You are impressed, whether you meet him thus or back of his desk in the main office of the Bunker Hill Mining & Concentrating Co., with the fact that he is on the job. As a mine manager, he is in intimate touch with his staff, foremen, and workers and with the operation as a whole or in detail. Mr. Easton's parents were California pioneers from New England. His mother was Mary Esther Gushee. Her father came to California in 1848 by way of Vera Cruz and Mexico. Mr. Easton was born at Santa Cruz, Cal., and was fortunate in establishing a connection with the mining industry early in life. His first employment was as an office boy for Hans C. Behr and W. I. Salkeld, a firm of engineers engaged in mechanical and mining engineering in San Francisco. They were prominent in mill and hoisting plant construction in Virginia City, Nev., at the time. Hans C. Behr became internationally known in mine hoisting and mechanical engineering of mines. From office boy young Easton was advanced to the field and in construction work had his first opportunity of getting in intimate contact with the many activities in mining current at that time.

[illegible]

With this opportune acquaintance with the industry he entered the college of mines of the University of California, and was graduated from that institution in 1894. On leaving college, Mr. Easton made for the nearest mines and found employment underground at gold properties in Calaveras and Tuolumne counties where he was known, having previously spent his vacations there. The usual run of miscellaneous work was encountered, such as assaying, mining, and mill and construction work. In 1896 he went to the Northwest and enlarged his experience by working underground in western Montana, Rossland, B. C., and in the Coeur d'Alene. In the last named place he was employed as a miner in the winter of 1896-97 at the Bunker Hill & Sullivan. Whether he visualized his future connection with this famous mine at the time is not known, but subsequent events no doubt made this preliminary experience exceedingly valuable.

His next experience was in charge of productive mining work at Silver City, Idaho, in 1897, and in 1899-1900 he had charge of development work at Greenwood, B. C., and afterward at Republic, Wash. With six years of valuable experience, he engaged in mine examination work (1901-1902) under F. W. Bradley and with the late Capt. J. R. De Lamar's corps of engineers. Mr. Bradley was impressed by the ability and character of the young man, who had become a valuable assistant, and placed him in charge of the Bunker Hill & Sullivan properties when Albert Burch resigned. Since Jan. 1, 1903, Mr. Easton, under Mr. Bradley, has been in direct charge of all operations, and both of these men have consistently developed and equipped the property, with the result that since that time over $2[illegible] has been disbursed as dividends and over $4,000,000 of earnings returned to the property in betterments and extensions of operations. F. A. [illegible] history of the Bunker Hill enterprise is a complete account of this important property worthy of the attention of both engineer and mining student.

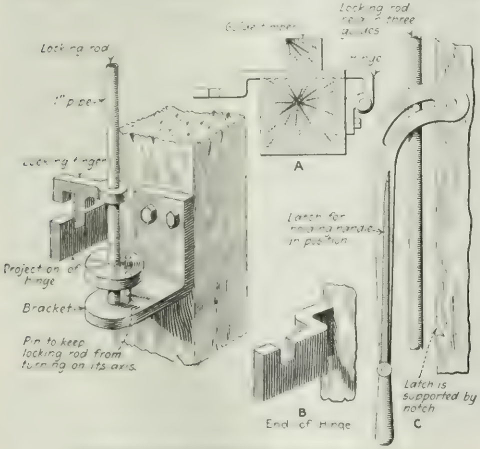
Despite the exacting requirements of his present position Mr. Easton has found time to engage in consulting practice and has directed two small but highly profitable operations in the Coeur d'Alene. He was married on Nov. 15, 1906, to Estelle Greenough of Missoula, Mont., and there are three children. Mr. Easton has energized the Idaho Mining Association and has been exceedingly helpful to young engineers. His ability as a leader has not been overlooked, for he is a member of the American Institute of Mining and Metallurgical Engineers at present and has been a director in the Mining and Metallurgical Society, president of the [illegible] and of the Idaho Mining Association. He is a member of the Idaho State Board of Education and holds at present the position of chairman of the executive committee of the Board of Regents of the University of Idaho.

HANDY KNOWLEDGE

Locking Hinged Guides

Written for Engineering and Mining Journal

Skips and cages are removed from the shaft compartment in most instances by providing hinged guides for each compartment at a convenient height above the collar of the shaft. The length of the hinged guide section is determined by the distance between the lower and upper skips or cage runners, plus 2 or 3 ft. for clearance. The guide section is bolted to two, three, or four heavy hinges, which are forged from ½ x 4-in. or ¾ x 4-in. wrought iron and securely bolted to the timbers. The securing of the hinges when the guides are in running position is worked out in various ways. One of the simplest methods is the hasp and pin. This answers for a short section of guide, but at best is inconvenient and wasteful of time. A device for locking the hinges in place has been worked out at the Plymouth Consolidated Gold Mines, at Plymouth, Cal., and is used at the main shaft of the mine.


Locking rod
1" pipe
Locking finger
Projection of hinge
Bracket
Pin to keep locking rod from turning on its axis
Guide timber
Locking rod ... three guides
Hinge
A
Latch for holding handle in position
B
End of Hinge
Latch is supported by notch
C

DEVICE FOR LOCKING HINGED GUIDES

A—Horizontal section through guide timber. *B*—Detail of device. *C*—Handle for lifting locking rod.

The moving blade of the hinge is extended and a square notch cut into it. A locking finger attached to a vertical 1-in. pipe engages the notch on the blade of the hinge. The locking rod is sufficiently long to carry a locking finger for each hinge on a guide section. Near the end of the locking rod is a collar which rests upon the lower bracket and supports the weight of the rod and its attachments when the hinges are locked in position. To keep the locking fingers in proper position a guide pin is screwed into the lower collar, as shown in the illustration. The rod is held at the top, middle, and bottom by brackets, which prevent it from buckling. To lift the locking rod an ingenious handle operating on the principle of the cam is provided. This is shown at *C* in the figure. *A* is a horizontal section through the guide timber. Each hinged guide section is provided with a locking rod and operating handle.

Device for Indicating Hoisting Level

Written for Engineering and Mining Journal

At the Kennedy mine, Jackson, Cal., the device shown in Fig. 1 is used to indicate to the hoisting engineer the level from which hoisting is to be done. The arrangement consists of a vertical board attached by brackets to the vertical timbers supporting the guides above the shaft collar. The numbers of the levels are painted in large figures upon the board. A pointer attached to a cable is moved up and down by a hand wheel, thus indicating the level to the engineer.

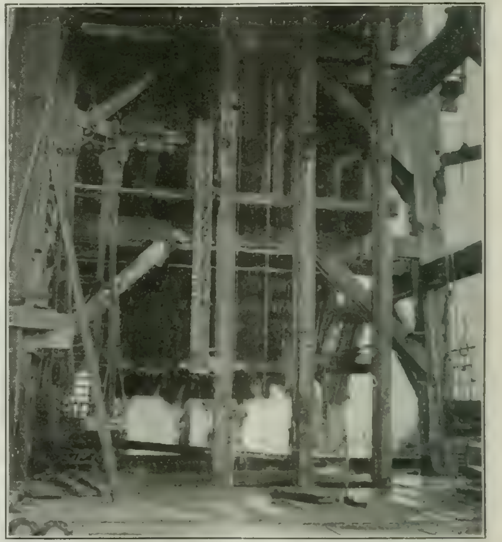


FIG. 1. DEVICE USED AT KENNEDY MINE, JACKSON, CAL., TO INDICATE HOISTING LEVEL

At the Argonaut mine the shaft level is shown to the engineer at the hoist by a series of boards, each one of which is numbered in accordance with the level indicated. The boards are strung upon two rods in two rows in a position convenient to the top man and within view of the hoisting engineer. Levels are indicated to the hoisting engineer by swinging the board down as shown in Fig. 2. At several other California mines electrical devices are used.

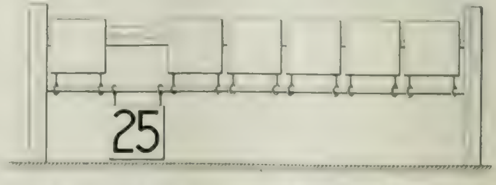


FIG. 2. DEVICE FOR INDICATING HOISTING LEVEL USED AT ARGONAUT MINE, JACKSON, CAL.

THE PETROLEUM INDUSTRY

Fort Norman Oil Supplies Local Demand

SPECIAL CORRESPONDENCE

A market has already been found for the oil produced by the Imperial Oil Co. at Fort Norman. There is an active demand all along the river for gasoline for motor launches and motor-propelled scows, and officials at the well have been overwhelmed with applications for supplies, which they were generally unable to meet, as only a few drums had been distilled by a primitive apparatus. Gasoline sells for $2 per gal. along the river at the northern posts, and traders, trappers, and all who engage in river transportation are looking for a reduction in price as soon as any appreciable local supply is available.

G. P. Kells has a force of men erecting gasoline storage tanks and a modern gasoline distillation plant. Five tanks of 4,500 gal. capacity each will be erected. The distillation plant has a capacity of from 150 to 200 gal. of gasoline per day, and it is expected to be operation in a few weeks.

Oil Obtained by Shaft in Estill County, Ky.

SPECIAL CORRESPONDENCE

In Estill County, Ky., where the oil industry of the state started, a method[1] of taking crude oil from the ground, which is designed for areas where shallow wells have been pumped out, is being tested.

The method consists of mining the oil, and is being tried out by D. W. R. Kinney, a former Montana gold miner. There is a growing expectation among those who have watched his work that the attempt will be an entire success.

Mr. Kinney began operations last May, and now has a shaft 8 ft. x 12 ft. sunk to a depth of about 135 ft. This is lined with timbers and cement. Stairs have been built all the way down to the cap rock. At that point the shaft penetrates the oil sand, and there is a production of four or five barrels a day.

It is Mr. Kinney's intention to continue through the oil sand, and when he has again struck a solid stratum, to enlarge the shaft, thus forming a pit into which oil will drain from the oil sand above.

To Begin Oil Drilling in Cochise County, Ariz.

SPECIAL CORRESPONDENCE

Under the terms of an agreement with a well-drilling company of Yuma, Ariz., drilling will begin within ninety days for oil in the Mescal Gap district, twenty miles from Tombstone. Leases have been secured on 5,055 acres of land.

Many geologists have examined the district, and all agree it is favorable for oil prospecting, with indications that oil will be struck from 2,200 ft. to 2,500 ft. The company has agreed to drill to this depth, and, should indications warrant, will go further.

Oil Concessions on Dead Sea To Be Drilled

WASHINGTON CORRESPONDENCE

Inquiry by the Department of Commerce into reports that discoveries of oil have been made in the vicinity of the Dead Sea, in Palestine, develops the fact that though traces of oil have been found in that vicinity, there are no producing wells. A New York company, however, is preparing to drill on a concession near the southwestern edge of the Dead Sea. Because of the broken character of the country and the hostile attitude of the Bedouin tribes, little prospecting has been done on the east side of the Dead Sea, but bitumen is collected in small quantities from the surface of its waters. Before the war, about fifty tons of this material was sent to Germany, where it was used in the glazing of patent leather. Limestone shales impregnated with oil are found on the northwestern coast of the Dead Sea and in the Yarmuk Valley.

Petroleum in Poland

WASHINGTON CORRESPONDENCE

Poland is well on the way to economic independence, in the opinion of the Department of Commerce. A survey of economic conditions in that country shows that the production of coal is now approximating the pre-war rate. With regard to the petroleum situation in Poland, the report which was made public Sept. 12 says: "The production of crude oil, another important mineral product of Poland, also fell nearly one-third during the war. As two or three years are required to complete new wells, the production has not begun to recover, but the number of wells in process of drilling has increased materially. The refineries are now in position to handle all the oil produced, and exports of the finished product are rapidly increasing. They amounted to more than 200,000 tons in 1920."

Wireless in Canadian Oil Field

SPECIAL CORRESPONDENCE

In reply to a demand by O. S. Finnie, acting secretary for the Northwest Territories of Canada, for a system of wireless communication in the oil fields, A. H. Morse, of the Marconi Wireless Co., has issued a statement showing that the responsibility for delay in the matter does not rest with the company. The latter, he says, has studied the situation at Fort Norman for several months and got together the complete sets of modern wireless equipment, and by Aug. 1 it had everything ready for the establishment of a chain of five stations. It applied to Ottawa for licenses to proceed with the installation, but as the licenses had not been granted the company was unable to carry out the scheme, and even should the licenses be received the season is now so late that nothing can be done this year.

---

[1] [illegible]

MEN YOU SHOULD KNOW ABOUT

Arthur B. Foote, of Grass Valley, was recently in San Francisco.

Lindsay Duncan, of San Francisco, has returned from Tacoma, Wash.

H. A. Guess has returned to New York from a trip to the Northwest.

Charles A. Roger has returned from Chile, and has gone to Salida, Col.

F. E. Briber is with the Utah Consolidated Mining Co., at Bingham, Utah.

Tallmadge Kyner, of Denver, is making examinations in the Lordsburg, N. M., district.

R. A. Bryce, of Toronto, has returned from an examination in the Kirkland Lake gold area.

Dorsey Lyon, of the U. S. Bureau of Mines, has returned from Alaska and is in San Francisco.

H. Foster Bain will be in Berkeley, Cal., Oct. 3 and will leave for Bakersfield, Cal., Oct. 6.

L. H. Goodwin is temporarily at Absecon, N. J., for the Allis-Chalmers Manufacturing Co.

Fred B. Ely is leaving Arizona to make extensive examinations for oil and gas in western Mexico.

Sir Robert Borden, former Premier of Canada, has been appointed a director of the British American Nickel Co.

Jay A. Carpenter has accepted the professorship of mining at the South Dakota School of Mines at Rapid City, South Dakota.

E. Horton Jones, formerly chief engineer of the International Nickel Co. at Copper Cliff, Ont., is in New York City for two weeks.

E. M. Sawyer, general manager of the Phelps Dodge Corporation, Burro Mountain Branch, is in New York and the East on a vacation.

Stuart Croasdale & Co., mining and metallurgical engineers, announce the removal of the Pittsburgh offices to 946 Union Arcade, Pittsburgh.

William H. Emmons, professor of geology, University of Minnesota, was recently in San Francisco en route to Minneapolis from China.

R. A. Hardy, manager of the United Comstock Mines Co., operating at Gold Hill, Nev., has returned from a several weeks' business trip to Alaska.

Alan M. Bateman, of the Department of Economic Geology of Yale University, has returned to New Haven from professional work in Alaska.

Arthur Murphy, of the Ash Peak mine, Duncan, Ariz., has gone to the Pacific Coast on business in connection with the construction of a new mill.

Sam P. Hodgson, geologist, has left the Hanover Bessemer C. & I. Co. to become mining engineer with the Albuquerque & Cerrios Coal Co. at Madrid, N. M.

M. H. Foss, who has recently been directing mining operations near Idaho Springs, Col., is now in New York. Mr. Foss will soon go to Michigan.

D. M. Bacon, of St. Augustine, Fla., who has been the agent of the Cleveland Iron Mining Co. on the Marquette iron range, is paying a visit to the Lake Superior district.

C. Q. Schlereth has resigned as general superintendent of the mining department of the Cia. de Minerales y Metales, at Monterrey, N. L., Mexico, and will return to Denver.

M. J. Kirwan, petroleum engineer, and **F. X. Schwarzenbek**, assistant petroleum technologist, of the Bartlesville station, are investigating underground conditions in the Deaner field in Oklahoma.

Tudor S. Rodgers has resigned his position of chief chemist for the Tecopa Consolidated Mining Co., of California, to engage in the practice of mining law under the firm name of Rodgers & Rodgers, with offices in Salt Lake City.

Charles W. Goodale, head of the safety department of the Anaconda Copper Mining Co., and president of the Barnes-King Development Co., will represent the Butte district at the National Safety Council at Boston.

L. C. Graton, of the Department of Geology, Harvard, and **B. S. Butler**, of Calumet, Mich., have been carrying on a special geological investigation in Cobalt to determine if any relationship can be established between the deposits of native copper in Michigan and native silver in Cobalt.

Arthur J. Hoskin, mining engineer of Colorado, has recently taken charge of coal-mining investigations under coöperative agreement with the University of Illinois, the U. S. Bureau of Mines, and the State Geological Survey. His address will be 214 Transportation Building, Urbana, Ill.

R. H. Elliott, Pacific Coast manager for the Metals Exploration Co. at San Francisco, which is the parent company of the United Comstock Mines Co., at Gold Hill, and the Gold Canyon Dredging Co., operating a dredge near Dayton, has been in Gold Hill and Dayton during the early part of September inspecting operations.

Dean W. R. Appleby of the Minnesota School of Mines has returned to Minneapolis from a three-months' trip through Japan, Korea, and Manchuria. Dean Appleby headed a party of mining engineers, consisting of **Dr. W. H. Emmons, W. H. Crago, L. D. Davenport, Frank Hutchinson**, and **W. J. Mead**, who were engaged by the South Manchuria Railway to investigate coal and iron-ore deposits.

Mining engineers and metallurgists recently in New York included: **Abbot A. Hanks**, San Francisco, Cal.; **Richard H. Catlett**, Boston, Mass.; **Alfred G. Wilson**, Ottawa, Can.; **John E. Hodge**, Minneapolis, Minn.; **R. T. Wilder**, El Paso, Tex.; **Alexander D. Harvey**, Boston, Mass., and **Joseph L. Rosenmiller**, Oklahoma City, Okla

SOCIETY MEETINGS ANNOUNCED

The Mining Section of the National Safety Council, which meets at Boston Sept. 26 to Sept. 30, has arranged the following program of papers:

Monday—"Storage Battery Locomotives," by Charles E. Stuart, E. V. Daveller, and R. E. Renz; "Trolley Locomotives," by Frederick W. Whiteside; "Animal Haulage," by E. L. Solomon and R. M. McGraw; "Block Signal and Dispatching Systems," by R. T. Murrill; "Compressed-Air Haulage," by Guy J. Johnson.

Wednesday—"Mine Fire Prevention and Fire Fighting; Anthracite Mines," by H. H. Otto; "Bituminous Mines," by Joseph W. Reed; "Metal Mines," by H. M. Wolflin.

Thursday—"Maintaining Interest in Safety; Among Executives," by M. H. Moulton and William Connibear; "Among Foremen and Shift Bosses," by Thomas Copperswaite; "Among Miners," by J. T. Bradley; "Observations of a Safety Engineer in Various Coal and Metal Mining Camps of the United States," by C. L. Colburn.

Friday—"First-Aid Stations Underground," by Dr. R. R. Sayers; "Provisions for Drinking Water," by B. C. Yates; "Traveling Ways and Signs," by R. H. Seip.

OBITUARY

O. B. Warren, president of the Meriden Iron Mining Co., and one of the best-known mining engineers on the Minnesota ranges, died at the age of fifty-one years, after an operation for appendicitis, at Minneapolis on Sept. 16.

Captain Marcus L. Fay, aged seventy-two, one of the best-known mining men in the Lake Superior district, died recently at his home in Duluth, Minn., of heart failure.

Mr. Fay was widely known as an authority upon both the technical and operating side of mining. At the time of his death he was president and treasurer of the Tesora Mining Co. and president of the Fay-Cananea Copper Mining Co.

Joseph Hotchkiss Harper, founder of the firm of Harper & McDonald, and long prominent in Butte as a mining engineer, died recently at Shelby, Miss., at the age of seventy-six. In 1874 he erected the smelter at Glendale for the old-time Hecla Consolidated Mining Co., and in 1884 he laid out the town of Anaconda and the first smelting and concentrating plant there for the Anaconda interests, under the direction of Marcus Daly, then the ruling force of the Anaconda. In 1916 he published "Harper's Hydraulic Tables," a work well known to engineers. He was connected with a number of engineering projects of prominence and importance in Montana.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

WEEKLY RESUME

At Washington the Department of Commerce has been gathering data on conditions of unemployment throughout the country and a brief survey of the situation in the various mining districts is given in this issue. In Ontario, the Kirkland Lake Gold Mining Co. has announced a reduction in wages, this company being the first gold producer to take this step in the province. The improved price of foreign silver is causing the operators at Cobalt to be more optimistic.

In Colorado, the Interstate Commerce Commission has ruled on an action brought by the Gold Hunter company, of Mullan, Idaho, that the Rio Grande railroad should base its freight charges for carrying ore and concentrates on the net value of the shipments rather than the gross value. At Butte, it is rumored that there may be a resumption of mining activity on a more or less limited scale before long. Considerable activity in the gold district of southwestern Oregon is reported. Another incident connected with the history of the Dolly Varden mine, in British Columbia, is a suit recently brought by George Wingfield of Reno, Nev., against the Taylor Engineering Co., in which action the property is involved.

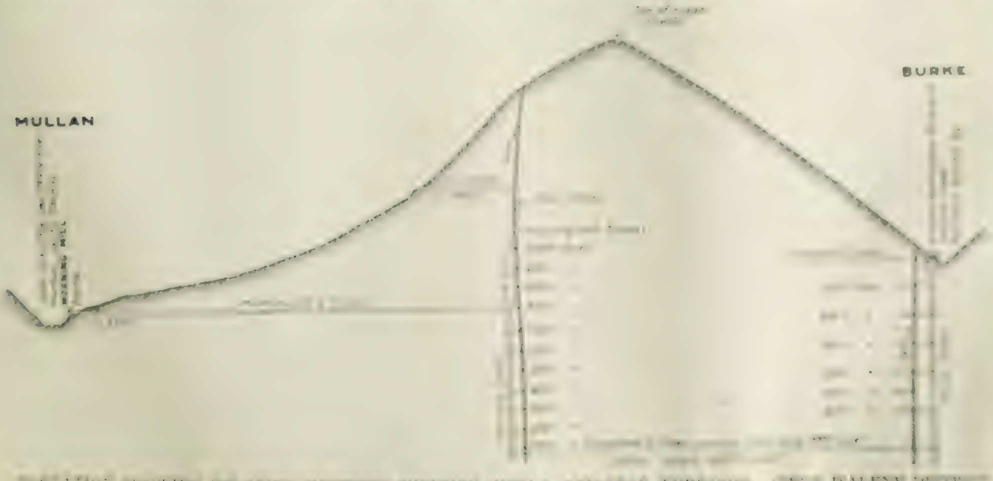
The Proposed Operation of the Star Mine

Cœur d'Alene Property, Under Joint Control of Hecla and Bunker Hill Companies, Will Give District a New Important Producer

THE MOST INTERESTING as well as the most important mining enterprise that has been undertaken in the Coeur d'Alene district in many years is the development and operation of the Star mine by the Bunker Hill & Sullivan Mining & Concentrating Co. and the Hecla Mining Co. It is interesting and significant because the joining of these two big companies in the operation of the Star means a closer affiliation between them in the matter of policies affecting the district. The importance of the enterprise lies in the fact that it will add another great producing mine to the district at a time when such an addition is needed, and also involves the construction of an electrolytic zinc plant by the Bunker Hill & Sullivan company for the treatment of Star zinc-lead ores.

The ownership of a part of the Star orebodies was the issue in extended litigation a few years ago with the Federal Mining & Smelting Co. (Morning mine), the result of which was favorable to the latter in the trial court, but the decision was reversed in favor of the Star by the U. S. Court of Appeals. The work done by the Federal company, which precipitated the litigation, and the large amount of development by both companies in preparation for the trial, together with the large ore shoot exposed by the Star company in its original workings independent of that in litigation, has combined to prove the great value of the Star mine. The enterprise in which the Bunker Hill and Hecla have joined is therefore free from the usual risk of mining, for the Star orebodies have been proved, and it is now simply a question of placing the mine on a productive basis.

Operations at the Star will be conducted under the name of the Sullivan Mining Co., all the stock of which is held by the Bunker Hill & Sullivan and the Hecla, half and half. The plan for reaching and handling the Star ore is out of the ordinary, and presents a fine example of modern mining engineering and the possibilities of deep mining operations. The accompanying sketch, hastily prepared by one of the engineers of the Sullivan Mining Co., gives at a glance a vivid conception of this great enterprise. This sketch gives a cross section [illegible]



[illegible] COEUR D'ALENE DISTRICT, IDAHO. THE SULLIVAN MINING CO. IS TO OPERATE THE STAR MINE der which the crosscut is being projected approximately 8,000 ft. to the Star vein. The Star joins the Morning on the west, and the position of the vein, which is identical with the Morning, is shown in connection with the various Morning levels.

The Star orebody has been proved from the Star tunnel on various levels down to the 1,450 level of the Morning, a vertical distance of 3,150 ft. The crosscut will reach a maximum depth under the peak of the mountain of 4,300 ft., and the depth at the intersection of the vein will be 3,800 ft. beneath the apex. Starting from the 2,000 level of the Hecla, the crosscut will maintain a straight course to the objective point in the Star ground. A skip pocket has been completed at the bottom of the Hecla shaft which will hold 1,000 tons, and actual work in the crosscut is now under way. Work will be pushed with all possible speed, and it is expected that it will be completed within two years.

One of the problems in connection with the crosscut is the disposition of the muck. It will be hoisted to the surface and deposited in a great bin that has been constructed for the purpose and which discharges into No. 3 tunnel level, through which it will be trammed back and used for filling in the workings of the Hecla mine. A large amount of the waste can be disposed of in this manner and to the advantage of the Hecla, and when this plan is no longer available, it is probable that the remainder will be hauled away by the railroad company.

The possibility of cutting other valuable mineral-bearing veins before the Star ground is reached is another feature of this big enterprise that lends special interest. Leaving the Hecla ground, the crosscut will pass through the Omaha, Thisbie, Midway Summit, and Flynn groups of claims, all of which have great prospective value, and, with the exception of the Midway Summit, are now in process of development.

Kirkland Lake Gold Mining Co. Announces Wage Cut

The first step to reduce wages at any of the gold mines of northern Ontario was taken recently when the Kirkland Lake Gold Mining Co. announced a reduction in wages of 50c. and 75c. a day, the reduction to take effect the second week in October. The result of this action will be followed with considerable interest, as the gold-mining industry of northern Ontario is practically the only one in the province which has not cut wages.

It is quite probable that other operators at Kirkland Lake will also make a cut, and it will not be at all surprising if a similar action is taken at all the gold mines within the next two or three months. In addition to helping the operating mines, a reduction in wages would have a noticeable effect upon the amount of work being done by the small non-producing properties, and would result in a large amount of development work throughout the country.

Electrolytic Zinc Co. Makes Contract

(Cable by Reuters to "Engineering and Mining Journal")

Melbourne, Sept. 19—The Electrolytic Zinc Co. of Australasia has completed a contract with the British Board of Trade for the purchase of 750,000 tons of concentrates and slimes.

Broken Hill to Resume Production

(Cable by Reuters to "Engineering and Mining Journal")

London, Sept. 20—A cable received today from Melbourne, Australia, states that the Broken Hill Proprietary Co. has decided to resume production of zinc concentrates.

Czechoslovakia Gold Mines To Be Reopened

(Cable by Reuters to "Engineering and Mining Journal")

Paris, Sept. 20—A French financial group is preparing to resume operations at the disused gold mines near Eule, in Czechoslovakia. Modern machinery will be installed.

Production of Minerals Decreases in Japan

(By Reuters Agency)

Tokyo—It is reported by the Department of Agriculture and Commerce that during June, 1921, nearly all kinds of minerals decreased in production from the preceding month, as may be seen from the following details:

	June	May
Gold, *momme*	160,640	155,164
Silver, *momme*	2,703,125	3,197,362
Copper, *kin*	7,618,347	8,992,894
Iron, *French tons*	3,089	4,868
Coal, *French tons*	1,844,299	2,226,575
Kerosene oil, *koku*	157,002	148,256
Sulphur, *French tons*	2,712	3,732

The total for the first six months of 1921:

	January-June, 1921	January June, 1920
Gold, *momme*	943,267	978,705
Silver, *momme*	17,641,175	19,474,708
Copper, *kin*	45,500,976	54,973,541
Iron, *French tons*	18,376	34,129
Coal, *French tons*	11,928,890	13,353,554
Kerosene oil, *koku*	946,543	933,222
Sulphur, *French tons*	12,983	22,111

A *momme* = 0.1325 oz.; a *kin* = 1.325 lb.; a *koku* = 47.6 gal.

Topographic Mapping Program To Be Pushed

Every effort will be made at the regular session of Congress, which begins in December, to convince the Appropriations committees that the topographic mapping program outlined by the Board of Surveys and Maps should be carried forward. This program calls for $950,000 during the fiscal year of 1922-23.

Purchases of silver by the Bureau of the Mint during the week ended Sept. 17 were 1,462,000 fine ounces, bringing the total purchases under the Pittman Act to 72,850,430 fine ounces.

Gold Hunter Co. Wins Decision In Rio Grande Rate Case

Interstate Commerce Commission Holds Freight Charges on Ore Unreasonable—Should Be Based on Net Value of Shipment

The recent decision of the Interstate Commerce Commission in the case of the Gold Hunter Mining & Smelting Co. has been of much interest to Colorado mining men. This company complained that freight rates assessed on the gross value of ore or concentrates shipped from the Cœur d'Alene district of Idaho to Salida, Col., were unreasonable and unduly prejudiced, and in the decision of the Interstate Commerce Commission the contention was sustained.

It has been the custom of the Denver & Rio Grande R.R. to establish rates on ore and concentrates based upon the gross assay value of the ore, allowing no deductions for refining or handling at the smelter. Colorado and Utah mining men have contended that rates based upon gross assay values were inequitable and often misleading, as with complex ores or concentrates, the values shown by the assay certificate are often not recovered by the smelter. On the contrary, in the case of ores or concentrates carrying zinc, the ores are penalized to greater or less extent.

The decision not only involved a matter of freight rates on ores from Idaho, and a readjustment of local rates, but has direct bearing upon the smelter situation in Colorado, as it is necessary to ship in large quantities of lead ores to be used as a flux in smelting the ores from Colorado properties.

In referring to gross and net value rates, the Interstate Commerce Commission says:

"While defendants contend that under the net-value method smelter returns can be manipulated to secure lower rates, it appears that there are means of detecting such manipulation and that the gross-value method is not free from the same possibility of abuse. Indeed, the interpretation of gross value which defendants now urge does not correspond with the interpretation which has frequently been applied in practice, for the evidence shows that in many cases the metal contents have not been taken at 100 per cent but at some lesser percentage determined by the amount that can be extracted from the ore for commercial purposes. Upon argument, also, counsel for defendants was apparently uncertain whether all of the metals are or should be included in the reckoning, or only those which are commercially utilized. The presence of zinc, for example, in the ores in question detracts from rather than adds to actual value. The voluntary and general application of the net-value rates by ore-carrying roads other than the Rio Grande is in itself strong evidence both of the practicability and of the reasonableness of the net-value plan. It is clear that this 'net value' approximates the actual value of the ore far more closely than does 'gross value.'"

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Unemployment Situation Worst In Lake Superior District

Conditions Vary Widely, According to Reports Received by Government—Butte Suffers Most in West

That unemployment in the metal-mining industry varies widely in different districts is shown by figures being gathered by Government agencies for use at the unemployment conference called by Secretary Hoover. It is estimated that the industry is employing fully 50 per cent less men than in 1913. The reports indicate, however, that many of the men have found employment in other industries, and, except in the important copper districts, it seems unlikely that there will be distress among metal-mine workers this winter.

The activity in gold and silver mining absorbed many workmen last summer. From California it is reported that no miners are looking for work in that state. The unemployment problem in the metal-mining industry, as well as in the coal-mining industry, is in fact an eastern one, that is, east of a line drawn north and south through the eastern boundary of Kansas. It is a fact not generally recognized that the large majority of metal-mine workers are employed east of that line.

The hasty surveys which have been made indicate that the worst condition is in the Lake Superior region. The prospects there are brightening, however, owing to the probability of increased employment on the iron ranges. The better prospect for the iron and steel industry has led to a recent improvement in employment in the iron mines in Alabama.

One of the effects of the Pittman Act is that it makes possible the operation of lead-silver properties, which furnish work to many men in several states. In the zinc-mining districts the seriousness of the unemployment situation is relieved by the fact that agriculture and highway construction have offered ready employment to most of the men who have been relieved of work in the mines.

The most serious situation with regard to unemployment in the West is in the Butte district. Unless there is an increase in operations there before winter, it is believed that there will be want and suffering. Part-time operation has been in effect throughout the summer, so as to make possible the employment of the maximum number of men. Preference has been given to employees with dependents.

Though 30 per cent fewer men are being employed in the mines of Idaho, many of those who have been relieved have found employment as prospectors. In the Coeur d'Alenes district, the price of silver is keeping things going. In southern Idaho, there is no noticeable unemployment. The same is true of Wyoming. In the Black Hills, as well as in the other gold-mining regions, employment is above normal. Taking Utah as a whole, the employment situation is regarded as practically normal, as the mining of other metals has absorbed the men thrown out of employment by the closing of copper mines.

With the completion of the harvest season and the suspension of highway work on account of weather conditions, it is anticipated that there will be marked increase in general unemployment and that the number classing themselves as metal-mining operatives will show a considerable increase.

Rhodes Studying Mining Industry

The fact that Representative Marion E. Rhodes, the chairman of the House Committee on Mines and Mining, is accompanying Director Bain of the U. S. Bureau of Mines on a considerable portion of his extended Western trip is pointed to as being unusual in that it is the first time that a chairman charged with mining legislation has shown such determination to acquire first-hand knowledge of the industry.

Copper, Lead and Zinc Figures Wanted More Often

Publication by the U. S. Geological Survey of weekly figures of coal production and monthly figures of petroleum production is leading to increased demand for more frequent publication of copper, lead and zinc figures. Before this can be done, however, it will be necessary for Congress to authorize increased appropriations for the mineral resources work of the Survey.

NEWS BY MINING DISTRICTS

London Letter

Rumored Rand Companies Seek To Sell Production in Advance—Bwana M'Kubwa To Use M. S. Flotation Process—Lonely Reef Reserves Decreasing

By W. A. Doman

London, Sept. 6—According to a rumor cabled from Johannesburg, the Transvaal gold-mining companies are [illegible] made.

[illegible] If such an arrangement were practicable, the Shamva Mines (Rhodesia), for one, [illegible] 1915, the cost to this company of [illegible] though in the final quarter the figure [illegible] months of the current year, owing [illegible]

As with other companies the Shamva [illegible]

[illegible]

fore, for the quantity crushed, new ore to the extent of 106,250 tons has been added. The average value of the whole remains at 4.1 dwt.

The reorganization of the capital of the Bwana M'Kubwa is being discussed again. At the end of last year estimates were in hand for developing and equipping the mine for a plant of 1,000 tons a day capacity, and paying off a debt of £26,000, the total amount involved being £300,000. For years the property has lain dormant, owing to the character of the ore. The Minerals Separation has, however, devised a process for extracting the copper. It has been officially stated that there is at least 3,000,000 tons of ore proved assaying from 4 to 5 per cent, with the probability of many more millions of tons to be developed.

Though the Lonely Reef continues to open up ore of high gold content in the lowest levels, the 23d and 24th, the average of the reserves is gradually lessening. This can be seen from the estimates at the following dates:

Dec., 1920	March, 1921	June, 1921
Tons	Tons	Tons
202,845	200,555	197,704
Dwt.	Dwt.	Dwt.
20.80	19.98	19.11

Actually the tonnage has not suffered any great reduction, and a fall in value of 1.69 dwt. over the whole reserves in six months is not so serious at this mine as it would be at many other properties.

At the date of the June quarterly report the 23d and 24th levels were disclosing good values, though rather more variable than in the levels above. The new gas plant is being erected, and the part that has been put into operation is giving satisfaction. By the end of October the installation should be complete, and it is expected that working costs will be reduced in consequence by £2,000 monthly.

Johannesburg Letter

Strike of Mine Workers Averted—South African Statistics

By John Watson

Johannesburg, Aug 9.—There is general satisfaction at the news that, as a result of a series of conferences between the Chamber of Mines and representatives of the various unions, there is to be no strike. A reduction of 1s. 6d. per shift has come into force from Aug. 1, and the Chamber has agreed that this shall be the only reduction up to the end of this year. *The Star* of Aug. 6 says: "The consolidation of the 3s. 6d. per day on the wages at once meets the demand of the joint executives for a 4s. per day consolidated increase, and certainly goes much further than many people anticipated the mines would be prepared to go."

The Chemical, Metallurgical and Mining Society is locally designated by the formula C.M.S for the sake of brevity. At its twenty-fifth annual general meeting the election of officers and council took place as follows: President, F. Wartenweiler; vice-presidents, Prof. G. A. Watermeyer, F. W. Watson, and C. J. Gray; treasurer, William J. R. Thurlowe. The twelve members of the new council include four past presidents, whose long experience it is hoped will strengthen the society. The new president is on the consulting metallurgical staff of "The Corner House" (that is, the Rand Mines and the Central Mining & Investment Corporation group) and had formerly a wide experience in American metallurgical practice with C. W. Merrill, and others.

The quarterly abstract from the office of census and statistics for the Union was recently issued (price 1s.). The latest census (May, 1921,) shows a white population of 1,523,424. The length of government railways open in 1920 was 9,542 miles. The Union production for 1920 was 8,158,455 oz. fine gold; 2,545,017 carats diamonds, and 11,473,452 short tons of coal. The total mineral production for 1920 had a value of £55,193,389, and the factory output for the year (July, 1919, to June, 1920) had a gross value of £92,913,844.

AUSTRALIA

Price of Osmiridium Declines in Tasmania

Hobart, Sept. 14—The price of osmiridium has dropped to £18 per oz. Many miners are giving up the quest for the mineral.

Melbourne—Alluvial tin was discovered early in the summer on King Island, in Bass Straits, and, the assay proving good, sluicing has been started.

CHOSEN

Unsankinko — The August clean-up of the Oriental Consolidated Mining Co. was $75,500.

MEXICO

Federal District

Government Holds to Its Position of Refusing Special Aid to Mining Industry

City of Mexico—While new denouncements are being made in various parts of the republic, and many owners of old properties are paying back taxes, the general mining situation remains far from satisfactory. Owing to the depressed price of lead, the big, low-grade silver properties in the northern part of the country are not paying and cannot pay under existing conditions, and the great silver properties in the central plateau regions with high-grade ores cannot meet the excessive costs of labor and materials and what they term the exaggerated export taxes which the government insists on maintaining.

This is the mining man's side of the case. The facts are, however, that most of the important silver properties continue operation, with the exception of two or three concerns in the State of Michoacan, and their closing appears to be due more to certain local conditions than to anything else. It may also be remarked that despite the pessimistic tone of the average mine owner, new properties are being taken over by some of the most important groups now operating (at an alleged loss), and they seem to be in nowise dismayed regarding the final outcome of Mexico's most important industry.

The Minister of Finance announces that it is not the intention of the government at present or in the near future to change the present taxation on the import of mining supplies nor the export duty. The government insists on the point that the metal industry must work out its own salvation, and expresses the belief that conditions are slowly but surely returning to normal. For many months official protection was given the mine owners in the way of exemption from export taxes and special concessions regarding bringing into the country all sorts of supplies used in mining operations. It is contended by the authorities that the lift should have enabled the mining men to readjust themselves to meet present conditions; that a continuance of federal support would more incline them to lean on the government and not endeavor to work out the problem on their own account. Hence the pulling away of the props.

The minister also denies the report that there is any immediate intention of prohibiting the exportation or importation of silver into the country. There is nothing alarming in the present situation that calls for drastic action. Though the local banks are refusing to accept silver deposits, except in a separate category, the condition is purely local; that is to say, the surplus of silver money is confined largely to the Federal District, there being a shortage in the interior. It is believed that the opening of the new Bank of the Republic this month, with probably an initial paid-up capital of 30,000,000 or 40,000,000 pesos, will regulate the monetary situation, and will naturally affect the mining industry for the better.

Jalisco

James Gerard Visits Cinco Minas Property

Guadalajara—James Gerard, former American Ambassador to Germany, recently arrived here en route to the Cinco Minas property near Magdalena, accompanied by several persons interested in the property. Mr. Gerard is president of the Cinco company and, with the Daly interests, controls practically all the stock.

It is reported that the principal object of Mr. Gerard's visit is to pass upon the desirability of taking over some nearby properties which the Cinco Minas is said to be badly in need of in view of the fact that its own ore is running low.

Cinco Minas, which is a large body of low-grade silver, has returned big profits in times past. Owing to the character of the ores and the fact that the section has suffered less by labor agitation than many sections of the country, the company continued dividends when many properties were obliged to close down owing to the heavy decline that occurred in the price of silver.

Baja California

Construction of Boleo's Converter Plant Under Way

Santa Rosalia—Cie. du Boleo is installing a converter plant, but no date has been set for its operation. The company is producing 100 tons of copper per month, as compared with a normal output of 1,000 tons. Since June, 1916, all matte and black copper has been shipped to the Tacoma smelter. The matte formerly ran 62 to 63 per cent copper, but in recent years pyritic ore from Shasta County, Cal., carrying about 2 per cent copper, has been used for flux. The present grade of the matte is about 50 per cent copper. This matte is put into the reverberatory at Tacoma, where it melts and combines with the other matte produced in the furnace. The black copper running 92 to 93 per cent copper is charged into the converters.

Chihuahua

Silver Exports From Chihuahua to the United States Increasing Compared With Former Years

Chihuahua—Consul James B. Stewart, at Chihuahua, Mexico, under date of July 29, 1921, reports that more silver was produced in the Chihuahua consular district (which includes such important silver camps as Parral, Santa Bárbara, Santa Eulalia, and Cusihuiriáchic) during 1920 than any year since 1910. In fact, judging from the available figures, 1920 was one of Chihuahua's banner years, comparing favorably with the best years previous to 1910 and no doubt exceeding most of them in the total amount of silver produced.

The increased silver production in Chihuahua is not due to the operating of a larger number of mines (fewer are being operated than in former years), but to the ability of large mining companies, mostly American, to work the large low-grade properties, this having been made possible by the installation of modern machinery and new processes of ore handling and treatment. Especially has this been the case in the Parral district, which is one of the world's leading low-grade silver camps. The following table shows the bullion and ore declared at the Chihuahua Consulate for export to the United States during 1920 and the first six months of 1921:

	Calendar Year 1920		First Six Months 1921	
	Troy Ounces	Value	Troy Ounces	Value
Bullion				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Silver ore	[illegible]	[illegible]		
Totals	[illegible]	[illegible]	[illegible]	[illegible]

As the entire silver production of this district is exported to the United States, the preceding table gives a fair idea of the silver produced in the district. These figures, however, must not be taken as showing that the Chihuahua mines are now producing more silver than last year, because for several months the lead smelter at Chihuahua, which produces the gold-silver-lead bullion, has been the only large one of its kind operating in Mexico, and so it has been receiving and smelting rich silver ores and concentrates from various parts of the Republic, even from mines in the vicinity of Mexico City. Whereas the ores usually smelted at Chihuahua average around 6 kg. of silver per ton, the high-grade ores being received from the south average as much as 12 and 13 kg. and even more.

The mining industry is also improving in some districts. The freight congestion which existed at Ciudad Juarez was cleared in June, and it was stated that freight shipments from Ciudad Juarez to Chihuahua take only one day longer than express shipments.

CANADA

British Columbia

George Wingfield Sues Taylor Engineering Co.—Granby's Smelter Remains in Blast

Stewart—The Fish Creek Mining Co. has made a trial shipment of twenty tons of ore, valued at from $500 to $600 a ton. The first shipment of concentrates from the Premier mine, Salmon River, was made a few weeks ago. It consisted of 160 tons, estimated as being worth about $1,750 a ton.

The Silverado property has been acquired by a syndicate headed by J. J. Coughlan, of Vancouver. It is on the west side of Portland Canal opposite the mouth of Bear River and the town of Stewart. The new owners intend building a light tramway from the discovery at 4,200 ft. elevation down to the 2,200 level. From this point a trail will be built to tidewater. The plans also include the construction of a permanent camp.

Alice Arm—The North Star has shipped ninety tons of ore to the smelter at Anyox.

Action has been brought against the Taylor Engineering Co. in the Supreme Court of British Columbia by George Wingfield, of Reno, Nev., for the recovery of $182,322. This money it is alleged is owing to Mr. Wingfield and his associates by the company on account of [illegible] when the Dolly Varden [illegible] the [illegible] of the company. It will be recalled that the Provincial Legislature laid down certain terms to which the Taylor Engineering Co. subscribed itself. One of these was the payment of $150,000, which it now is claimed has never been paid. The difference between that amount and the amount sought through the courts is accrued interest.

Considerable note is taken locally in recent developments on the Toric group of mineral claims, on Kitsault River. A promising body of ore is said to have been opened up. The Toric is situated on the Dolly Varden railroad grade and not far from that mine.

Anyox—The question was recently put before the workmen of the Granby Consolidated Mining, Smelting & Power Co. as to whether the Anyox plant should close down or wages be reduced. A vote was taken on the issue by the men, the result being a very substantial majority in favor of the continuance of work.

Nelson—Supplies have been sent up to the Bayonne property, on the north fork of Summit Creek, recently acquired for Spokane interests. It is planned to work it during the winter.

Rossland—Operators of the Velvet mine, south of Rossland, have made tentative plans for production and shipment of ore during the winter.

Kaslo—O. C. Thompson, lessee of the Utica mine, is repairing the wagon road from Adamant station to the property and preparing for operations.

Vancouver—Sperry & White, of Vancouver have secured control of the Eureka silver mine, in the Cheam Mountain near Hope, and are said to be planning to spend a considerable sum on development and plant. The Eureka is one of the oldest mines in the province.

Ashcroft—The Highland Valley Mining Co., owning a copper prospect about forty miles from this point, has been reorganized on an assessable basis. The first assessment of 1c. per share has been issued.

Trout Lake—What is believed to be [illegible] has been found in this vicinity. Samples have been sent to Ottawa for determination.

Trail—Ore received at the Consolidated M. & S. Co.'s smelter during the week ended [illegible] was as follows:

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Ontario

Foster to Take Up Option on Murphy Claim in Goudreau District

Porcupine—The [illegible] has taken an option on the [illegible] and [illegible] properties and will drill them [illegible].

It is expected that with a few minor changes the capacity of the Hollinger mill can be brought up to [illegible] tons a day. During one day recently 3,[illegible] tons was milled. The company has declared the regular four-weekly dividend of 1 per cent, payable Oct. 7, making total disbursements so far this year of $2,460,000.

The amalgamation of the West Dome and Dome Lake is proceeding satisfactorily. It is understood that the new company will have a capital of $5,000,000, and that the treasury will be financed to the extent of about $200,000.

Up to the end of June, 1921, the MacIntyre mill had treated 1,152,150 tons of ore, having an average value of $9.58 per ton, and recovered $11,035,564. Dividends amounting to 70 per cent have been paid.

The McEnaney Gold Mines, Ltd., is the name of a new company, with a capitalization of 3,000,000 shares of $1 par, which has taken over the old Hollinger Reserve property.

Cobalt—During August the Nipissing mined ore of an estimated net value of $172,931, and shipped bullion from Nipissing and custom ores of an estimated net value of $236,558. Silver was taken at 63c. an oz. On the 2d level of the No. 63 shaft a new vein has been found which has a width of 2 to 3 in. and assays several thousand ounces to the ton. The low-grade mill treated 7,325 tons, and the refinery shipped 381,504 fine ounces of bullion.

At the annual meeting of the Oxford-Cobalt Silver Mines, Ltd., the two Waldman claims adjoining the Oxford were taken over for a consideration of 150,000 shares of stock. The report states that during the year encouraging silver values were found. The financial statement shows $500 cash on hand, and buildings and equipment valued at $10,900.

Seventy-five feet of drifting has been done on the new discovery on the Violet property of the La Rose, and the values are stated to be satisfactory.

It is understood that the option held by C. A. Foster and associates on the Murphy property, in the Goudreau gold district, will be exercised. This property was discovered a few months ago, and showed some spectacular values. The price is stated to be about $350,000, but it is understood that a large part of this will be paid with stock.

WASHINGTON

Senator Poindexter Visits Magnesite Properties

Chewelah—Senator Miles Poindexter paid a visit to the quarries and plant of the Northwest Magnesite Co. early in September for the purpose of gathering first-hand information regarding magnesite, for which local producers wish to obtain tariff protection

What may be an important strike on the Old Dominion mine was made on Sept. 10, when a short crosscut from the lower tunnel encountered a 3 ft body of high-grade ore.

Tacoma—The Tacoma smelter and refinery is running at about half capacity. The three blast furnaces are cold, but the reverberatory is running to capacity. A 30,000 cu.ft. Ratteau Battu Smoot turbo compressor has been installed. It runs at 3,600 r.p.m., and furnishes converter blast up to 15 lb. per sq.in. The compressor is driven by a direct-connected 2,000-hp. Ridgeway motor.

The Danish motor ship "Siam" recently discharged blister from Braden and custom copper ore from various Chilean mines.

Leavenworth—Under provisions of a deal made recently, John Smith, a miner and prospector of this section, has disposed of a group of five claims held by him for a number of years to the Royal Development Co., receiving a substantial cash payment and monthly payments during his lifetime, together with the right to mine on the ground himself with two helpers. The ore is principally copper, with some high-grade silver and gold.

Northport—A. J. Hodges and A. F. Gentsch have leased a section of the Silver Bee mine.

Everett—It is currently reported that the Boston-American Mining Co. plans to do work on properties acquired the last few years in the Monte Cristo district.

Orient—The First Thought Mining Co. is planning to instal a cyanide mill.

OREGON

Gold Properties in Southwestern Part of State Being Reopened

Grant's Pass—Henry M. Lancaster, of the St. Lawrence Copper Mining Co., of Saltese, Mont., has an option on a large tract of mineral land sixteen miles from Grant's Pass. The vein on the tract contains platinum, iridium, and gold.

Jacksonville — The Bell-Mankin gold mine, an old producer three miles out of Jacksonville, consisting of eighty acres of mineral land, is being reopened by Clark & Childers, of Medford, Ore., under a lease.

Selma—The Myrtle gold mine, near Selma, owned by Frank Hobart and B. W. Fowler, two local operators, is being reopened.

Jacksonville — The Opp mine, two miles west of Jacksonville, has just been reopened. This property, which is credited with an excellent production, has been closed since 1914. There is 7,000 ft. of underground workings. The surface equipment consists of a six-drill compressor, a 20-stamp mill and a 125-ton cyanide plant. The California-Oregon Power Co. has announced that its power line will be extended beyond the Opp mine west toward the Gold Ridge, Millionaire, Centennial, and Roaring Gimlet mines, now in operation in the Gold Hill district.

Baker—Following careful prospecting of the I. X. L. group this season on behalf of prospective purchasers, a deal has been made for disposal of the property by the Hidden Treasure Gold Mining Co., which has held the ground for a number of years. The property is east of Greenhorn, in Grant County.

MONTANA

Anaconda Rebuilding Badger State Hoisting Plant—Rumors of East Butte-Davis Daly Consolidation Denied

Butte—The Anaconda Copper Mining Co. is rebuilding its hoisting plant at the Badger-State mine, one of its larger properties in the Butte district, installing new drums calculated to increase the capacity of the engine up to 4,000 ft. The present depth of the Badger-State is 2,800 ft. New skips will be installed, and the property will be placed in condition to afford an increased output. Anaconda also is taking the present occasion to concrete the Mollie Gibson shaft, an airway located just to the north of the St. Lawrence shaft. This concreting is a fireproofing measure. The Anaconda has been doing more or less repair work, such as fixing ore chutes at the West Colusa. The Colusa ores carry a fair amount of silver.

Butte & Superior expects to have more definite information about the recently opened body of copper ore on the 2,200 level within the next ten days, according to the local management. The average assay across 18 ft. was given at 2.6 per cent copper. Parts of the face ran as high as 7.6 per cent copper.

The Tuolumne Copper Mining Co. is continuing to drift westerly on the 1,600 level of the Spread Delight, with a somewhat higher grade of ore appearing and with the ground getting softer with more water in evidence.

The East Butte Mining Co. is the center of much interest locally in consequence of reports, which lack confirmation, of a pending merger with the Davis-Daly, or of some kind of negotiations said to be under way looking to a closer relationship between the two companies. Local officials of both concerns profess positive lack of knowledge respecting the rumors. The advantages which would accrue to the Davis-Daly through an ownership of East Butte's smelting plant are obvious, according to some, and the fact equally appears obvious to the same people in that the greater part of the East Butte's present good showing is traceable to revenue had from the treatment of the Davis-Daly's ore.

The Elm Orlu Mining Co. has opened the Rainbow vein on the 2,500 level, and according to unofficial advices the showing of zinc is somewhat of a disappointment. The silver content has held its own and the lead increased. It is considered possible, however, that the heart of the orebody as shown on the upper levels is raking to the east.

Elkhorn—Stringing of a large copper cable to permit of increased power delivery to the Elkhorn concentrator of the Boston & Montana has been started from the Butte substation of the Montana Power Co. to the latter's Big Hole River station. The construction of the line from the station to Elkhorn is rapidly nearing completion.

NEVADA

Construction Work at Gold Hill Progressing Rapidly—Development of Orleans Mine Favorable

Virginia City—Actual concrete construction on the fine-ore bins of the new plant of the United Comstock Mines Co. at Gold Hill was started Sept. 9. Excavation for the foundations of the coarse-crushing plant is practically completed. Lodging, mess, and general office buildings will be completed about the end of September. Work has been started on residence cottages.

The main haulage tunnel, which is now 75 per cent completed, is 2,400 ft. from the portal, and will make connection to the Knickerbocker shaft about Oct. 1.

Tonopah—Recent bullion shipments from this district, representing clean-up of operations for the last half of August, are as follows: Tonopah Belmont, $94,330; Tonopah Mining, $55,000; West End, $70,000, and Tonopah Extension, $50,000. In the Tonopah Extension much development work is being done. At the Belmont 500 tons of ore per day is being mined. The auxiliary mill, for the treatment of sweepings from the tailing ponds, was started on Sept. 8, treating thirty-five tons per day.

At the Tonopah Mining Co. ore is being hoisted from the Mizpah, Sandgrass, and Silver Top shafts. Tonnage mined for the week ending Sept. 5 was 1,650.

The West End is producing 225 tons per day from the West End and Ohio shaft. At the Halifax a station is being cut at the 900 level, and as soon as it is completed a crosscut will be driven to cut the orebody discovered several months ago in a raise from the 1,000 level.

Divide—The Tonopah Divide mine is shipping fifty tons of ore per day to the Belmont mill at Tonopah. The ore averages better than $30 per ton. The shaft is making fair progress and is now about 25 ft. below the 1,000 level. Lateral development is being carried on from the 100, 200, and 800 levels.

The Divide Extension is making regular thirty-ton shipments to the MacNamara mill at Tonopah. The ore is high grade. The faulted segment of the vein is reported to have been cut on the 200-level crosscut, with low values so far.

The Giant Divide is running two development faces on the 450 level. The Brougher Divide is drifting on the 185 and 400 levels. The drift on the 185 level, which is following the extension of the Divide Extension vein, shows occasional spots of high grade.

Hornsilver—Reports on the development at the Orleans mine are favorable. It is claimed that the foot-wall drift driven by Dunfee, former lessee, was parallel to the ore shoot, and that by simply driving short hanging-wall crosscuts the shoot has been proved to have a total length of 300 ft. on the 600 level. The vein is over 20 ft. wide in places, with high-grade streaks in evidence. The average grade is not shipping ore, but will pay to mill. A 50-ft. winze from the 600 level is in ore, and the main shaft is to be sunk an additional 200 ft.

Pioche—The Mendha mine, in the Highland district, about eight miles from Pioche, has been leased to Roy V. Bicknell, who has a car of lead-silver ore ready to ship.

Judge Frank Walker and Henry Olinghouse, of Pioche, have taken a lease on the Point mine, owned by the Pioche Metals Mining Co., and have started a development tunnel to open up a body of silver-lead ore exposed on the surface, by recent severe rains, at a point 200 ft. south of the main shaft.

Ely—The holdings of the Eureka Hamilton Mining Co. have recently been sampled by W. H. Washburn, of the Tonopah Mining Co.

The recent discoveries of gold ore at McCoy Creek, in Spring Valley, are still being developed by the Millick brothers, with good results on the main property. Little interest is being taken in adjoining property.

Steady progress is being made in the work of tuning up the milling plant of the Wyoming Mining & Milling Co., at Taylor, and the plant should be running soon. Ten men are employed.

The big copper companies are doing nothing toward resumption of work, and Ely is very quiet.

CALIFORNIA

To Build 100-Ton Mill at Kelly Mine—Belmont Shawmut Mining Co. Resumes Work

Jackson—Prospects for early resumption of ore production on a larger scale at the Kennedy continue bright. The Argonaut is operating steadily, and development and prospecting of new areas in the mine is being planned.

Shawmut—The Belmont Shawmut Mining Co. has resumed production. Since the shutdown in August, 1920, the shaft has been completely retimbered and the mine maintained in good condition. The mine will be developed at greater depth. A surface plant in good condition is ready to be used. The capacity of the mill and cyanide plant for treatment of concentrates is 400 tons per day. O. McCraney is superintendent, B. F. Rowe [illegible] superintendent and Carl W[illegible] mill superintendent. Frederick Bradshaw is general manager.

Sutter Creek—At the Central Eureka a contract for sinking the main shaft 200 ft. deeper has been let. During August, 4,136 tons of ore was milled, and production reached $4[illegible]. A. S. Howe is superintendent.

Georgetown—At the Grit mine, near Spanish Dry Diggings, a rich strike is reported by Walter King.

Randsburg—The California Rand Mining, Ltd., better known as the Kelly mine, has decided to install a 100-ton mill, and machinery has been ordered. The mill, as planned, consists of a coarse-ore bin receiving ore from the shaft, a Blake rock crusher, an elevator to a 200-ton wooden bin, a ball mill, a classifier and thence to a tube mill, where a final product of minus 80 mesh will be made. This product is to be treated in M. S. flotation machines. A table is to be used as pilot before the flotation machine, and the tailings from the flotation unit will be passed to another table before going to waste. The concentrates are to be settled in canvas-bottom drying tanks. The question of treating the concentrates at the mill is under discussion. It is expected to have the mill in operation by the first of the new year.

Thirty stamps are in operation at the Yellow Aster.

The Randsburg Silver Mining Co. has struck a vein in sinking its shaft. The vein is parallel to the Kelly vein. A second parallel vein has been struck 200 east of the shaft in a crosscut. Drifts are being extended on this vein in both directions.

Grass Valley—The North Star is operating sixty stamps, and the labor output has reached the figures obtained in 1913.

COLORADO

Much Activity in Alma District—Rumored Deep Operations at Cripple Creek Financed in East

Alma—The slump in the mining of gold and silver in the Alma district has apparently passed the critical stage, as indicated by the resumption of operations by a number of the larger companies. Several new projects have been organized, and the preliminary development work has been started.

The Yuba Construction Co. has started work on the first of a fleet of four gold dredges to be installed on the middle fork of the South Platte River, near Fairplay. A complete survey by several churn drills, covering a period of three years, has established the fact that this deposit of pay gravel is the largest known in the United States, and it is stated that sufficient pay gravel is now [illegible] to keep the fleet busy for fifteen years.

The [illegible] Power Co. has a force of men installing a new power line from the [illegible], one mile north of Alma, to the Yuba dredge. This extension will be about [illegible] long.

W. K. Jewett, A. H. Hunt, and J. L. Bennett, of Colorado Springs, have incorporated the London Gold Mines Co., capitalized at $100,000, the stock being divided into [illegible] shares with a par value of $10 each. The company has started a drive of [illegible] ft. in the lower London tunnel. This tunnel, when complete, will be over [illegible] ft. long and will open the London vein [illegible] ft. below the present workings.

The London vein has been very strong and continuous and has been worked for approximately [illegible] ft. in length and to a depth of about 700 ft. from the surface, producing about $6,000,000.

The ore occurs in the white porphyry, and on the contact of the white and gray porphyry. These porphyries constitute the filling of the London fault, which at London Mountain shows a vertical displacement of about 1,500 ft. The ore is a white quartz containing gold, silver, lead and copper, the gold value predominating and showing from 2 to 10 oz. per ton.

Albert Johnson & Co., lessees on a block of ground in the South London workings, shipped to the A. V. smelter at Leadville 100 tons of 7-oz. gold ore the latter part of August, and have a second similar shipment ready.

The Louisiana & Colorado Mining Co. resumed operations Sept. 1, and is extracting a good grade of silver-lead ore from the Dolly Varden property, situated on Mount Bross. The ore is transported over the company's two-mile tramway to its flotation mill on the Platte River, one and one-half miles north of Alma. Electric power for the mine, mill, and tramway is secured from the lines of the Colorado Power Co.

The Russia Consolidation Mining Co., on Mount Lincoln, has a force of men busy excavating for the foundations of an electrically driven compressor, and surveys are being made to connect the mine with the lines of the Colorado Power Co. at Quartzville, one and one-half miles away.

A Denver company has taken a lease on the Champaign mine, in North Mosquito Gulch, and is building a road preparatory to installing a gasoline-driven air compressor. A large amount of development will be done. This property has produced high-grade gold and silver ore.

The Pulaski Investment M. & P. Co. has opened up a large body of milling ore on the Brownlow property in Mosquito Gulch, and has started to erect a fifty-ton concentrator.

A large body of lead-silver ore has been developed in the Hill Top mine, in the Horseshoe district. Regular shipments of five cars a week are now being made to the A. V. smelter at Leadville.

G. W. Logan is making regular shipments of a good grade of gold-silver-lead ore from the Hocking property, on the southeast end of Pennsylvania Mountain.

The Milan Placer Co., operating in Buckskin Gulch, two miles west of Alma, has finished installing its flumes and pipe line and is ready for a campaign the coming season.

The Calumet & Hecla Co., operating on Mount Lincoln, is working two shifts on development, endeavoring to get a lower tunnel into the known orebody before winter sets in.

In Buckskin Gulch, development work is being pushed on the Sweet Home, Criterion, Red Lion, and Silver Wave properties, all of which are adding their quota of gold, silver, lead, and copper to the production of the camp.

Cripple Creek—Bulkeley Wells has been elected a director of the Cresson Consolidated Gold M. & M. Co., and also of the Golden Cycle Mining & Reduction Co., both Cripple Creek properties controlled by the Carlton interests.

The association of Bulkeley Wells with the most active mining enterprises in the camp is connected with the report that a strong group of eastern capitalists have undertaken to finance deep mining operations in the Cripple Creek district.

Governor Shoup, with Ralph D. Brooks, vice-president of the Midwest Refining Co., and other mining men of Denver, have incorporated the Ajax Mines Leasing Co., and have taken a five year lease on the Ajax property. This consists of about 28 acres adjoining the Portland property on Battle Mountain.

Production in the district for August was 39,500 tons, with a bullion value of $411,792. As compared with the previous month, there was an increase in production of $117,211.

A recent strike on the property of the United Gold Mines Co. promises to rank as one of the most important in years. Grab samples of the ore from a 7-ft. vein assay from $20 to $100 per ton, and a high-grade streak yields several hundred dollars, it is reported, to the ton.

Aspen—The Park Tunnel Transportation Co., a subsidiary of the Park Tunnel Co., has completed its survey for a tramway and secured terminal site on the railroad here. Both companies are financed by Leadville and Aspen capital, the tram company acting only as a transportation company to move ore from the Park tunnel. The tram will be of the aerial type, 7,500 ft. long, and is to be completed within ninety days. The company estimates that it has 200,000 tons of marketable ore blocked out at present.

Bonanza—The Eagle mine has been equipped with a mill, and is being developed and operated under the management of C. Erb Wuensch. Recent development work has opened promising additional ore shoots, and both crude ore and concentrates of payable grade are being produced.

Caribou — The Potosi-Caribou Mining Co., with a capital of $500,000, has been organized to operate the Potosi properties. The officers and directors are: J. A. F. Durocher-Stone, president; William Kline, vice-president; J. E. Riva, treasurer; R. J. Faulkingham, secretary; J. G. Clark, of Boulder, Col., general manager, and R. S. McKiernan. Machinery has been purchased and will be installed soon. Development work has been resumed.

Telluride—Shipments of concentrates during August were as follows: Smuggler-Union, 80 cars; Tomboy Gold Mines, 55; Liberty Bell, 5; total 140. This production compares with 95 cars for the same month last year. The Liberty Bell is now shut down permanently.

JOPLIN-MIAMI DISTRICT

Oklahoma-Kansas-Missouri

Underwriters' Land Co. To Resume Work at St. Louis, Okla.

St. Louis, Okla.—The Underwriters' Land Co. has decided to start up its No. 2 property at St. Louis, Okla., after a shutdown since some time in 1920. F. N. Bendelari, manager for the company, states that it is intended to seek particularly lead ore, and for this reason two shifts will be worked in the ground in the two lead drifts to supply enough ore to keep the mill busy for one shift. The company has kept the principal members of its working organization on its force during the shutdown.

MINNESOTA

Mesabi Range

Oliver's Screening Plant at Coleraine Tested

Coleraine—A test run of the new screening plant of the Oliver Iron Mining Co. has been made. This plant is to be operated in conjunction with the Trout Lake concentrator. All mixed material will go direct to it, and no sorting will be done in the pit.

CHRONOLOGY OF MINING

August, 1921

Aug. 1—Oliver Iron Mining Co. cut wages an additional 10 per cent.—Mexican government restored export and import taxes on mining products and supplies.

Aug. 5—Freight rate on pig lead reduced from $8 to $6 per ton between Pacific and Atlantic ports.

Aug. 6-7—Strike at Tonopah and Divide, Nev., declared off.

Aug. 8 — Stockholders of Erupcion Mining Co. voted to build fifty-mile railroad in northern Chihuahua.

Aug. 11—Reduction in freight rates on bullion between Western points and Atlantic seaboard became effective.

Aug. 12—Judge Bourquin decided in favor of limiting standard of comparison in Butte & Superior's accounting to Minerals Separation.

Aug. 15—Walter Fitch, Jr., Co. broke world's shaft-sinking record in Water Lily shaft of Chief Consolidated Mining Co., Eureka, Utah, by completing an advance of 427.5 ft. in 31 days.

Aug. 17—Suit of George C. Carson against Afterthought Copper Co. for infringement of a patent covering side feeding of reverberatories heard in San Francisco.—Reported from Australia that employees of Broken Hill Associated Smelters at Port Pirie had agreed to accept lower wages.—Announced from South Africa that miners on Rand would accept a wage cut.—Discovery of gold in Klondyke in 1896 celebrated at Dawson, Y. T.

Aug. 24 — Shareholders of Davidson Consolidated, Porcupine, Ont., ratified sale of assets to new company known as Porcupine Davidson Gold Mines.

THE MARKET REPORT

Daily Prices of Metals

Sept.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
15	11.875	25.875	26.375	4.60	4.40	4.175
16	11.875	25.625	26.00	4.60	4.40	4.175
17	11.875	25.625	26.00	4.60	4.40	4.175
19	11.875@12	26.00	26.25	4.60	4.40@4.45	4.175
20	11.875@12	26.125	26.50	4.60@4.65	4.40@4.45	4.175
21	11.875@12	26.25	26.625	4.65	4.45	4.175

*These prices correspond to the following quotations for copper "delivered": 12.125c. for Sept. 15, 16 and 17, and 12.125@12.25c. for Sept. 19, 20, and 21.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
15	67¼	68½	72¼	155	157½	23½	22¾	25	25½
16	67½	68½	72½	154½	156½	23¼	22½	24¾	25¼
17								..	..
19	67½	68½	72¼	154¼	156¼	22¾	22¾	25	25½
20	67½	68½	72½	155½	157½	22¾	22¾	25	25½
21	67¾	68¼	72	155¾	158	23	22¾	25¼	25¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver			Sept.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
15	[illegible]	99½	64¼	[illegible]	19	[illegible]	[illegible]	[illegible]	39½
16	370	99½	65	[illegible]	20	[illegible]	[illegible]	[illegible]	[illegible]
17	371	99½	65	[illegible]	21	[illegible]	[illegible]	[illegible]	40

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, Sept. 21, 1921

The metal markets have generally been quiet during the last week, but prices have been firmly maintained. It is unlikely that any sudden price changes will take place in any of the metals, for conditions are gradually becoming more sound.

Freight rates to England have succumbed to competition and are now $[illegible] per long ton on lead and copper, except on brass bars, on which the rate is $[illegible]

Copper

Both domestic and export demand has been exceedingly quiet during the last week, but prices have shown no tendency to ease off. Almost all of the producers are well above the prices which we quote, and it is generally thought that no copper can be obtained for less than 12.25c. delivered. However, careful buyers have been able to get the metal for prompt delivery at 12.125c. by shopping around, and a few sales of fairly large tonnages have been made at this figure. Yesterday there was an inquiry on the market for about a thousand tons, but it is reported that no one was willing to accept it for less than 12.25c., which was more than the buyer was willing to pay. The undertone is strong, and most producers are likely to continue to quote somewhat above what consumers care to offer. The market for forward delivery is unsettled.

Japan, Germany, France, and Switzerland have all been in the market for American copper during the week, but sales have not been of large volume.

Lead

The American Smelting & Refining Co. increased its official contract price for lead from 4.60 to 4.65c. on Tuesday, Sept. 20.

Demand has quieted down somewhat, but the market continues firm at gradually advancing prices, owing to the depleted stocks of producers. Many have all of their September lead sold. The advance by the Smelting company yesterday was not unexpected, as outside traders and some other producers had been asking from 5 to 10 points premium over the 4.60c. figure. Up to the time the advance was made known small tonnages of both chemical and desilverized lead were obtainable in St. Louis at 4.40c., but despite this fact some lead was sold at higher prices. Chicago business was generally booked at 4.50c. and lead for Pittsburgh delivery was obtainable at 4.575@4.60c. The recent reduction in freight rates from the Rocky Mountain states while the rates from the Mississippi valley have remained constant has virtually cut off Missouri producers from any market except St. Louis and Chicago. Pittsburgh, for example, would normally be 33 points above the St. Louis market, that being equal to the freight rate, but it is now only 20 points above. A freight rate of 0.44c. from Omaha to the East, compared to [illegible] from Herculaneum, Mo., is ridiculous, and the discrepancy will no doubt be remedied at an early date.

Consumers' demand is reported to be improving, particularly in the lead-pipe industry. Cable, battery, and paint manufacturers are now using somewhat more lead than has been the case during the summer, and paint manufacturers are still [illegible]

Zinc

An increased number of producers are out of the market at present prices. An occasional sale has been made through the week at [illegible], but by far the larger volume of business has been done at the level which we quote. [illegible]

Tin

With the exception of last Friday the tin market has shown few signs of life. [illegible] price concessions, which traders do not seem disposed to make. There is still but little 99 per cent grade on the market; in fact, it is practically all in the hands of one interest. More disposition has been evident lately to contract for forward delivery, and in some cases slight premiums have been asked over the prices for spot.

Arrivals of tin, in long tons: Sept. 13th, Liverpool, 25; 16th, Bremen, 25; 17th, Straits, 10; 19th, Rotterdam, 90; 20th, London, 25.

Gold

Gold in London: Sept. 15th, 111s. 6d.; 16th, 110s. 10d.; 19th, 110s. 3d.; 20th, 110s. 6d.; 21st, 110s. 7d.

General stock of money in the United States, Sept. 1: Gold coin, $3,377,417,980; standard silver dollars, $303,739,326; subsidiary silver, $272,366,584; United States notes, $346,681,016; Federal Reserve notes, $2,849,722,060; Federal Reserve Bank notes, $121,766,400; National Bank notes, $739,148,874; total, $8,010,842,240. The outstanding notes decreased $79,000,000 during August and the gold and silver coin increased $101,000,000. Money in circulation per capita, $52.41.

Foreign Exchange

Dealings in foreign exchange have been light during the last week, with the chief interest centering in the continued weakness of the German mark. On Tuesday, Sept. 20, francs were 7.0175c.; lire, 4.175c.; and marks, 0.92c. New York funds in Montreal, 11.14 per cent premium. Sterling cables were quoted at one-half cent premium over the demand figures given on page 515.

Silver

Advances in the price of silver in both New York and London occurred in the last week. Continued buying for the Indian bazaars and China account is responsible for the rise, and at the close the market appears steady. China exchanges have also improved as silver rose, which lends a good tone to the market.

Mexican Dollars—Sept. 15th, 49¾; 16th, 50; 17th, 50; 19th, 50⅜; 20th, 50⅜; 21st, 50½.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 18@20c. per lb.; 18½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 4.45@4.50c.; market dull. W.C.C. brand, 5.25c. per lb. Cookson's "C" grade, spot, 9c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots 6½@7c.

Bismuth—$1.50@$1.55 per lb.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb., black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $160@$170 per oz.

[1]**Molybdenum Metal** — In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominally, $52@$55 per oz.

Platinum—$72@$78 per oz., according to quantity.

Quicksilver—Market weaker at $42.50 @$43 per 75-lb. flask. Largely a jobbing business. San Francisco wires $43. Dull.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium** — Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $25@$27; ground, $28; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—20@22c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 50c. per lb. of contained sulphide, New York. Quotation purely nominal.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¾@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

[1]**Zircon**—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70 @$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 17—Zinc blende, per ton, high, $22.90; basis 60 per cent zinc, premium and Prime Western, $21; fines and slimes, $19@$17; average settling price, all grades of zinc, $21.59.

Lead, high, $58.80; basis 80 per cent lead, $57.50@$58; average settling price, all grades of lead, $54.55 per ton.

Shipments for the week: Blende, 5,830; lead, 935 tons. Value, all ores the week, $176,890.

Larger demand again advanced zinc blende to $21 basis, over 5,000 tons commanding this price, with a tonnage around 1,700 selling on $20 basis. Lead ore was again advanced, this time to $57.50, with uncredited rumors of $58.

Purchases this week aggregated 6,750 tons, a gain of 3,100 tons over last week, and with the stronger demand the price level became more encouraging to sellers. Sellers were slow to accept the slight advance, expecting a still higher market.

Platteville, Wis., Sept. 17—No sales of lead or zinc ore. Shipments for the week none. Shipments for the year: Blende, 8,461; lead ore, 1,171. Shipped during week to separating plants, 334 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,500@$2,000; No. 2, $850@$1,250; spinning fibers, $350@$850; magnesia and compressed sheet fibers, $225@$350; shingle stock, $95@$150; paper stock, $55@$70; cement stock, $16@$27.50; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada.

Barytes—Crude, 88 to 94 per cent barium content, $10@$12 per net ton; ground (white) $23@$24 in bags, carload lots; (off-color) $21@$22 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Borax—Granulated, crystals, or powdered in bags, carloads, 5⅛c. per lb.; in bbls. 5⅜c.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

---

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

China Clay (Kaolin)—Crude, $6.50@$8.50; washed, $9@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $25@$30, f.o.b., quoted at New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b., from New England points.

Feldspar—No. 1 soap grade, $7@$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, $6@$6.50; No. 2, $5@$5.50. Market dull. Large stocks are available and quotations are nominal. Producers report cancellations of orders. No. 1, Canadian, ground, $26 f.o.b. cars.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; lump, $12.50, f.o.b. Lordsburg, N. M. Ground, acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, ¾@2½c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $45@$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica — India block mica, slightly stained, per lb.: No. 6, [illegible]; No. 5, $1.50; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 70c.; No. 5, [illegible]; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton depending upon quantity; ground roofing mica, $50@$70, all f.o.b. New York.

Monazite — Minimum of 6 per cent thorium oxide, $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $11.65; 75 per cent, $10.65; 75@74 per cent, $10.15; 70 per cent, $6.25; 68 per cent, $5.75; 68@66 per cent, $5.50.

Pumice Stone — Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 13c.; Spanish lump, 13@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $7.50@$11 per ton; less than carload, $25, f.o.b. cars. Imported, $30@$40; Canadian, $18@$40 per ton.

Mineral Products

Arsenic—5.75@6c. per lb.

Sodium Nitrate — $2.10@$2.30 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $12.50 per ton, f.o.b. in bulk, Western mines, spot and six months' contract; $20@$25 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.20@$1.25 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 11½c. per lb. of chromium contained; 4 to 6 per cent carbon, 11@12c., f.o.b. works.

Ferromanganese—Domestic, 76 to 80 per cent, $65@$67, f.o.b. furnace; resale, $90, delivered; English, $65@$67, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $25@$27, f.o.b. furnace.

Ferromolybdenum—Standard grades carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, [illegible] per lb. of contained metal, f.o.b. works. Imported material, $1.70@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, [illegible]@$40; 50 per cent, $60@$65; 75 per cent, $130@$135.

Ferrotungsten—Domestic, 75 to 80 per cent W., 40@45c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$4.25@$4.50 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 19.50c. per lb.; wire, 13.75c.

Lead Sheets—Full lead sheets, 7¾c.; cut lead sheets, 8c. in quantity, mill lots.

Nickel Silver—29.50c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets, 16.25c.; sheathing, 15.25c.; rods, ⅜ to 3 in., 13.25c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $50 per ton; 76 per cent, $90@$95 f.o.b. works.

Chrome Cement — 40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—$52@$55 per net ton.

Fire Brick—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $65@$70 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98. f.o.b. works.

Silica Brick—9-in., per 1,000; $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Sept. 20, 1921

The advance in prices of steel products made a week ago is held, though on account of distributors having been covered for limited periods at the old prices, no rigid test has been applied. In sheets nearly all the independents have advanced prices $5 a ton. In pipe, on the other hand, new cards have been issued showing reductions from the July 7 card of $5 to $10 per ton, according to size, and oil-[illegible] have been [illegible]. The formal reduction is partly in [illegible] of [illegible] in the last few weeks, so that the [illegible] so much. In [illegible] ordinary [illegible] at 1.60, [illegible] has [illegible] prices, as a [illegible].

Prices [illegible] except that [illegible].

Pig Iron—[illegible] $19 [illegible] and $21 [illegible] f.o.b. Valley furnaces.

Coke

Connellsville — Furnace, [illegible]; foundry, [illegible].

---

[1] Foote Mineral Co., Philadelphia, Pa.

MINING STOCKS

Week Ended September 17, 1921

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Ahmeek	Boston	47¼	45½	47	Sept. '20, Q	$0 50
Alaska-Br. Col.	N. Y. Curb	*52	*38	*39		
Allouez	Boston	19	19	19	Mar. '19	1 00
Anaconda	New York	38¼	37	38½	Nov. '20, Q	1.00
Arcadian Consol	Boston	2	1¾	1¾		
Ariz. Com'l	Boston	8	8	8⅛	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*28	*22	*25		
Bingham Mines	Boston	11	10¼	10½	Sept. '19, Q	.25
Calumet & Arizona	Boston			45½	June '21, Q	50
Calumet & Hecla	Boston	239	230	238	June '20, Q	5 00
Canada Copper	N. Y. Curb	*36	*33	33		
Centennial	Boston	8½	8	8¼	Dec. '18, SA	1 00
Cerro de Pasco	New York	27½	26	26½	Mar. '21, Q	.50
Chile Copper	New York	11¼	10¾	11		
Chino	New York	24	23½	23⅞	Sept. '20, Q	37½
Columbus Rexall	Salt Lake	*18	*17½	*17½		
Con. Arizona	N. Y. Curb	*1	*1	*1	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	*1	*1	*1¼		
Copper Range	Boston	35	33½	34	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*36	25	*27		
Davis-Daly	Boston	6⅜	6¼	6½	Mar. '20, Q	.25
East Butte	Boston	9½	9¼	9¼	Dec. '19, A	.50
First National	Boston Curb	*55	*55	55	Feb. '19, SA	.15
Franklin	Boston	2	1¾	1⅞		
Gadsden Copper	N. Y. Curb			*25		
Granby Consol	New York	19	18	18	May '19, Q	1 25
Greene-Cananea	New York	22	21	21	Nov. '20, Q	.50
Hancock	Boston	†3	†2¼	2		
Howe Sound	N. Y. Curb	2⅜	2¼	2¼	Jan. '21, Q	05
Inspiration Consol	New York	34½	33¾	34	Oct. '20, Q	1 00
Iron Cap	Boston Curb			5½	Sept. '20, K	.25
Isle Royale	Boston	19½	19¼	19¼	Sept. '19, SA	.50
Kennecott	New York	20¾	19½	19⅞	Dec. '20, Q	.50
Keweenaw	Boston	†1	†*90	1		
Lake Copper	Boston	2¾	2¼	2½		
La Salle	Boston	†2¼	†1½	1½		
Magma Chief	N. Y. Curb	*3	*3	*3		
Magma Copper	N. Y. Curb	*22	*20½	*21	Jan. '19, Q	.50
Majestic	Boston Curb	*8	*5	*8		
Mason Valley	Boston	2	1¼	1¼		
Mass Consolidated	Boston	1⅝	1½	1¾	Nov. '17, Q	1 00
Miami Copper	New York	21⅞	21	21½	Aug. '21, Q	.50
Michigan	Boston	1½	1½	1½		
Mohawk	Boston	50	49	50	Nov. '20, Q	1 00
Mother Lode Coa.	N. Y. Curb	4⅝	4½	4½		
Nevada Consol	New York	11¾	11	11¼	Sept. '20, Q	.25
New Baltic	Boston Curb			3		
New Cornelia	Boston	14	13½	14	Aug. '20, K	.25
North Butte	Boston	10	9¾	9⅞	Oct. '18, Q	.25
North Lake	Boston	†*50	†*25	*25		
Ohio Copper	N. Y. Curb	*6	*6	*6		
Old Dominion	Boston	23	22¾	22¾	Dec. '18, Q	1 00
Osceola	Boston	27¼	25	25	June '20, Q	50
Phelps Dodge	Open Mar.	†1 60	†1 45		July '21, Q	1 00
Quincy	Boston	38¼	36	36	Mar. '20, Q	1 00
Ray Consolidated	New York	13¼	12¾	12⅞	Dec. '20, Q	25
Ray Hercules	N. Y. Curb	*20	*15	20		
St. Mary's Min. Ld.	Boston	38½	36	36	June '20, K	2 00
Seneca Copper	Boston			13¼		
Shannon	Boston	*99	*90	*90	Nov. '17, Q	.25
Shattuck Arizona	New York	6½	6½	6½	Jan. '20, Q	.25
South Lake	Boston	†1½	†*50	1		
Superior & Boston	Boston	1	1½	1½		
Tenn. C. & C. cfs.	New York	8¾	8½	8½	May '18, I	1 00
Tuolumne	Boston	*50	*46	46	May '13,	10
United Verde Ex.	Boston Curb	24¾	23½	24½	May '21, Q	25
Utah Consol.	Boston	3½	3¼	3¼	Sept. '18,	25
Utah Copper	New York	51¼	49¾	50	June '21, Q	.50
Utah Metal & T.	Boston	1¼	1¼	1¼	Dec. '17,	.30
Victoria	Boston	1½	1¼	1¼		
Winona	Boston	*50	*45	*45		
Wolverine	Boston	12	11½	12		
NICKEL-COPPER						
Internat. Nickel	New York	14½	13¾	14	Mar. '19,	50
Internat. Nickel, pf.	New York			80	Aug. '21, Q	1 50
LEAD						
National Lead	New York	76	74½	75	June '21, Q	1 50
National Lead, pfd.	New York	105	103	103	Sept. '21, Q	1 75
St. Joseph Lead	New York	11⅞	11⅞	11⅞	June '21, Q	25
QUICKSILVER						
New Idria	Boston	†*50		*50		
ZINC						
Am. Z. L. & S.	New York	8½	8	8½	May '20	1 00
Am. Z. L. & S. pfd.	New York	27	[illegible]	[illegible]	Nov. '20, Q	1 50
Butte C. & Z.	New York	4	4	4	[illegible] '18	50
Butte & Superior	New York	14	[illegible]	14	Sept. '20	1 25
Callahan Zn-Ld	New York	4¼	4	4	Dec. '20, Q	50
New Jersey Zn.	N. Y. Curb	116½	115	115	May '21, Q	2 00
Success	N. Y. Curb			2	July '16,	03
Yellow Pine	Los Angeles	†*55	†*50	*55	Sept. '20, Q	03

Stock	Exch	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	New York	½	½	½		
Alaska Juneau	New York	1¼	1⅛	1⅛		
Carson Hill	Boston	15½	14⅞	14⅞		
Cresson Consol. G.	N. Y. Curb	1 9/16	1 7/16	1 7/16	June '20, Q	$0.10
Dome Extension	Toronto		*65	*65		
Dome Mines	New York	17½	17	17½	July '21, Q	.25
Florence Goldfield	N. Y. Curb	*44	*39	*40		
Golden Cycle	Colo. Springs	*67	65	*67	June '21, Q	02
Goldfield Consol	N. Y. Curb	*6	*6	*6	Dec. '19,	05
Hollinger Consol	Toronto	7 42	7 35	7 41	Sept. '21, 4 wks.	05
Homestake Mining	New York			55½	Aug. '21	25
Kirkland Lake	Toronto	*38	*34	35		
Lake Shore	Toronto	1 30	1 25	1 34	Aug. '21, K	02
McIntyre-Porcupine	Toronto	1 95	1 93	1 95	Sept. '21, K	05
Porcupine Crown	Toronto	*18	*16	17	July '17,	.03
Porcupine V. N. T.	Toronto	*19	*15	*19		
Portland	Colo. Springs	*38	*38	*38	Oct. '20, Q	01
Reorgan. Booth	N. Y. Curb			4	May '19,	05
Schumacher	Toronto	*23	*20	*23		
Silver Pick	N. Y. Curb	*10	*9	*10		
Teck Hughes	Toronto	*15	15	15½		
Tom Reed	Los Angeles	*75	*72½	*73	Dec. '19,	.02
United Eastern	N. Y. Curb	2 3/16	2¼	2 3/16	July '21, Q	.15
Vindicator Consol.	Colo. Springs	*25	*25	*25	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*4	*3	3		
Yukon Gold	N. Y. Curb	*95	*85	*95	June '18,	02½
SILVER						
Arizona Silver	Boston Curb	*21	*18	*18	Apr. '20, M	.03
Batopilas Mining	New York	⅝	⅝	⅝	Dec. '07, I	.12½
Beaver Consol.	Toronto	*27	*25	*26½	May '20, K	.03
Coniagas	Toronto	1 65		1 64	May '21, Q	.12½
Crown Reserve	Toronto	*11	*9½	*11	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3¾	3¾	3⅞	July '21, Q	.12½
La Rose	Toronto	*32	*27	*31	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*16½		*16½	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.15	1 00	1 14	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	4½	4¼	4¼	July '21, Q	.15
Ontario Silver	New York	3½	3½	3½	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb			*11	Jan. '12,	.10
Temiskaming	Toronto	*25	*21	*24	Jan. '20, K	.04
Trethewey	Toronto	*12½	*10¾	*12½	Jan. '19,	.05
GOLD AND SILVER						
Barnes-King	Butte			*60	Aug. '20, Q	05
Boston & Montana	N. Y. Curb	*75	*70	*74		
Cash Boy	N. Y. Curb	*4	*3	4		
Consol. Virginia	San Francisco	*31	*30	*30		
Dolores Esperanza	N. Y. Curb	1 3/16	1⅛	1 3/16		
El Salvador	N. Y. Curb	*19	*15	*16		
Jim Butler	N. Y. Curb	*7	*7	7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*5	*3	*3	June '16,	.05
Louisiana Con.	N. Y. Curb			⅛		
MacNamara M.& M.	N. Y. Curb	*18	*14	*14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.			4	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1½	1 5/16	1 5/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*73	*65	*65		
Tonopah-Extension	N. Y. Curb	1 7/16	1 5/16	1 7/16	July '21, Q	.05
Tonopah Mining	N. Y. Curb	1¼	1 3/16	1¼	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	*90	*83	*83	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*7	*7	*7	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1 07½	1 07½	1 07½	Dec. '21.	.15
Chief Consol.	Boston Curb	2¾	2¾	2¾	Aug. '21, Q	.05
Consol. M. & S.	Montreal			15	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†2 50	†1 30	...	July '20, Q	.10
Daly-West	Boston	†2½	†1½	2½	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb			2	Apr. '21, K	.05
Electric Point	Spokane	*6½	*6	*6½	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*33	*29	*31		
Federal M. & S.	New York			7	Jan. '09,	1 50
Federal M. & S., pfd	New York			22½	Sept. '21, Q	1.00
Florence Silver	Spokane	*10	*10	10	Apr. '19,	.01½
Grand Central	Salt Lake	[illegible]	[illegible]		June '20, K	.03
Hecla Mining	N. Y. Curb	4	4	4	June '21, Q	.08
Iron Blossom Con.	N. Y. Curb	*18	*18	*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†3 10	†1 75		Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb			3	June '21, I	.02
Prince Consol.	Salt Lake	*8	*8	*8½	Nov. '17.	.02½
Rambler-Cariboo	Spokane	*2	*2	*2	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*10	*8	*9		
South Hecla	Salt Lake	†*30			Sept. '19, K	.15
Standard Silver-Ld	N. Y. Curb			*8	Oct. '17,	.05
Stewart Mining	N. Y. Curb	*5	*5	*5	Dec. '15	.05
Tamarack-Custer	Spokane	1 65	1 65	1 65	Jan. '21, K	.04
Tintic Standard	Salt Lake	1 87	1 87	1 87	July '21, Q	05
Utah Apex	Boston	2¼	2	2	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb			2	Nov. '17,	.01
VANADIUM						
Vanadium Corp.	New York	35	32¼	32½	Jan. '21, Q	1 00
ASBESTOS						
Asbestos Corp.	Montreal	45	40	45	July '21, Q	1.50
Asbestos Corp., pfd.	Montreal	69	68	69	July '21, Q	1 75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	38½	36¼	36¼	Mar '21, Q	1 00
Amer. Sm. & Ref. pf	New York	71	70½	70½	Sept. '21, Q	1 75
Am. Sm. pf. A	New York	68	68	68	July '21, Q	1 50
U. S. Sm. R. & M.	New York	30½	29¼	29¼	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	New York	40	39	40	July '21, Q	87

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

INDUSTRIAL NOTES

Exhibitors at Exposition of Chemical Industries Show Latest Improvements in Machinery and Processes

Few technical men who happened to be in the vicinity of New York City during the week beginning Sept. 12 failed to attend the Seventh National Exhibition of Chemical Industries at the mammoth Eighth Coast Artillery Armory. In addition, thousands of laymen were attracted to the various booths, which offered visual evidence of the rapid strides which this country has made in the manufacture of the many products into which chemistry plays a major part.

This year's show possibly did not contain as many novelties as that of last year, when much of the progress made during the war was exhibited, but it was no less interesting to one who attended for the first time. The site selected was thought by some to be too remote from the center of the city, being at the corner of Kingsbridge Road and Jerome Ave., but it could be reached within forty-five minutes from 42d St., and it is unlikely that the prospect of the ride discouraged many. The building is much better adapted to exhibition purposes than the Grand Central Palace, where last year's exhibition was held, for the ground floor is sufficiently large to house everything. Also, a suitable auditorium was available for showing the moving pictures and holding the technical meetings, which were featured this year more than has been the case before.

The moving pictures were selected from those prepared by the U. S. Bureau of Mines and various private companies engaged in the chemical field. They proved generally entertaining and gave a clear idea of how familiar articles are mined and manufactured, although some industries, such as the manufacture of dyes, do not lend themselves well to this method of explanation. About seventy reels were thrown on the screen in the six nights that the exhibition was open, the showing running from 7 to 10 o'clock each evening.

About four hundred manufacturers took advantage of the opportunity to advertise their products and meet possible buyers. Symposiums were held on Crushing, Grinding and Pulverizing; on Evaporating and Drying; on Paint and Varnish; on Ceramics; on The Power Plant in the Chemical Industries, and on Dyes and Colors, together with many addresses on miscellaneous topics. A full report of the exposition activities will be made in the Sept. [illegible] issue of *Chemical and Metallurgical Engineering*. Some of the exhibits of interest to the mining fraternity will be briefly mentioned here though many others were equally attractive.

United Filters Corporation, New York City—The American Filter has now proved its usefulness in concentrating mills as well as in other more strictly chemical plants. Two models made the operation of this machine clear, the one-disk, 4-ft. model attracting especial attention. There was also a commercial-size unit of the Sweetland filter, and of the United filter press. A large view of the company's new home at Hazleton, Pa., formed an appropriate background.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis.—The principal feature of this exhibit was a small one-quarter size model of the Allis-Chalmers dust-collector in operation. This machine was also explained by a representative at the technical session on Tuesday afternoon. It should have many applications in removing dust from gases, and has some features not heretofore employed in baghouse processes. A sectional model of a rubber-lined sand pump also attracted attention.

The Duriron Co., Dayton, Ohio—The various products which can be advantageously made of Duriron formed the principal part of this exhibit.

The American La France Fire Engine Co., Elmira, New York—This company evidently does not make fire engines exclusively, for a varied collection of fire extinguishers, masks, and goggles was shown, which should have application in almost every mine, mill, and smelter.

Nash Engineering Co., So. Norwalk, Conn.—A new pump was exhibited in the Nash booth, which is destined to find much favor among mining engineers. Whereas the ordinary sump pump must be submerged and is difficult to get at, this invention makes the use of such a machine unnecessary. Two rotors are mounted on a single shaft, one sucking the water up for, say, a distance of fifteen feet, and the other acting as a centrifugal pump elevating to any distance required.

The Magnesia Association of America, Philadelphia, Pa.—Samples of insulation formed the large part of this exhibit. Eighty-five per cent magnesia is now well known, (the other 15 per cent is asbestos), and the benefits derived from covering heated pipes and furnaces with this material are evident with little study. A flow chart showing the various steps in the production of magnesia products and illustrating each with a sample proved informative.

The Dorr Co., New York City—Almost everyone has heard of Dorr classifiers, thickeners, [illegible], and other metallurgical equipment. Working models of many of these were on view and clearly showed the simplicity and efficiency of the methods used.

The Bristol Co., Waterbury, Conn.—The Bristol exhibit was confined to pressure and temperature gages and recording devices, and gave an [illegible] idea of the [illegible] of instruments which this company manufactures.

Oliver Continuous Filter Co., New York City—A small Oliver filter dewatering paper pulp was the object of much interest on the part of both technicians and laymen. This material proved particularly well adapted for exhibition purposes. A small, partially dismantled model of the standard portable Oliver filter, showing the copper screen and copper wire construction, was also on view. The installations of this filter are exceedingly numerous, as was evidenced by a map of the United States with each installation represented by a tag.

International Nickel Co., New York City—The exhibit of this company, which is the largest nickel interest in the world, was confined largely to samples of the various articles into which nickel and monel metal may enter with advantage. Cooking and household implements were especially interesting to the women present. Samples of raw materials were also on view.

Anaconda Copper Mining Co., Perth Amboy, N. J.—That the products of this company are not confined to copper was at once evident. Still, a great many different forms of manufactured copper were exhibited, including stamped roofing, cooking utensils, works of art, copper wire and cable, and other articles of general utility. Fertilizer, white lead, a large crystallized pot of tellurium and a mirror made of vitreous selenium, electrolytic silver, and various lead products were also on view. The large bar of gold shown was of doubtful origin.

Norwalk Iron Works Co., South Norwalk, Conn.—This company had on exhibit three compressors, including a new vertical three-stage oxygen compressor.

American Cyanamide Co., New York City—"Aero Brand" cyanide is now well known to American metallurgists as a result of its introduction into many mills where the high-grade product was formerly used. A large jarful was on view, together with "Ammo-Phos," a fertilizer which is the other chief product of this company.

General Chemical Co., New York City—The General Chemical booths occupied the largest amount of space and were the most elaborate shown at the exhibition. The general appearance took one back to the age of Rameses. The subsidiary companies including the Solvay Process Co., the Barrett Co., and the National Aniline & Chemical Co., were afforded ample opportunity to show their products.

Manhattan Rubber Manufacturing Co., Passaic, N. J.—The belts made by this firm both for driving machinery and conveying material, are well and favorably known to most American millmen. A feature of the Manhattan exhibit showed the resistance to heat and moisture of a rubber belt which was running in water heated to 130 deg. F.

Lead Lined Iron Pipe Co., Wakefield, Mass.—Where fluids too corrosive for iron pipe are to be handled, and still the strength of iron must be retained, lead-lined pipes and fittings such as were exhibited by this company are almost a necessity.

United Lead Co., Cincinnati, Ohio.—During the war, when tin was scarce, a process of electro-chemically hardening lead was devised, and samples of this product, known as Frary metal, were shown. A bell made of this metal was sufficiently hard to give an excellent ring, despite the fact that the metal contains 98 per cent of lead. Many other lead products were also shown in this exhibit.

Dings Magnetic Separator Co., Milwaukee, Wis. — Two small working models of the Dings Magnetic Separator were featured. Some of the numerous products which may be separated by this process were also exhibited in a case.

Roessler-Hasslacher Chemical Co., New York City.—Some of the chemical products which are manufactured by this firm were exhibited in numerous jars.

Nichols Copper Co., New York City.—One of the most attractive features of the exhibits was afforded by a large pedestal formed of crystallized copper sulphate, supporting models of fruits and vegetables, in the growing of which this substance is universally used as an insecticide. Some of the rougher products of this company, such as copper wire bars and ingots, were also on view.

Taylor Instrument Co., Rochester, N. Y.—Samples of all of the instruments made by this company would no doubt occupy half the floor, but some of the more important found a place in the booth.

The Merrill Co., San Francisco, Cal.—The principal feature of the Merrill exhibit was the Merrco valve, which was exemplified in several forms and which is now well known to metallurgists.

The S. Obermayer Co., Pittsburgh, Pa.—This company manufactures the Hot-Patch furnace cement, and a small electric furnace was installed to show the applications of this material.

Coors Porcelain Co., Golden, Col.—American chemists are no longer dependent upon German porcelain, as was evidenced by the varied forms of laboratory porcelain which were exhibited by this company, and all of which were made in Colorado.

General Electric Co., Schenectady, N. Y.—An automatic arc-welding outfit and a 50-lb. brass-melting furnace were featured in the large exhibit of this company.

Bausch & Lomb Optical Co., Rochester, N. Y.—The booth occupied by this firm was taken up with samples of microscopes and various other optical instruments.

Raymond Brothers Impact Pulverizer Co., Chicago, Ill.—The Raymond exhibit included a one-quarter size model of the Raymond No. 1 automatic pulverizer, with automatic throw-out; a one-quarter size model of the Raymond air-separating plant, for grading and classifying finely ground materials; a one-quarter size Raymond High-Side four-roller miller for the fine grinding of lime, limestone, coal, phosphate rock, clays, talc, and like substances; and a full size Raymond No. 0000 pulverizer for grinding colors, clays, and similar materials. These were all working models.

Stimpson Equipment Co., Salt Lake City Utah.—Mining engineers were particularly interested in the Stimpson exhibit, inasmuch as two models of the new Mitchell crusher were on view, as well as a small Mitchell vibrating screen and a section of one of the vibrators. The Mitchell crusher is of the gyratory type, but the vertical shaft contains an electric vibrating unit which gives a much greater capacity than is obtained in the older forms. Lower power requirements and a more evenly sized product are also secured. This machine would seem to have great possibilities, and, although not yet on the market, it is understood that it is to be actively pushed in 1922.

The Lunkenheimer Co., Cincinnati, Ohio—Valves and oil-feeding devices formed the major part of the Lunkenheimer exhibit.

Sullivan Machinery Co., Chicago, Ill.—A feature of the Sullivan booth was a model of air-lift pumping equipment manufactured by this firm.

Morse Chain Co., Ithaca, N. Y.—Machinery models in actual operation always attract attention, and the silent chain drive exhibited by this company was no exception.

Yale & Towne Manufacturing Co., Stamford, Conn.—Although this company is famous chiefly for locks, it manufactures many other kinds of equipment. A portable crane mounted on an electric truck was featured. The exhibit also included several models of chain blocks.

Hardinge Co., New York City—A new type of the Hardinge conical mill was exhibited in a commercial size, 5 ft. x 22 in. The discharge opening is much enlarged, allowing a larger circulating load to be carried than in mills of the older design as well as securing a larger tonnage ground per unit of power. The familiar glass model using nuts instead of steel balls was also on view for those who were not familiar with the action of this mill.

W. S. Tyler Co., Cleveland, Ohio—The screening apparatus made by the Tyler company has a world-wide reputation. The Hum-mer electrically vibrated screen attracted a great deal of attention. It has now been on the market for two or three years, and has proved greatly superior to older designs.

Huff Electrostatic Separator Co., Arlington, Mass. A working model of the Huff separator was on view and attracted much interest, as it did last year. The machine has many applications in removing impurities from certain types of ores.

M. W. Kellogg Co., Inc., New York City—The Kellogg exhibit consisted of a few forge-welded Chemi-Steel products.

Blaw-Knox Co., Pittsburgh, Pa.—A sectional steel building formed the centerpiece of the Blaw-Knox booth, but the small models of grab buckets picking up sand aroused the most interest. Some of the ladies expressed the opinion that they would make ideal toys for small boys.

Ruggles Coles Engineering Co., New York City.—A small brass and mica model of the familiar Ruggles Coles drier was a feature of this exhibit.

William Ainsworth & Sons, Denver, Col.—Three of the latest forms of balances for laboratory use were on view in this booth.

Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.—A model steam turbine for driving pumps, fans, and like machinery was the *pièce de resistance* of the Westinghouse exhibit, although one or two motors and a bakelite-micarta airplane propeller were also on view.

Baker & Co., Inc., Newark, N. J.—Rare metals and some of the products in which they are used formed the basis of the Baker exhibit.

Wedge Mechanical Furnace Co., Philadelphia, Pa.—A small model of the Wedge roasting furnace was included in the exhibit of the Pennsylvania Salt Manufacturing Co. This furnace has received general application for roasting concentrates for feeding to reverberatory furnaces.

British America Nickel Corporation, Ltd., Ottawa, Ont.—Although the mining operations of this company are now suspended, it was evident that it is still an active organization. A large tube of nickel, possibly two feet in diameter and fifteen or twenty feet long, attracted much attention.

Kennedy Valve Mfg. Co., Elmira, N. Y.—The valves and fittings manufactured by this company were well exemplified in their exhibit.

Canadian Pacific Railway Co., Montreal, Que.—The immense illuminated map of Canada showing all railways and mineral districts by miniature incandescent lights proved as interesting to the crowds as in former exhibits. It is a remarkably effective method of showing the situation and accessibility of a nation's resources, a switchboard making it possible to illuminate only those industries in which the onlooker is interested.

Dominion of Canada, Ottawa, Ont.—The Canadian government exhibit was a large one and showed the numerous resources in lands, forests and mines of our northern neighbor to good effect. Samples of a large number of raw materials and finished products were on view, and much statistical information was available for those interested.

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and
Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

[illegible]
[illegible]
Assistant Editors
BENJAMIN L. MILLER
[illegible] M. HAIG
[illegible] LEWIS
[illegible]
Consulting Editors

Volume 112 New York, October 1, 1921 Number 14

The Unemployed

THE UNEMPLOYMENT CONFERENCE over which Mr. Hoover is to preside in Washington does not at first strike one as likely to have any more tangible outcome than the industrial conferences already staged in the capital. Can any amount of conference make a wider market for copper or shirts, and is it within the bounds of possibility for the producer of copper or shirts to employ men if he cannot sell the product? What practical cure can be devised for the lack of purchasing power of sick and prostrate Europe, which is the main element at the bottom of our semi-paralysis of production?

Yet there are many curious problems which may be investigated in this connection, and even a little daylight let into them may help, even if a very little. The first thing will be to get away from the sob stuff—not to try to arrange a sort of paternalistic federal employment bureau, and find "jobs for the jobless." It can't be done: and if it could, the Government owes no man a job unless it needs him—that is to say, unless the taxpayers need him as an investment profitable to them.

Conditions, practice, and theory, as regards employment, are at present diversified and chaotic. Business is depressed; many men and women have been laid off from their war-time and post-war employment. Costs of living are on the decrease; the price of commodities in many lines has come down. It seems impossible, for example, that the price of copper—or leather—or rubber—should go lower. With the slacking or cessation of many industries, with the complete shutting off of wages, the purchasing power of the country has greatly diminished, while that of Europe shows only a shadow of its pre-war vigor. For purchasing power to be renewed, one thing is essential—rock-bottom prices to attract the needy but purse-limited buyer of America or Europe. But the buyer purchases the manufactured commodity, not the raw material; and into the cost of the manufactured commodity enters as the principal item the cost of manufacture—to wit, the price of the human energy involved. Railroading furnishes an example. Railroad freight and passenger rates are still soaring in war-time skies. The result is that short-haul freight is handled by motor truck, and the passenger [illegible] is shrunk by the many who stay at home. The cause of the unreasonably high railroad rates, and the consequently low railroad business: high wages, secured and maintained by the unions. The result of this is a shortage of the amount of railroad equipment, of the employees of car and locomotive works and steel mills, which depend on the railroads, of the iron foundries and iron mines which depend on the car and locomotive works. Thus many men are thrown out of a job, but the few that stay in manage to maintain the approved and agreed wage scale.

In the city of Washington, where the conference is to be held, carpenters, plasterers, and paperhangers get eight dollars a day, and plumbers nine dollars, having recently secured a raise of fifty cents. There is very little building going on in Washington. People will not build—cannot afford to build—at these wages. The housing situation is accordingly as bad as it was three years ago. The result is that many people who would at once be employed on extensive building operations, if the cost were reasonable enough to justify the sensible investor, are out of a job—looking to the Government for a job—but the few that are employed are able to maintain or even increase their wages. Who is keeping the unemployed out of a job in these typical cases: the Government, the investor, or the unions? Let the unions ponder the problem, and let the unemployed ponder it, and the conferees under Mr. Hoover. All workers should get the highest possible wage—only let them ponder how the average wage of all shall be the highest possible.

In the Government service the same conditions do not obtain. Recently a drastic cut in the wages of navy yard employees has been made—governmental economy; good political stuff. In one instance that came under our observation a man employed as a mechanic, having a wife and six small children, had his pay cut to sixteen dollars a week. Figure it out for yourself. The conference will not be enthusiastic about soliciting this kind of jobs from the Government.

Well then, should we not have an evening up of these chaotic conditions, some democratic sharing? And is not this one way to approach the problem? This is a matter which concerns the mining industry. For example, the breaking of the housing deadlock is far more important to the zinc industry than a tariff on zinc.

It is of no use to build a dam across a dry valley.

Echoes

A SHORT TIME AGO it was announced that some wizard in the Middle West had [illegible] his wand and rediscovered the process for tempering copper said to have been lost by the ancients. Forthwith the gallery applauded. A process so nifty as this was not to be left lying around where [illegible] [illegible] the Steel Corporation, or so the rumors said—the price set by the wizard being a small sum like a million dollars or so with a 5% royalty. The gallery applauded again. [illegible] But the gallery is still applauding. It has the [illegible] and it is a habit that is hard to break. [illegible] after another throughout the country is reprinting this lie about tempering copper [illegible]

It is easily seen why stringent laws covering libel and slander have been drawn. Once uttered or printed, words cannot be checked, but take wings and fly to the furthermost parts of the earth. A false report may endure as long as the page on which it is printed lasts or a tongue that can utter it lives. Many are reading the story of how the ancients' secret has been rediscovered, and, being interested, are repeating it to others. Few, however, have seen Judge Gary's denial, for this is prosaic and unsensational, and is retained in the memory with difficulty, if indeed it is noted at all.

This is but a single instance of a common occurrence. One who watches the out-of-town newspapers is familiar with the way in which a canard goes its way, continuing its course for weeks and even months after it has been supposedly laid to rest. The eagerness of the papers to make a "scoop" is primarily responsible.

Absentee Capitalism

GOOD MORNING! Have you heard that absentee capitalism is the big new political issue? Ask the Miami, Ariz., *Silver Belt*. It knows. Under the heading "The People Lose Control" a writer says:

> "Foreign labor [in Arizona] without votes, was used to displace American workers who would not vote in the interests of the Absentee Capitalists. Deportations were resorted to in different camps and planned for some of the others. The laws of the state and nation were openly flaunted. The Governor was snubbed, and the representatives of the President of the United States were treated as interlopers, and some of them were outrageously insulted."

Evidently the writer has the Bisbee deportations in mind, forgetful of the fact that all the indictments were quashed. But he gives us an idea. It is that all the stockholders of the various copper companies in Arizona should at once move to the camps in which their money has been invested and take up their residence there. What a development of Arizona there would be! Globe-Miami and other camps would at once become large cities, and the *Silver Belt* a larger and better (though the last-named virtue is hardly possible) newspaper. Of course it would take a lot of money to provide food, lodging, and other things for all these people, but they, being capitalists, would never mind the expense. The curse of absenteeism would then be removed.

The Rôle of Sampling in Mine Operation

IN THIS ISSUE we present an article on mine sampling methods at Tyrone, N. M., which details the work conducted by the Phelps Dodge Corporation. To the best of our recollection, the system, with fewer modifications as to book work, tickets, and tagging, originated at the Clifton-Morenci branch of this same company, and was used with considerable success, a remarkably close check being obtained on the mine sampling and actual mill runs. One point which is not brought out in the article, with reference to groove or channel sampling, is the necessity of close measurement, particularly where the higher-grade streaks or small veins were cut, and it was essential that foot-assays be computed and that these be properly figured in with the regular interval samples. Another point not mentioned is the great value of recording observations that may be useful to the geological department, such as faults, occurrences of rock, and other conditions that will be of service in the mapping of the orebody.

In addition to furnishing data to the mine foreman and to the geological department, a further use for such a sampling system is found in the calculation of tonnages in certain blocks, the uniformity of the orebodies in the Tyrone and Morenci districts being particularly adaptable to this method of estimation. The same is true, to a certain extent, of the iron-ore deposits of the Mesabi Range and other regions where fairly large areas can be blocked out and the contents, together with the assay values, calculated to within a close figure of the actual volume and mineral content.

We understand that the Committee on Mining Methods of the Institute, under the chairmanship of John E. Hodge, is now considering a complete symposium and study of the various methods in use in all of the mining districts. With all of its ramifications, such an undertaking is necessarily a large one, for there is already a mass of published data which must be collected, tabulated, and properly interpolated. Following that, it will be necessary to collect considerable additional information, and this, too, must be so prepared that it will not only constitute a permanent record but be in a form that will be available for such use as mining engineers choose to make of it.

The mine operator of today has a number of methods to select from, and usually chooses that which is best suited to his particular problem. In some instances a careful consideration is not given to all the factors involved, and the result is not only wasteful from a monetary standpoint but a distinct loss to the profession; for mining, like every other undertaking, is a jealous master and takes pride in a well and carefully worked out plan which gives a maximum result. Then, too, the day is past when a complete gutting of an orebody to the detriment of subsequent extraction of lower-grade material is the fashionable procedure.

The consideration of estimation, extraction, and costs in mining is of the utmost importance, and it is most essential that a standardization, as near as is possible, of the several contributing factors be effected. Necessarily, these will vary with the different districts and, to a considerable extent, in the same district, but the plan now proposed by the committee is certainly commendable and invites the support and interest of every mining man.

Following exploration by drilling, test pitting, or shaft sinking and drifting, or a combination of all three, together with the application of such geological features as are available, will come the selection of the mining method, which may or may not be permanent, depending on the conditions encountered. In any case, one of the governing factors which is continually essential throughout the operation of the mine, and from the very beginning, is sampling. The subject in itself forms the very groundwork of mining, and upon the methods adopted in all branches of mine development depends the success or failure of the enterprise.

The paper by Mr. Anderson, therefore, may be regarded as an added contribution to the subject which forms such an important part of the general topic we have mentioned in the foregoing paragraphs. Costs have not been included, and necessarily they will influence the extent to which this system or any other can be carried out. But we hope from time to time to present such figures; for after all, the cost must keep within its fair proportion of the ultimate expense, and knowledge of the methods that accomplish this purpose is quite as important as the "knowing how."

WHAT OTHERS THINK

Asbestos Mining in the Black Lake Area

It is with great interest that I read the article on asbestos mining in the Black Lake area, in your Sept. 3 issue. Without entering into a discussion of the geological portion, which is accurate enough to all intents and purposes, thanks possibly to the "scattered reports and articles that have been published concerning the asbestos and chrome-bearing rocks of Quebec," some of which seem to have come into your correspondent's possession, I, however, do wish to take exception to the last portion of the article.

Being with a competitive firm, I hold no brief for the defense of the Black Lake Asbestos & Chrome Mines, nor are the methods of this mine anywhere as near as primitive in execution as your correspondent endeavors to make out. Most of the statements made are misleading. One portion of this article, however, contains a slur on the asbestos-mining industry as a whole, and that is that portion of it dealing with the labor conditions and the management of the various properties.

One does not conceive that this paper could have been written in good faith with the object of giving the outside world a true insight into working conditions in this district. It sounds more like a disgruntled employee, relieved of his job, endeavoring to get back at his late employers; or of a college student publishing his summer thesis.

No doubt the methods at one or two of the mines may seem antiquated to the uninitiated, but when the history of the camp is studied it will be found that they are not so antiquated as they may seem. For one thing, asbestos is not like a high-grade metallic ore, which can be mined by the usual method of shaft sinking, drifting, and stoping. The serpentine occurs in large bodies, necessitating the quarrying of the rock on a large scale. One of the pits in this district is now at a depth of 340 ft., with a superficial area of 900 ft. square. Owing to the depth of overburden, which amounts in places to over forty feet (none of which must get into the mill, as it discolors the fiber), it has been found more economical to continue sinking on the full area of stripped surface until the maximum depth of open cut has been reached compatible with safety. With those mines which have a property of sufficient size and quality to enable them to carry on their operations over a wider area, steam shovels and cranes are in operation for handling the rock, and the loaded cars run up inclines to the surface and thence to the mill. In one or two mines where the surface area owned is small, modern underground methods are also being followed with success.

With a few exceptions the mines are privately owned and developed by private capital. Until a few years ago, the asbestos industry was in its infancy, and fiber could be marketed only in the crude form. It is barely in its teens even now. As more and more uses were found for our product, the demand increased, and the mines and milling methods were developed as fast as possible. Now nearly every mine has an extensive and up-to-date program of development, which is being proceeded with as quickly as circumstances will permit.

With regard to the South African engineer who was through here and whom your correspondent refers to facetiously, it is significant to note that we have received visits of a number of South Africans interested in the asbestos industry, who have come to study our methods of milling, one of whom, especially, brought on a small shipment of the South African fiber-bearing rock to be tried out by our methods.

The statement regarding the French Canadians is so erroneous as to be ridiculous, were it not for the bad impression that it is liable to create upon those who have had no experience with them. They are a very intelligent, hard-working, God-fearing people, cleanly in their persons and in their homes. Satisfied with little, fond of their religion and churches, hospitable to a fault, sociable, they are far and away the best labor to be found anywhere; witness the number of industries sponsored by outside capital that have been established in the Province of Quebec to exploit it. Their homes are extremely well kept. Being fundamentally devoted to their families, they have an interesting and amusing social life. Even a colony of only a few families will supply a surprising number of small entertainments and amusements.

A glance at statistics will show that the percentage of crime is the lowest in America. The statement that they are not capable of rising above the mucker stage (locally) is amply refuted by going into figures. Ninety-eight per cent of the superintendents, mill foremen, millwrights, drill runners, blacksmiths, machinists, and craftsmen are French Canadians, and nearly 60 per cent of the office staffs.

On the other hand, there are few of the Czechs, Russians, and Austrians who are not muckers, and these were only imported at a time when labor was scarce, and they are gradually being displaced. This latter movement was precipitated by their lawlessness, the culminating event being the holding up of the paymaster of the Black Lake Asbestos & Chrome Mines while he was proceeding up the self-same hill mentioned by your correspondent, by two of these gentry who, disregarding the usual gentlemanly stand-and-deliver challenge, began shooting as soon as they stepped out of the bush. Much to their disgust, the paymaster could shoot also, and did. One of the two got a bullet in the body, and the other [illegible] being captured later. Your correspondent will doubtless remember the occurrence.

It is to be regretted that a publication of the world-wide standing of the *Engineering and Mining Journal* should see fit to publish a paper, whatever its geological features may be, which contains such groundless [illegible] charges of inefficiency and waste against men who have devoted their lives to the development of this industry, especially when this charge has been laid by a man who has gone thru the district recently and has had only slight [illegible] since that time at one small portion of it. [illegible] LINDSAY.

Thetford Mines, Quebec, Canada.

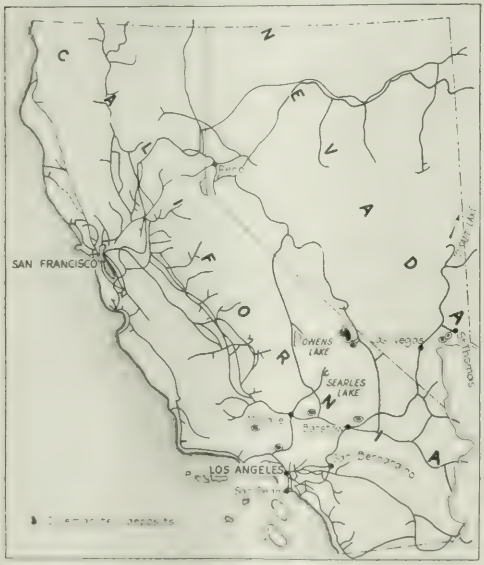
The Callville Wash Colemanite Deposit

A Recent Borax Mineral Discovery in Nevada Which Bids Fair To Rival Other Existing Deposits of Colemanite -Large Mineral Reserves Indicated — Geological Investigation Points to Close Association With Local Sedimentary Rock Deposition

By Hoyt S. Gale

Written for *Engineering and Mining Journal*

THE DEPOSIT OF COLEMANITE in the Callville Wash, Clark County, Nev., recently acquired by the F. M. Smith interests, was discovered in the latter part of January, 1921, by two prospectors, F. M. Lovell and George D. Hartman, who were then engaged in a systematic search for this mineral. Their exploration had been instigated by the finding, a few months earlier, of a district carrying a considerable number of smaller veins of colemanite in the White Basin, about fourteen miles northeast of the Callville discovery. Both districts are in the southern and eastern foothills of the Muddy Mountain Range, on tributaries of the Colorado River. The entire district, including both areas of the recent discoveries, lies about half way between the towns of Las Vegas and St. Thomas, and all the localities referred to are in Clark County, the southernmost part of Nevada. These discoveries are also notable in that they constitute the first record of occurrence of commercial deposits of the mineral colemanite outside the State of California, not only in the United States but apparently in the whole world.



MAP SHOWING LOCATION OF COLEMANITE DEPOSITS IN NEVADA AND CALIFORNIA

The accompanying general index map shows the relative situation of the Nevada deposits with reference to the railroad systems and also with reference to the older developed colemanite districts in California.

At present, the route of access to the Callville deposit is from Las Vegas, a division point on the Salt Lake R.R., by way of the "Arrowhead" automobile road northeasterly from Las Vegas, fourteen miles to a fork leaving the main road toward the south by way of the so-called gypsum cave and Las Vegas Wash to Colorado River. At the mouth of Las Vegas Wash the present road follows near and north of the Colorado, up a valley about six miles to the mouth of Callville Wash, a locality known as Old Callville. Thence the route follows directly up the channel of Callville Wash to the deposit The total distance by this road is about forty-two miles. A shorter and better route is in process of construction.

The deposit lies about six miles due south of Muddy Peak, the main summit of the Muddy Range. It is approximately twenty-eight miles in a course due easterly from Las Vegas. According to recent surveys the outcrop of the bed lies in sections 11 and 14, T.20 S., R.65 E., Nevada, as shown by the traverse map of the deposit, which is based on a rough field survey which I made some time ago. Preliminary surveys for a branch line from the Salt Lake R.R. at the station called Dike show a satisfactory route and grade about twenty-two miles off the main line. This is also one of the three routes that have been surveyed to reach and supply the Boulder Canyon reclamation project dam site, and a fair likelihood exists that the railroad will be built independently of the colemanite interest.

Colemanite Occurs in a Large Lenticular Bed

The accompanying outcrop traverse map shows the trend of the outcrop, pitch, and general character of the associated formations. The shaded portions refer to estimates concerning probable extension of the bed underground as discussed in a subsequent paragraph.

The colemanite in the Callville deposit is a single large lenticular bed which at this place occurs as a regularly stratified member of the Tertiary succession. It is included with a series of interbedded fresh-water limestones and sandy and shaly beds that are composed chiefly of gray or light-colored volcanic ash or pumice, the beds being of varying degrees of coarseness or comminution. The entire stratigraphic section clearly represents a period of widespread volcanic activity, of lavas of comparatively acidic type, the ash or pumice from which was distributed over the region, forming sedimentary beds mixed with chemically precipitated calcium carbonate.

The evidence seems conclusive that the colemanite itself, and probably much of the associated travertine-like limestone, are the product of ancient spring deposition, formed at the time the inclosing beds were laid down. The mass as a whole seems to be a large lenticular body, such as might reasonably be assumed to have been spread out below the center of spring vents, the waters of which probably came up laden with lime and borate constituents to a degree that was supersaturated at surface temperatures and pressure.

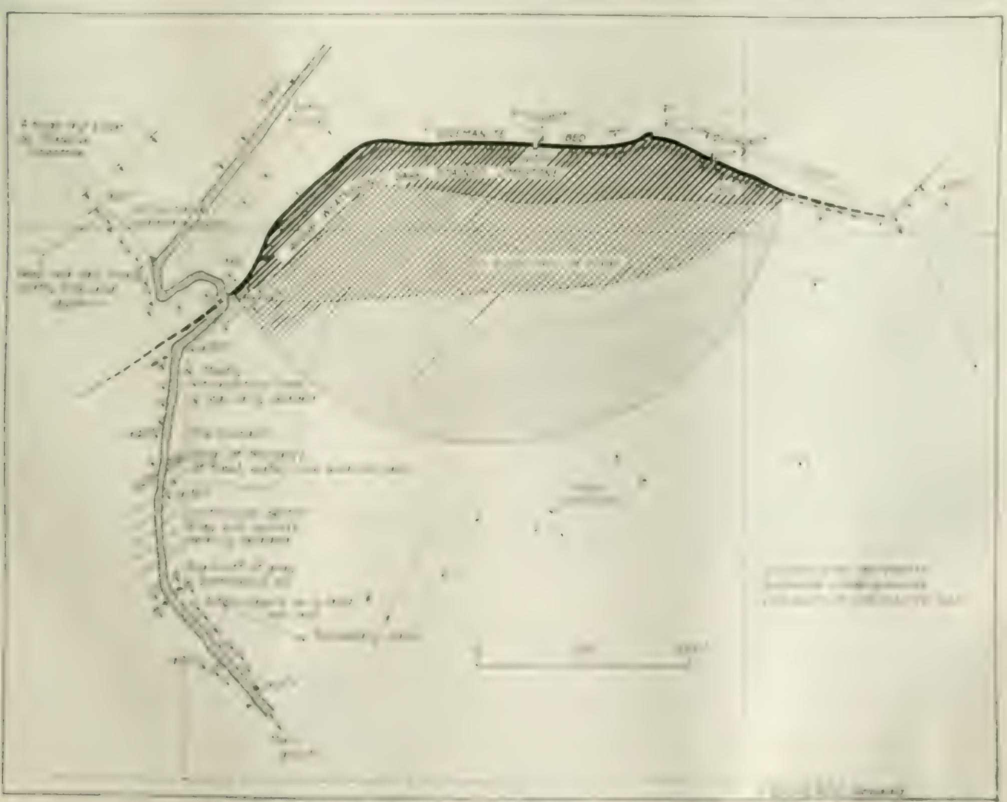
The colemanite bed was undoubtedly deposited during that particular stage of Tertiary time in which the enclosing ash and limy beds were also laid down. It is possible that some of the original mineral may have been ulexite, as the colemanite occurs partly as nodular masses within the bed, and included in shaly bands or beds, but the present mineral of the deposit seems to be almost entirely colemanite. A detail sketch of the colemanite bed, more or less idealized, is shown to represent the appearance of the colemanite in the deposit.

OUTCROP IS EXPOSED ABOUT 3,000 FEET

The structure and stratigraphic section which is given in the diagram on p. 526 is from the data recorded on the traverse plat, the vertical and horizontal scale being equal, indicated by dotted lines in the top sketch. The section thus represents a vertical cut extending northwest from a point near the temporary camp, the profile of the topography being to some degree idealized. The strata described are as exposed along the main gulch (which has been named Lovell Wash, a branch of Callville Wash). The stratigraphic thickness is undoubtedly about correct, but the individual members of the section differ in character from place to place, so that these units probably are not duplicated exactly, or even approximately, far from the section where the measurements are taken. The section serves to show the general character of the beds in which the colemanite occurs.

Specifically described, the colemanite bed, as represented in the outcrop, is shown in natural exposure over a distance of about 3,000 ft. This mineral is included within a softer more shaly part of the section, with massive limestone members above and below, so that the details of the bed are not clearly revealed in the outcrop. However, at the time of my last visit, two prospect cuts had been driven in on the outcrop at points about 800 ft. apart, and these showed practically identical sections. It is from one of these cuts that the structure diagrams were made. These sections showed a measurement of about eighteen feet, taken at right angles to the dip of the bed, which included the most massive layers of the colemanite. Distinct layers of scattered nodules occurred in the shale above this section.

The mineral colemanite occurs within this main bed both as compact, massive layers, composed of essentially pure mineral, and as nodular layered masses interbedded with shaly material. As shown in the two prospect cuts mentioned, the more massive colemanite seems to be included in the upper ten feet of the main bed, the lower eight feet containing more shale, which grades to pinkish or reddish color at the base. A sample was cut by the writer, intended to be an average directly across the upper ten feet of the main bed, in the easternmost of the two prospects, as indicated in the cross-section diagram. This is, of course, not a conclusive test of the average quality of even this part of the deposit, because



[illegible]

it is a single sample cut in only one place. It is, however, a fair indication of what the bed may be expected to run. Analysis of this sample has been made by the firm of Curtis & Tompkins, analytical chemists, San Francisco, with the following results:

ANALYSIS OF AVERAGE SAMPLE FROM CALLVILLE WASH COLEMANITE DEPOSIT

Chemical Determinations	Per Cent	
B_2O_3 ...	23.18	
SiO_2	14.55	
Fe and Al	11.60	(as Al_2O_3)
CaO	21.97	
MgO	9.42	
Na and K	trace	
SO_3	1.30	
Cl... ..	None	
CO_2.............. ..	13.97	
H_2O and undet.	4.01	
Total	100.00	

Computed Equivalents (Approximate)	Per Cent	
$Ca_2B_6O_{11}$(anhyd.)	35.56	(colemanite)
$CaSO_4$(anhyd.)..	2.21	(gypsum)
$CaCO_3 \cdot MgCO_3$	32.07	(dolomite)
$Fe_2O_3 \cdot Al_2O_3 \cdot SiO_2$	30.16	(pumice)
Total	100.00	

Thus it may be seen that this part of the bed carries about one-third pure colemanite, about one-third dolomite, and one-third volcanic ash, with a small proportion of gypsum. Interpreting this, it should be remembered that the sample included everything crossed in the section, with no selection at all. This result shows a satisfactory grade of minable ore, part high grade and part for concentrating.

As previously stated, the main colemanite bed seems to be, as a whole, of lenticular form, in that the colemanite itself pinches or disappears in extension either way along the outcrop of the horizon beyond the 3,000-ft. length. Natural exposures are not sufficient to show whether the colemanite itself actually thins off gradually toward the edges, or whether the bed ends abruptly. Observation on the outcrop, and the correspondence in the two cuts already discussed, seem to indicate that the bed maintains nearly its full dimensions throughout most of its exposed length, but the evidence on this point in the present undeveloped condition of the deposit is admittedly rather weak.

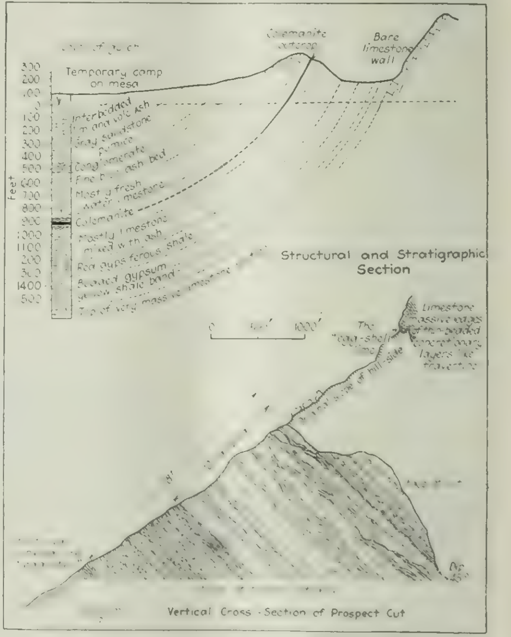
LARGE MINERAL RESERVES ARE INDICATED

The bed dips toward the south, with a turn toward the southeast at the western end of the outcrop, the angle of the dip ranging from about 45 deg. to, say, 50 or 60 deg. at either end. This dip carries the horizon beneath the limestone "cuesta" or "hog back" in which it is found, and out toward the open valley to the south of this ridge. Estimates of the distance to which the colemanite may be expected to extend underground are based, first, on the postulate that the bed is a remaining portion or segment of the original lens-shaped mass deposited, a part having been cut away with uplift and erosion of the inclosing sediments, and, second, on the assumption that, with an outcrop of such size and regularity, a segment of considerable size of the original lens may reasonably be expected still to exist.

The chance seems small that almost the whole of an original lens has been removed by erosion and only the narrow edge remains, and from the general attitude and curvature of the outcrop one is inclined rather to assume the contrary to be the fact. It seems reasonable to assume as a probability that a segment with a radius at least half the length of the exposed outcrop may still exist, but the tonnage computations on which the first purchase and sale of the property were based were far more conservative than this.

On the traverse map are shown, by shading, three hypotheses as to the likely extension of the colemanite bed underground. The first and narrower strip assumes that the colemanite extends and may be mined out as far down as the level of the crossing in the main (Lovell) gulch. This should give an average breadth of workable bed, down the dip, of about 200 ft., for the outcrop length of about 3,000 ft. Estimating on a minable thickness of the colemanite of only ten feet, as sampled, these dimensions show a volume of 6,000,000 cu.ft. of crude ore reserve, above the level stated. Assuming 15 cu.ft. to the ton, this shows 400,000 short tons of crude ore. This will probably average better than 20 per cent anhydrous boric acid (B_2O_3), equivalent to 8,000,000 units A.B.A. (anhydrous boric acid) as expressed in commercial terminology.

The quantity assumptions involved in the foregoing calculations are so conservative that a diagrammatic representation has also been given of what would be implied in the assumption that the segment of the lenticular mass still remaining may be that part south of the outcrop circumscribed by an arc having as radius half the length of the recognized outcrop. The area of this is represented by the entire shaded area on the plat. Without allowing for change in the dip of the beds, this is readily seen to be at least five times the first estimate given. A reasonable minimum expectation of extent is represented as just about one-half of the larger estimate, which is thus at least two and one-half times the first figures given.



STRUCTURAL AND STRATIGRAPHIC SECTION, VERTICAL CROSS-SECTION OF PROSPECT CUT

As shown by the traverse, the exposed outcrop of the colemanite extends from its crossing of the main gulch (Lovell Wash) on the west, around the north face of the "hog back" or "cuesta" ridge, over a divide and down toward the east into another and smaller wash. The same horizon that carries the colemanite may be readily traced far in extension of the mineral itself both ways from the recognized outcrop, but the colemanite is not conspicuous on the surface beyond the extent already discussed, and the possible greater lateral extension of the bed must be revealed by future exploration of the area.

The original showing of the colemanite on the surface consisted of bunchy masses of the radially fibrous cystalline colemanite, which, being more or less decomposed by the action of the weather, commonly assumes a crumbly granulated condition that is not at once readily distinguishable from gypsum, until one has become familiar with this phase of the mineral. The gritty crunching sound when the colemanite is scraped with a prospecting hammer, and the radial, finely bladed crystals usually serve to identify the borate mineral. The analysis quoted shows that there is actually very little of the mineral gypsum included with the main deposit of colemanite.

F. M. LOVELL, DISCOVERER, POINTING TO [illegible]. VIEW LOOKING SOUTHWEST ALONG OUTCROP

STRIKING REGULARITY OF COLEMANITE BED

The structure or general attitude of the strata, including the colemanite, is very regular. The valley south of the ridge containing the colemanite is a broad canoe-shaped synclinal fold, with axis extending from east to west. One or two minor wrinkles in the strata probably affect the colemanite, but certainly cannot cause serious inconvenience in following the bed in mining, as the offset is not great. On the whole, the colemanite bed is most exceptionally regular and continuous, as compared with all other occurrences of this mineral with which I am familiar, and it is believed that this factor alone is a strong point in favor of the efficient and economical working of this deposit.

The accompanying photographs show, one looking one way and one the other, along the outcrop, the appearance of the beds including the colemanite, and, in the foreground, the talus or debris slope covering the actual outcrop.

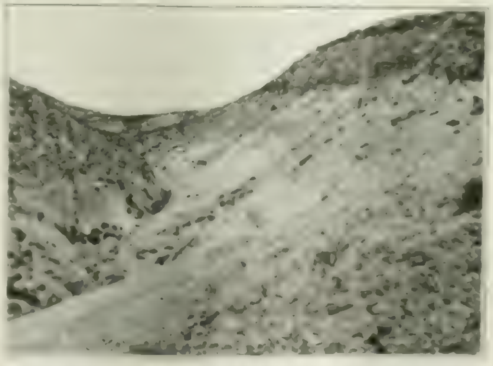
The colemanite is found as a part of the Tertiary series in southern Nevada, and the beds that include this mineral are probably essentially the same age as the beds that contain the colemanite in the other districts in southern California. Prospecting interest, which has been roused to feverish intensity by the recent discoveries and prompt sale of the properties, is being conducted with a clear recognition and practical appreciation of the principles of the stratigraphic association of the colemanite in the series, by which an attempt is made to trace the beds already found into further extension, and to identify in other localities the same formations in the hope of finding other deposits.

VARIATION IN TERTIARY SECTION MARKED

The Tertiary section is extremely variable in detail from place to place, but there is a fair correspondence of the principal units throughout the Muddy Mountain region, if not farther than this. The variability of the Tertiary section is in general as marked as an extreme of independability as is, on the other hand, the wonderful correspondence and uniformity of the units of the older Paleozoic section not only throughout this same region but reaching from here throughout the whole southwestern United States.

During Tertiary time the conditions of sedimentation were local, and so subject to many local changes, such as nearness to volcanic centers, or areas of upthrust Paleozoic masses, from which the sources of their sedimentary deposition were derived. Doubtless a great part of Tertiary deposition consisted of materials distributed over land surfaces by the agency of surface waters, probably mainly storm waters acting at periodic intervals, just as such materials are being distributed today. Tertiary topography also doubtless resembled that of the present time, being made up of structural mountain ranges and intervening isolated basins, some of which contained lakes. Although conditions of Tertiary sedimentation may have closely resembled those of the present in the desert areas of the country, those older deposits have in general been involved in strong mountain-building movements, so that these beds are now usually folded and faulted into great complexity.

The base of the Tertiary sedimentary section, as recognized in the Muddy Mountain region, is a great outwash deposit, made up chiefly of boulders of the dark blue to blackish limestones, which are clearly derived from adjacent upthrust masses of the older Paleozoic limestone formations. This formation has been called the Overton conglomerate by Prof. Chester R. Longwell in his geological study of the Muddy Mountain region, this name being given because this formation is extensively developed near the town of Overton, in the Muddy River Valley.


[illegible]

The Overton conglomerate clearly marks the beginning

[illegible]

ning of a period of redistribution of materials following one of the major mountain-building upheavals, such as brought the Paleozoic limestones up in great fault blocks, with which the region abounds. The summit of the Muddy Peak is itself an example of this. The conglomerate is a great alluvial fan, or wash-debris deposit, spread from these uplifts, which are so clearly the source of its materials. It thus marks an unconformity in the stratigraphic section and is the beginning of a new cycle of deposition. Buried at the base of the Tertiary section its pebbles and boulders have become firmly cemented with a calcareous travertine-like cement. This alluvial fan deposit naturally varies greatly in thickness, ranging, according to Professor Longwell, from several thousand feet near Overton to a thin but fairly persistent layer in other places. So far as I have observed, the Overton conglomerate lies directly over the conspicuous red cross-bedded Jurassic sandstone that is so well represented in the big ledges of the "Valley of Fire" west of St. Thomas. This seems to indicate that the major mountain-building movements of this region started in the Miocene Tertiary, giving the first records of Tertiary deposition for the particular region under discussion.

Next succeeding the Overton conglomerate, and probably resulting from a direct continuation of the same period of sedimentation, is noted a considerable section of finer deposits. These consist of reddish and then white-weathering shaly beds, which are largely fine volcanic ash or pumice, and in parts contain much calcium carbonate. The ash generally shows distinct little hexagonal crystals of biotite mica, when examined closely, and is also made up of a considerable proportion of clear sand-like grains assumed from the cleavage to be glassy feldspar. Some of the ash is in the form of gray sandstone-like beds. The section contains none of the original flow beds, but the lava is supposed to be of acidic type—perhaps rhyolitic or andesitic.

LIMESTONE ASSOCIATED WITH VOLCANIC ASH

Above this section of shaly tuff or ash is a section of calcareous beds that are essentially limestone. These are exposed in rough-weathering, dark-stained, massive beds which make some of the prominent escarpment bluffs and ridges of the region. In composition, these limestones are made up of travertine-like lime of irregular texture, frequently filled with markings or traces of crystalline calcite that might be taken for imperfectly preserved fossil markings. The limestone is interbedded with a great quantity of volcanic ash, and much of the limestone itself looks as if it contained a considerable percentage of ashy or pumiceous material as part constituent.

Some of the interbedded ashy layers are vivid green, but generally gray or dull greenish. The record is clearly one of chemical precipitation of the travertine-like lime during a period of intense volcanic activity in the vicinity, near enough to receive the ash and dust of eruption, but not the lava. This massive limestone section is at least 600 or 800 ft. in stratigraphic thickness, and overlies 300 or 400 ft. of the finer ashy shale beneath it, these thicknesses being approximate estimates which were made in the vicinity of the colemanite districts.

The colemanite bed or beds occur in the upper part of the massive limestone section already described—at least this position is obvious in the section exposed at the Callville deposit. The greater part of the massive limestone section lies below the large colemanite bed in the Callville Wash, forming the bare, rocky, dip-slope walls to the north and northwest of the outcrop of the bed. However, a portion of the massive, ridge-forming members also lies above the colemanite, the latter forming the "hog back" or "cuesta" ridge that stands above the colemanite outcrop, and forms the "hanging wall" of the "vein." The details of this part of the section are given in the diagrammatic structure and stratigraphic section. The limestone associated with the colemanite is referred to as "fresh-water" limestone. Its character is significant of the origin of the deposit as a whole, including the mineral colemanite and the associated beds, and which is described in detail in the following paragraph.

"EGG-SHELL LIME" A DISTINGUISHING FEATURE OF DEPOSIT

Some of the beds most characteristically associated with the colemanite, at once recognized as markers by the prospectors, are thin-layered concretionary deposits of lime that occur above and at places within and below the borate mineral. These concretionary deposits have been variously referred to as "the egg-shell lime," "goose-egg," and the "crinkled lime." In the White Basin district these take the form of rounded white balls, made up of onion-skin-like layers of calcium carbonate, generally found scattered along the weathered outcrop of the colemanite bed, or in extension of the horizon that carries the colemanite. These markers are not certain signs of the presence of the colemanite, but are an excellent prospecting indication. At the deposit in the Callville Wash, this concretionary deposit takes the form of layers, having a concretionary or botryoidal upper surface, a most characteristic example such as has been used in the textbooks on geology to illustrate forms of spring deposits. In cross-section the lime is seen to be made up of egg-shell thin layers, often in curiously contorted or crinkled form, from which the names cited have been derived. No better evidence of the spring-water origin of this particular part of the deposit is needed.

A great and rather irregular ledge of the crinkled lime overlies the Callville colemanite bed, forming the "hanging wall" of the deposit. Viewed from a distance this irregular ledge is somewhat in contrast with the more regularly bedded limestones and shales above and below. The thickest and most irregular part of the crinkled lime ledge seems to be co-extensive with the main part of the colemanite bed also. Thus its origin is undoubtedly closely linked with the origin also of the colemanite.

SEDIMENTS PARTLY DEPOSITED IN SHALLOW WATER

The stratigraphic section above the massive limestones described in the foregoing paragraphs, and above the colemanite, grades into a series of reddish and red-brown, sandy, pumiceous, and shaly beds, which include much gypsum. Some of the beds just above the colemanite-bearing series are characterized by an abundance of cherty or chalcedonic silica, a part of the silica being in bright colors. Some of these beds also contain excellent examples of ripple-marking, showing that, in part at least, they were laid down in shallow water. More study is needed to clear up a more complete understanding of the details of this section.

Another and distinct series of sands and clays, in places carrying large deposits of common salt and gypsiferous shale, succeeds the older Tertiary section already described. To this belong the large masses of rock salt exposed along the Virgin River below St. Thomas. These later beds are in general distinctly less deformed than the colemanite-bearing series, and so far as now known no colemanite has been found in the younger group. These younger beds contain in many places interflow bands and intrusions of basaltic lava. This series occupies large areas in the vicinity of the colemanite districts, and as its beds rather closely resemble those with which the colemanite is found, it is important that the distinction between the two groups should be as closely drawn as is possible.

DEPOSIT RESEMBLES REMAINS OF AN EXTINCT THERMAL SPRING

It is important to determine, as closely as may be practicable, the nature and origin of the colemanite bed for the bearing that this may have on the expected extension and continuity in depth of the deposit, if for no other reasons. It has been stated that the deposit as a whole has a distinct resemblance to a large spring deposit, possibly a thermal spring, as this may more readily be assumed to have provided waters carrying lime and boric acid in larger proportions than ordinary spring waters. The mass as a whole seems to be a large, roughly lenticular body such as would probably have been spread out below a center of spring vents, possibly at the edge of a shallow lake. The most convincing evidence of the spring-water origin of the deposits is the travertine-like lime or dolomite with concretionary and botryoidal forms, that occurs above, within, and below the main colemanite bed.

Observation at the deposit, as it is intended to show in the diagrammatic illustrations given with this account, is believed to clearly indicate the original interbedded character of the borate mineral or minerals of this deposit. The mineral colemanite now occurs in layers, mostly distinctly interbedded with shaly or calcareous beds, so interfingered with the original stratification that it seems that the mineral could scarcely have been introduced long after the deposits had begun to consolidate. The colemanite itself is, however, irregularly bedded or layered, or crystallized in bunchy masses along defined layers in the beds, and it is not improbable that the mineral may have grown in place in the shaly beds while the latter still formed loose surface deposits, because this is known to be a habit of borate minerals as they are forming today; witness, ulexite in the sands and muds about the margins of present intermittent or *playa* lakes, particularly below places where hot springs enter the deposits.

ORIGINAL BORATE MINERAL UNDETERMINED

It seems certain that in some deposits ulexite has altered to colemanite in place, in buried deposits, but it is equally indisputable that under certain conditions colemanite alters to ulexite, where exposed to surface weathering, and it cannot now be stated what may have been the original borate mineral that formed the Callville deposit. The borate present appears now to be entirely colemanite, the isolated nodules at the top of the deposit having been determined to be a radially fibrous aggregate of that mineral.

Possibly some of the bedded ulexite deposits in this country have been so extensive and at the same time so largely composed of the borate mineral through so great a thickness as the original extent of the Callville deposit, but many such deposits of even far greater magnitude than any known in this country exist in the *salars* of the South American Andes, and if these beds had been buried and consolidated and then become accessible for mining they would have produced deposits comparable in general aspect to that found in the Callville Wash.

NO CONSPICUOUS CROSS-VEINING NOTED

Comparatively little secondary recrystallization of the colemanite is to be noted in the Callville deposit, to the extent that would have caused this mineral to migrate into cross-fracture or secondary structure openings, such as has occurred so extensively in most of the other known occurrences of colemanite. So far as observed, the mineral follows the bedding of the inclosing sediments closely, and with the limited opportunity for observation of these details of the deposit now available, no conspicuous cross-veining has been recorded. Observation of the larger masses of colemanite in the older known California districts has so frequently shown the colemanite massed along fissure or fracture zones, in apparently secondary veins, that it has been difficult to determine just what had been the original form of the deposits. The newly discovered deposits in Nevada seem to present a clearer example.

In substance, the foregoing evidence is believed to indicate that the Callville colemanite will prove most unusually dependable as an orebody for mining, and because of its continuity on the outcrop, and as this outcrop has no essential relation to the original form of the deposit, the orebody may reasonably be expected to show like continuity in depth.

NEW DEPOSIT A RIVAL OF OTHERS

It should be made clear that the present account is not a complete or final report on the Callville Wash colemanite deposit. I am, however, confident that it embodies most of the essential facts of geological nature from which the character, dependability, and probable extension of the orebody are to be judged, in so far as such facts are available in the present stage of development. Additional evidence will, of course, be revealed as the underground work progresses, but it is unlikely that these will essentially alter the general conclusions now reached, as the record appears to be clear and satisfactory as far as it now goes.

At the present this deposit in the Callville Wash is the only one in the United States among those containing the larger commercial bodies of colemanite that is outside the properties under the control of Borax Consolidated, Ltd., of London, and its subsidiaries known as the Pacific Coast Borax Co. and the United States Borax Co. The half dozen districts in which commercial deposits of colemanite are known to occur in this country are shown by the index map. Each of these districts has had a complex history, and four of them—namely, the Furnace Creek-Death Valley district, the old Borate district, in the Calico Mountains, the Ventura County deposits, and the mine at Lang, in Los Angeles County—have yielded large commercial production of this mineral.

Colemanite still stands as the principal source of borax and boric acid in this country, the only competitor at the present time being the product manufactured from the brine of Searles Lake. Among the colemanite deposits the largest, from the point of view of total reserves actually in sight, is undoubtedly the Furnace

Creek field, when considered as a whole, but this is probably the only district that should be placed ahead of the Callville district in importance today.

The old Borate district in the Calico Mountains is considered essentially worked out; the Ventura County field doubtless contains some good colemanite, but is remote from transportation facilities and the best of the ore seems to have been removed; the Lang mine yields a low-grade ore, which was a single lenticular body of mixed shale and colemanite, and has been admittedly on the verge of exhaustion for some time. The field discovered in 1913 near Kramer, Cal., has not been developed except in an explorational way, but the evidence does not seem to indicate that it ranks with the larger more massive form of deposits of the mineral colemanite.

Furnace Creek Borax Mines Have Many Difficulties

The big deposits in the Furnace Creek district are undoubtedly the peer of any of the colemanite properties as yet opened in this country, from point of view of the total reserves of ore actually in sight. However, there are several factors that stand strongly to the disadvantage of this district as an economical producer. So far as I have been able to ascertain, the cleanest and best colemanite in the Furnace Creek district was that contained in the old Lila C. vein—not strictly on Furnace Creek, but belonging with that group of deposits; but the Lila C. bed or vein is now considered essentially worked out.

The other Furnace Creek properties that have been more recently the principal source of supply for manufacture of borax and boric acid in the country are, so far as I have been able to ascertain, great mixed-up masses of gangue and ore, which was mined at first in large open cuts and later by tunneling and crosscutting underground. The average product obtained in this way is reported to be comparatively low grade, which is the material treated in the big concentrating plant at Death Valley Junction. The difficulty of transportation from this district is well known, and the cost of maintenance for the two railroad systems, namely, the Tonopah and Tidewater, and the Death Valley R. R., is chiefly a direct charge against the operation of these properties.

I recently made a general survey in this district, and though free access to the working properties is usually denied to persons not officially connected with the operating company, the general facts concerning the deposits are readily determined. All of the deposits are professedly very irregular and broken, the colemanite appearing in large bunches or masses at one point and cutting off abruptly at another, so that a continuous and regular form of working cannot be practical. Some of the big open cuts make a wonderful showing, but the way in which the deposits are worked indicates that such bunchy masses are not continuous far in this district, and present mining problems that will be solved with difficulty.

Callville Wash Deposit in a Class by Itself

I have made careful study in all of the known colemanite districts, and in most districts I made detailed surveys in a general study of the deposits themselves. The evidence at hand indicates that in most of these deposits the colemanite is largely in a secondarily recrystallized condition, and that its present distribution is largely influenced by this metamorphism. A common association of the large bunchy vein deposits close below or near to thick interflow and intrusive volcanics suggests that the recrystallization may have been effected by hot waters accompanying the volcanics, and the ore concentration produced along fissure zones, or in such situations as ore concentration of this type is usually produced.

Judging from the evidence available on the Callville colemanite deposit, the thickness and extent, considered in connection with the evident uniformity and regularity of structure, which is believed to be dependent on the lack of secondary alteration of the deposit as a whole, seems to place this deposit in a class quite by itself. It thus has a number of important and obvious advantages from the point of view of efficient and economic recovery as compared with the other older known deposits of this mineral that are not so favorably circumstanced.

British Columbia Limonite Deposits of Minor Importance

In a recent report of J. D. MacKenzie, of the Canadian Geological Survey, on the limonite deposits of the Taseko Valley, B. C., Mr. MacKenzie confirms the findings of J. F. Crossland, who in 1920 conducted an exploratory party into the district on behalf of the provincial government. It was found that the deposits were not of sufficient importance to warrant development. The total tonnage is placed by Mr. MacKenzie at 669,350.

There are several deposits of varying quantity. They consist of brown limonite of varying shape, size and thickness, built up of thin layers of brown, cellular, and generally loose textured limonite, lying parallel to the surface of the ground on which they rest. The limonite, when dug, forms a large percentage of fines, most of it breaking into pieces of less than half an inch and much of it breaking into the fineness of sand. The iron is derived from finely divided pyrite, which impregnates greatly silicified and sericitized tuffs on the Taseko formation. The iron sulphate solutions formed by the oxidation and leaching of this pyrite trickle down the mountain slopes and deposit at the first favorable location, building up in the course of that process a bed of limonite.

Field observation was sufficient to determine that replacement of organic matter, which played such a large part in the deposition of the Zymoetz limonite (northern British Columbia), is here of negligible importance, and no certain instance of it was observed. The occurrence of considerable quantities of wood in the form of branches and twigs in certain zones often deep in the limonite, and quite unaltered except for a blackening of the outer layers, may be accepted as conclusive evidence that the iron solutions that are present are not of a nature to replace vegetable matter with limonite.

The report, which is of considerable length, is illustrated with maps and diagrams. Mr. MacKenzie also contributes to the geological survey publication, covering 1920, an article entitled "A Reconnaissance Between Taseko Lake and the Fraser River." On that trip the remains of an old volcano were encountered near the head of Relay Creek, which is in the Lillooet district, and further exploration of the character of the formation of the surrounding country disclosed traces of volcanic origin.

Mine Sampling Methods at Tyrone, N. M.

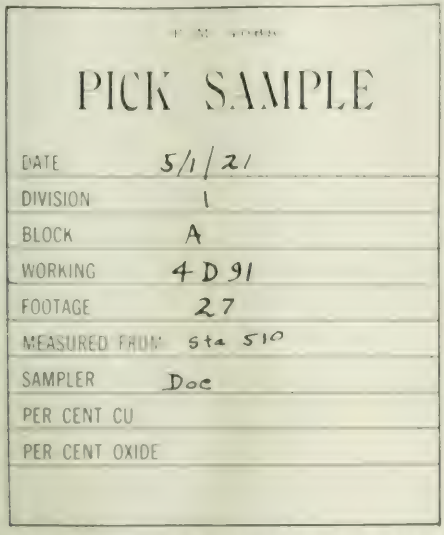
Highly Specialized Routine Work on a Large Disseminated Copper Deposit, Showing Many Forms Used and Records Kept Plan of Testing Enables Close Supervision To Be Made Over the Grade of Ore That Is Mined and Progress of Development

By Barclay G. Anderson
Written for Engineering and Mining Journal

THE MINES at Tyrone, N. M., of the Phelps Dodge Corporation are of the disseminated copper type, and sampling is a necessary part of the daily routine. The methods used in taking the samples and in keeping the records in usable form are therefore of interest. The daily output of the mine is 2,000 tons. The sampling force consists of the head sampler, divisional sample bosses, channel boss, pick and channel samplers, and office clerk.

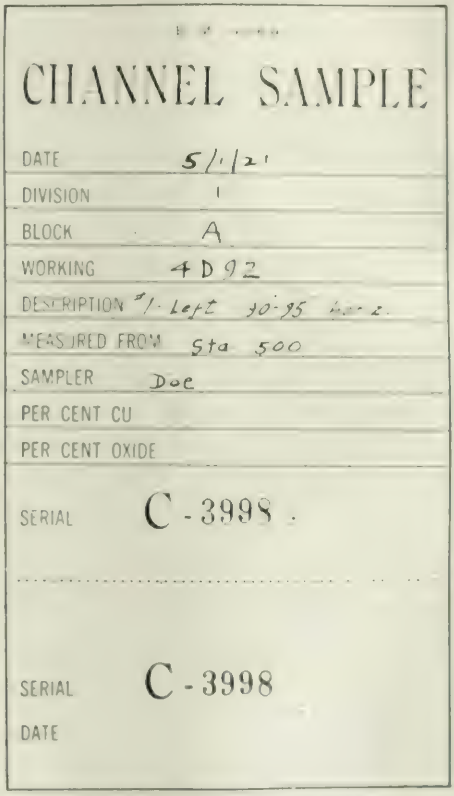
The pick samples are taken with a geological pick and ring bag. Each drift and raise that is being advanced is visited daily and a sample taken at the face. If a [illegible] is exposed it is sampled separately. It is planned to substitute a large grab sample for the pick sample now taken.

The kind and number of stope samples vary with the stoping method. In the top-slice stopes, samples are taken in each set [illegible] on both sides and face. When "run" through the [illegible] a grab sample of the run is taken. In the case of the shrinkage stopes, the back is sampled with a "stoper" drill, holes being put in at the intersection of five-foot squares. The [illegible] are sampled with a pick. Grab samples are taken only in the drawing-off chutes of the shrinkage and caving stopes.


PICK SAMPLE

DATE	5/1/21
DIVISION	1
BLOCK	A
WORKING	4 D 91
FOOTAGE	27
MEASURED FROM	Sta 510
SAMPLER	Doe
PER CENT CU	
PER CENT OXIDE	

FIG. 1. IDENTIFICATION TICKET FOR A PICK SAMPLE


CHANNEL SAMPLE

DATE	5/1/21
DIVISION	1
BLOCK	A
WORKING	4 D 92
DESCRIPTION	#1 Left 90-95 [illegible]
MEASURED FROM	Sta 500
SAMPLER	Doe
PER CENT CU	
PER CENT OXIDE	
SERIAL	C-3998

SERIAL	C-3998
DATE	

FIG. 2. CHANNEL SAMPLE TICKET

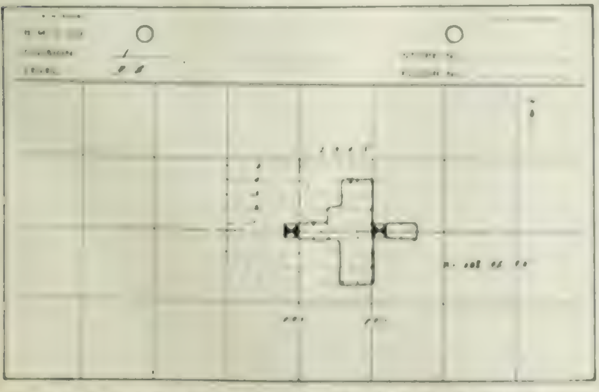
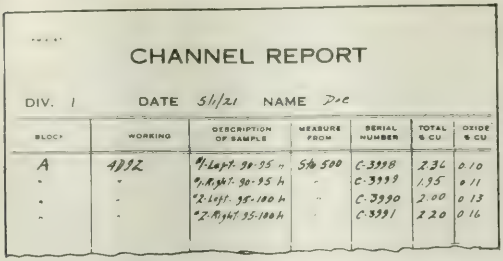


FIG. 3. SKETCH MAP INDICATING POSITION OF SAMPLES



CHANNEL REPORT

DIV. 1 DATE 5/1/21 NAME Doc

BLOCK	WORKING	DESCRIPTION OF SAMPLE	MEASURE FROM	SERIAL NUMBER	TOTAL % CU	OXIDE % CU
A	4B9Z	#1-Left-90-95 ft	Sta 500	C-3998	2.36	0.10
"	"	#1-Right-90-95 ft	"	C-3999	1.95	0.11
"	"	#2-Left-95-100 ft	"	C-3990	2.00	0.13
"	"	#2-Right-95-100 ft	"	C-3991	2.20	0.16

FIG. 4. DAILY CHANNEL REPORT, ORIGINAL AND DUPLICATE

To systematize the work of the pick sampler and to aid in checking up his work, a route book is made out for each run on the first of the month. An ordinary time book is used for this purpose. Each working place on the run is listed, and the sampler writes in his measuring point, usually a survey plug or drift intersection. When a sample is taken he puts down the footage opposite the proper working place and date. The division sample foreman, by frequently inspecting the books of his crew, is quickly able to check up their runs and see if any working places are being neglected and to direct where back sampling is to be done.

Fig. 1 is the identification ticket put in each pick sample. In the top-slice stopes, the samplers carry sketch maps, made on cross-section paper, to indicate the position of the samples and to record assays. On these maps they sketch in each day the outline of the slice, and indicate locations of the samples with a dot. The sets are referred to by a system of coordinates, starting from the initial raise in the slice. Fig. 2 illustrates such a map.

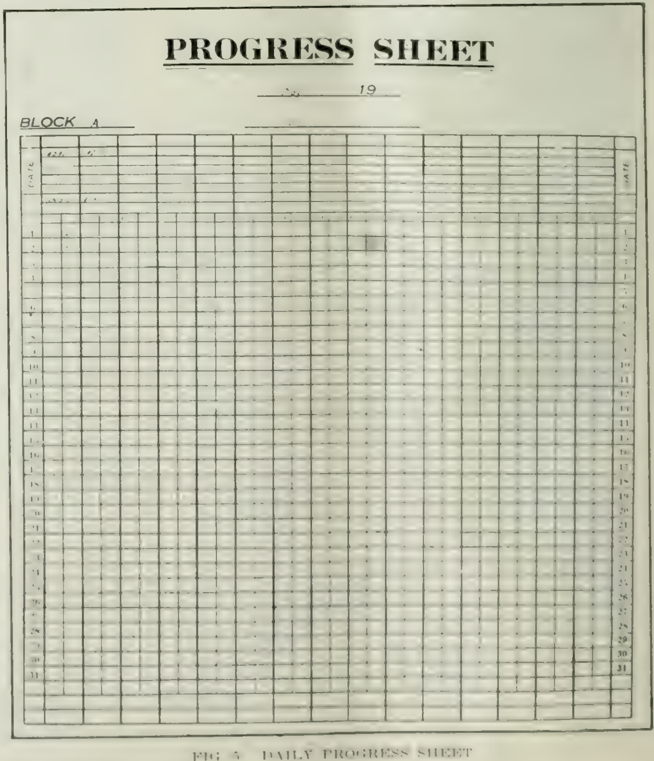
The assay office makes returns twice a day, giving the description of the sample and the percentage of copper. The clerk in the office lists the returns on linen tags (2 in. x 3 in.) for posting underground. The date, description and footage are written in pencil and the assay is indicated in colored crayon, red being used for waste and blue for ore. These tags are taken into the mine and posted by the samplers at working places. The returns from the stope samples are tacked up in the sets in which they were taken, and the drift and raise samples near the proper face. Stope maps are posted daily in the office and are ready for the sampler in the morning.

An eight-hour composite sample is obtained of ore mined or drawn from each stope. These samples are taken with a split fork by the trammer or brakeman, one forkful being taken from each car. The distance between the prongs of the fork, or the width of opening, is varied according to the amount of fines in the ore. The composite boxes are placed at the collecting pockets.

A novel scheme for indicating the stopes from which the ore comes is used in one of the divisions of the mine. On the main drawing-off level ore is collected from several stopes by a storage-battery locomotive. The ore is hauled to the main pockets, and here composite samples are taken. Each stope number is given a certain color, and bundles of sticks, 12 in. long and pointed, are painted to correspond with these colors. At each chute front is a box of sticks of the proper color. As the chute-puller fills a car he takes a stick from the box and puts it in the car. When the train reaches the pockets each car of ore is identified, for the purpose of taking a composite, by the colored stick. At the end of the shift the composite man counts the sticks and obtains a tally by stopes for the shift's run. The assay returns for both day and night shift are posted at the points where the samples are collected.

When the pick samples for a drift or raise show better than 1.25 per cent copper, groove or channel samples are cut. The groove is four inches wide and one inch deep; and gives about a fifty pound sample for a five-foot cut. Five feet is the usual sample interval, and the cuts are made horizontal, vertical or inclined, depending upon the structure exposed. Both sides of a drift are sampled, and two or more walls of a raise. A continuous cut is taken in a raise parallel to its axis. In cribbed raises the samples are cut after each round.

It is important that channel samples be accurately located and marked at the time that they are taken and in such a manner that they can be correctly plotted on permanent assay maps. The system used at this mine has given satisfactory results. The drift or raise is



PROGRESS SHEET

19

BLOCK A

FIG. 5. DAILY PROGRESS SHEET

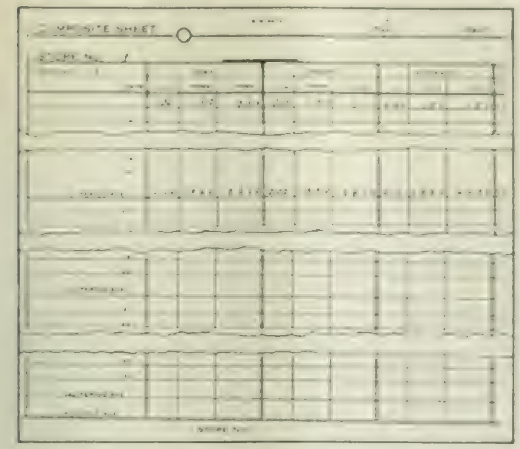

STOPE SHEET

FIG. 6. STOPE SHEET FOR MINE AND DIVISION

measured by the channel boss with a steel tape, starting from a survey plug or other definitely located point. Five-foot intervals are marked off on the sides with red paint and numbered consecutively 1, 2, 3, and so on, starting from the initial cut. The channel boss next makes a sketch of the working place, 30 ft. to 1 in., locating the cuts and giving them their proper number. Samples are cut with a moil and single-jack and cuttings caught on a tarp. After the sample is cut, it is sacked up and left in the drift at the point where it was taken. Before the end of the shift the channel boss visits the gangs and puts in identification tickets; and the samples are then taken out. These tickets (Fig. 3) are perforated, as a duplicate of the pulp is saved and the lower part of the original ticket put with it.

Experiments are now being carried on in cutting channel samples with a small air hammer. The results to date indicate that a satisfactory sample can be obtained in this way at half the cost of hand-cut samples.

A daily channel report (Fig. 4) is made out in duplicate by the foreman, who keeps one copy. The other goes to the office. When the work in a drift or raise is completed, he turns in his sketch map and report. This report gives a complete list of the samples taken in that working place.

The assay office makes a daily report of channel determinations to several offices, giving the serial number of the sample, description, and percentage of copper. With the report sent to the sample office, tickets are included, and the clerk in the office checks the description on the report with the original ticket. The assays are now written in on the channel report and sketch map. These form the completed record of the work done in that particular place, and are sent to the geological office, where the results are posted on assay maps. Such a system reduces the chance of error; the sample office always knows when the assays for a place are all reported, and the final plotting is made easier.

Pick sample returns are posted on the daily progress sheet (Fig. 5), and at the end of the month are sent to

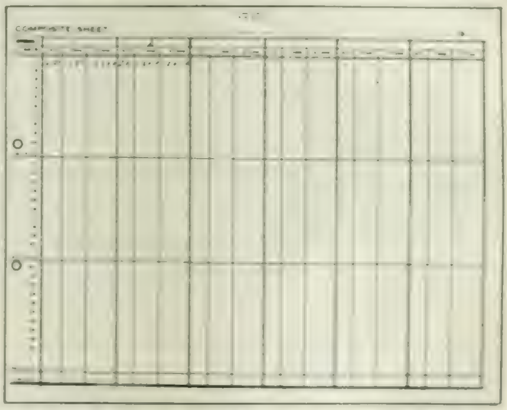

COMPOSITE SHEET

FIG. 7. STOPE SHEET FOR [illegible] AND DIVISION

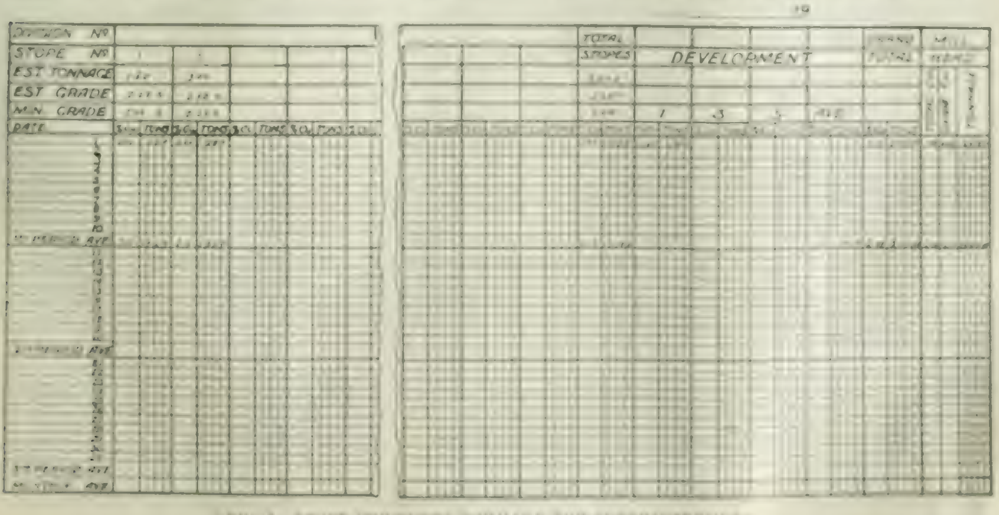

DIVISION NO
STOPE NO
EST TONNAGE
EST GRADE
MIN GRADE
DATE
TOTAL
STOPES
DEVELOPMENT

FIG. 8. STOPE [illegible] SUMMARY FOR SUPERINTENDENT

the geological office for plotting. Composite samples from the stopes are entered on individual stope sheets as shown in Figs. 6 and 7. The results are combined to give the daily division assays and the daily mine assays. Taken over a period of several days or a week, the latter agrees very closely with the mill-head assay. The large stope composite summary (Fig. 8) is kept in the superintendent's office.

Graphical assay charts were devised for use at the mine office. They have proved useful for quick reference, for they show at a glance all the information that the mine foreman wants to know. The pick and channel

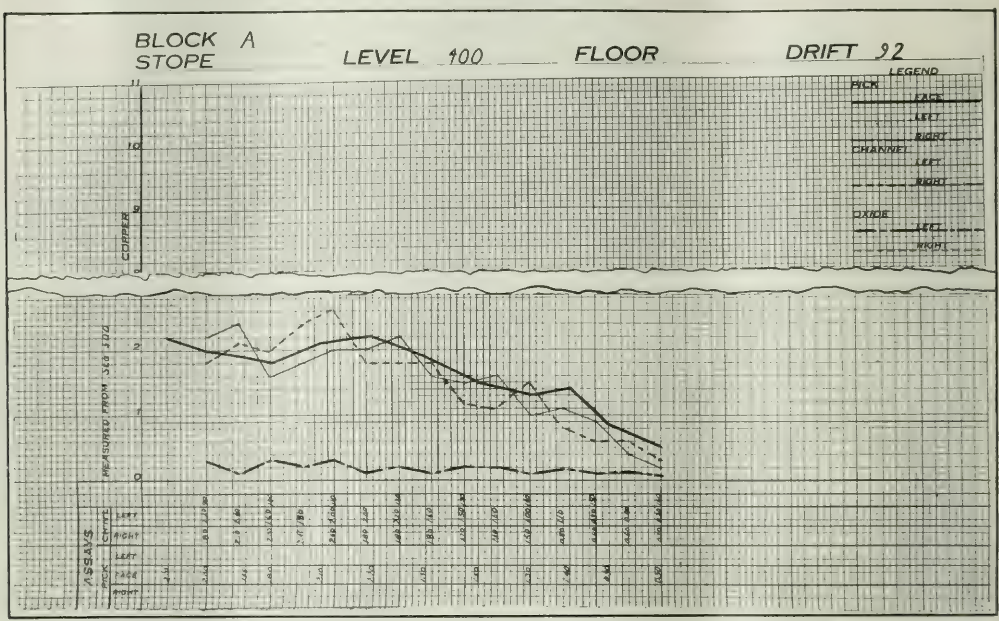


FIG. 9. COMPARATIVE SAMPLE RECORD

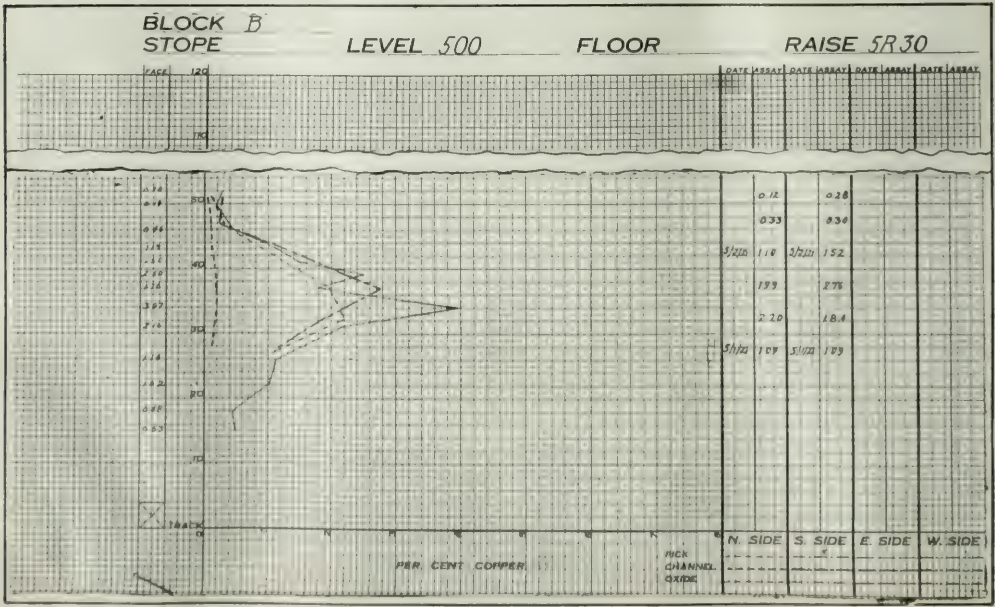


FIG. 10. COMPARATIVE SAMPLE RECORD

samples can all be plotted on one sheet without confusion. The graph shows whether the ore is continuous or spotty, and it also shows the footage of ore. It is sometimes necessary to sample a place more than once, and these two records can be plotted on the same sheet and easily compared (Figs. 9 and 10).

All the assay data are plotted on a set of sectionalized mine maps made on tracing cloth (50 ft. to 1 in.) These maps are made in duplicate, and on one set are plotted pick samples and on the other channel samples. The results of raise sampling are kept in a loose-leaf book, and plotted to a scale of 30 ft. = 1 in.

What Happens Under a Pressure of 300,000 Lb. per Sq. In.

Recent authoritative experiments with pressures as high as 20,000 atmospheres, or 300,000 lb. per sq. in., are discussed by P. W. Bridgman in the *Compressed Air Magazine* for September, 1921. Heretofore the maximum pressures which had been employed in scientific experimenting were about 3,000 atmospheres, and it was only by developing a special kind of packing and a method of measuring the high pressures that this work was made possible.

As Mr. Bridgman says, the wildest and most contradictory stories are in circulation as to the effects produced by tremendous pressures, such as exist at the bottom of the ocean. On the one hand sometimes the statement is made that water is forced bodily through the pores of steel vessels, and on the other hand that water is so powerfully compressed that it becomes even denser than iron, so that all the iron ships that have foundered float around forever at the level where the density of water has become equal to that of iron. Both of these statements are of course, utterly absurd; iron ships do not sink to the bottom, and if an iron bottle leaks it is because the joints were not tight. However, although one may be scornful of the pressure which Nature gives in the oceans of this globe, one must bow down when the billions of atmospheres in some of the stars are considered.

Engineering theories of the strength of vessels were found of no value at high pressures. A cylinder will stand much more pressure than would be expected and will stretch a great deal more than the ordinary tensile strength test would suggest. When it does break, the crack starts on the outside.

Among other things which these tests proved was that there is no truth in the superstition that metals become permeable to liquids under very high pressures, unless, of course, there is a flaw in the metal. The same is not true for gases, however. Hydrogen compressed under a pressure of 10,000 atmospheres will eat its way through a massive steel container and flow out, and if the experiment is repeated often enough will eventually make a crack that can be seen with the unaided eye. Mercury behaves much like hydrogen; it can be forced through massive steel walls by about 6,000 atmospheres. The action of hydrogen is doubtless due to the extreme smallness of the atom; the action of mercury is probably somewhat like it, assisted by an amalgamation with the iron.

Liquids are usually thought of as nearly incompressible, but water may be compressed to 20 per cent less than its normal volume by 12,000 atmospheres, and alcohol to 27 per cent. The compression of a liquid cannot be carried indefinitely, because when the pressure is pushed high enough the liquid will freeze, no matter how hot it is. Machine oil, used for transmitting these high pressures, was found to freeze solid at room temperatures at 4,000 atmospheres, so kerosene or gasoline had to be used.

Before these experiments were made it was not known whether a liquid could be forced to freeze by pressure alone. There were various theories. One was that there is a critical point between liquid and solid just as there is between liquid and vapor. Another was that there is a temperature beyond which no amount of pressure can force a liquid to freeze. The experiments should be interesting for the geologist in considering the probable state of matter in the interior of the earth.

Even water can be forced to freeze in this way. This is not what might be expected, for when pressure is first applied to water the effect is to make it freeze at a lower instead of a higher temperature. Every one knows that the reason a skate slips on ice is because the solid ice is melted by the pressure of the runners. But if the pressure on ice is raised to about 2,000 atmospheres, something suddenly happens; the slack between the molecules is squeezed out, and the ice collapses 18 per cent in volume, assuming a different appearance with new physical properties. For instance, it will sink instead of float in water. If the pressure is raised further, more slack is presently squeezed out and still another kind of ice appears. The process may be once more repeated at still higher pressures, but then apparently remains constant. Water at 180 deg. F. may be forced to freeze to this kind of ice by the application of about 20,000 atmospheres. The instant the pressure is released, of course, it melts back into ordinary water.

Other substances, such as camphor, show the same phenomena of different physical properties at different compressions. Phosphorus, under 12,000 atmospheres and at 200 deg. C., assumes a black form like graphite in appearance which has lost its combustibility, has become a conductor of electricity, and is 50 per cent more dense than the familiar yellow phosphorus. This transformation, unlike that of ice, is permanent, and the new modification does not go back to its original form when the pressure is released.

Another very striking change produced by high pressures is in the viscosity of liquids or soft solids. Ordinary lubricating oil becomes twenty-five or thirty times "stiffer" under a pressure of only a thousand atmospheres or so. Under 12,000 atmospheres ordinary paraffine wax becomes so hard that it can deform steel, and soft rubber becomes harder than mild steel, so that a steel disk may be squeezed [illegible] into the cracks of a soft rubber washer, as into a [illegible]. This knowledge should also interest the geologist.

In addition to these effects, there are many others of equal importance in theoretical physics, but perhaps less spectacular. For instance, the electrical properties of metals can be profoundly affected by high pressures; it is possible to make a metal like sodium or potassium conduct electricity five or ten times as well as under ordinary circumstances. In fact, the change produced by pressure in the electrical resistance of a metal, of manganin particularly, was found to be a convenient gage for the measurement of the pressures employed in these tests.

By the Way

The Folly of Poverty

We were walking through Wall Street recently, as is our custom, not at all experiencing any discomfort from our propinquity to the great forces about us. This fact made us ponder, especially when we recalled that it is said that a current of a million volts transmitted near by will make one's hair stand on end if one is up in the air or otherwise insulated from the earth. It seemed strange, as we stopped and lit a seventy-five cent cigar with a dollar bill, that any one could be so foolish or so stupid as to be other than rich. It was so easy, and everybody was doing it. And when we got back to the office and saw the latest mail we were even more convinced.

First, a broker's letter said: "The B—— & M—— mill is almost completed. Ore in abundance lies waiting for it to start. The mill should earn from $2,000,000 to $2,500,000 annually. *It is rumored that when the mill has been running a short time, a dividend will be declared.*"—Here, it is apparent, a fortune is to be had for the taking.

The next was an inquiry as to where an "instrement" could be obtained for "locating or finding gold or silver hidden in the earth if brought enywhere near it." Some day perhaps, we shall get out an attractive line of these ourselves. They would sell like hot cakes.

Then came a news clipping that told of a discovery at Franklin, N. H., where a farmer has started to "tear a portion of his land to pieces" upon receiving a letter from the "Assay Office in Washington in which occurs the statement '$9 worth of gold and $2 worth of silver per 1,100 lb. of ore." According to the clipping, experts say that this percentage is decidedly high and predict that this area may prove a second Klondike.—Yes, indeed, and the Homestake is working only $4 ore. This man is on the road to fortune, we hope.

The next was a booklet entitled "Opportunity—A Digest of the Possibilities of the Royalty and Operating Trust," from a "securities" company in Denver. The "Trust" has 1,780 acres of gold placer ground in Colorado, it is stated. The lowest estimate of "competent" engineers is 50,000,000 cu.yd. averaging 50c. per yd. The earnings are expected to be 8½ per cent per month on the entire capitalization. It is intimated that the return will be $2,547 per every $1 of capital. Another attractive feature is that there will be no delaying of dividends. This, indeed, is an opportunity for "red-blooded Americans" as the prospectus states.

Under this was one of the "Potash Fortune Opportunity Blanks" of the S. E. J. Cox Co., of Houston, Tex. Apparently one is supposed to fill out and return it with $25 or $150 in payment for a "unit" in the Potash Lease Syndicate. We were a little dubious about this potash business, for we recalled that the U. S. Geological Survey has sent out a warning against promotions of stock based on potash deposits in west Texas, saying that the deposits have not yet proved of commercial value. Against this, Mr. Cox's company advertises that "West Texas potash beds are of world's economic supremacy answer to Germany's proud boast." But although there may be no money in this for the investors, there certainly must be for the promoters.

There were more interesting things of the like in this mail and at the bottom of the heap was the latest issue of *World's Work.* On opening this the first advertisement that caught our eye was that of "M—— Patent Automatic Water and Oil Finders" made in Liverpool. These sell for £50 to £375, depending on how much you have, and cheap at twice the price.

We were much impressed by the great number of opportunities to get rich thus indicated to us, and as we climbed into our Rolls-Royce to go home we were still marveling why some, a few, remain poor.

A Revival

According to the *New York Tribune*, "the advance . . . yesterday in the quotation for foreign silver caused a speculative revival of interest in the shares of those mining companies which produce silver. One of these was Homestake Mining. . . . Dome Mines and Alaska Juneau were also higher." Personally we do not think all the attention should be paid to silver stocks, with all the decreased costs of gold mining. Such representative gold producers as Nipissing, Federal Mining & Smelting, and Kerr Lake merit attention.

The Greasy Palm

"Thee don't 'ear so much these days abaout 'igh-gradin', m'son," said Cap'n Dick. "Coorse naow h'it doesn't take so much to make a bloody mine, with this 'ere flotation an' h'all tha h'other schemes for h'extractin' tha pay dirt from tha low-grade h'ores. But, an', dam-me, t'weren't so long h'ago h'at that, there used to be some gert tales goin 'tha raoun's abaout 'igh-gradin'. I mind one I 'eard baout Jan Walters w'en they struck tha firs' body o' 'igh grade at tha Dividend mine. 'Billy,' sez 'ee to tha foreman, 'mind thee don't let h'any o' that h'ore stick to thy fingers w'en thee gaws h'off shif tonight.' 'Dam-me, Jan,' sez Billy, 'don't thee be tellin' me that. I remember thee back in tha h'old days in Grass Valley w'en thee wuz packin' a gert piece o' waste to keep in practus.'"

The Development of an Idea

That disseminator of jazz, the fixture without which no home is complete, namely the phonograph, now has a rival, or perhaps we had better say a counterpart so far as general appearance and certain effects go. We read of a "Heatrola—the parlor pipeless furnace," which, according to the description, "looks like a phonograph and works like a furnace." After all, there is something to a name, as evidenced by the adoption of the last two syllables from the trade name of a well-known sound reproducer. We confess to a feeling of spiritual warmth when listening to some famous aria rendered to us by one of the renowned musical artists through the medium of the domestic music box. The temperature of our physical being rises noticeably when we gallantly, and more or less gracefully, attempt the modern dance steps to the strains from the rifled disk. But this recent addition to the household miscellany produces heat without exertion or spiritual exhilaration. The development of an idea, of course. Applying, similarly, the same line of reasoning to other articles of furniture and their reincarnation in our own field, we have the coffee grinder as the forerunner of certain types of crushing machinery, the primitive self-rocking cradle represented in our concentrating tables of today, and so on. And who will deny that the proverbial grease in the boarding-house coffee was the progenitor of the flotation idea?

CONSULTATION

Ganister, Its Production and Uses

"What is ganister? Does it occur in natural form ready for use in this country, or are the supplies limited to the artificial combination? Where and how much is produced in the United States?"

Ganister is defined by the U. S. Geological Survey as a highly refractory siliceous sedimentary rock used for furnace linings; by Raymond, as a mixture of ground quartz and fire clay used in lining Bessemer converters. The term has a loose application and can refer to either the raw product as it is quarried or mined, or to the finished refractory brick made from the raw material ready for the furnace. It is more generally used to designate the raw material. Sandstone (quartzite), in its use as ganister, a refractory material for making silica brick, ferrosilicon, or converter linings, took its place during the war as an important stone product, according to the U. S. Geological Survey. The Survey also states that the requisite qualities for ganister are a content of 98 per cent silica and not more than 1½ per cent of alumina, and that the material should be of such a nature as to be crushed into fine angular fragments. The U. S. Bureau of Standards recommends a content of approximately 97 per cent silica and not much over 0.4 per cent alkalies. Loose sand and standstones reduced to the original rounded grains on crushing yield a weaker brick.

The ganister sold in the United States in 1918, the last year for which figures are available, was 1,297,874 tons, compared with 573,304 tons for 1915, indicating the great increase in production that occurred during the war. According to uses, the 1918 production was distributed as follows: 1,003,060 tons for use as silica brick, 215,164 tons as furnace and converter lining, and 79,650 tons in the manufacture of ferrosilicon. By far the largest proportion of ganister enters into the manufacture of silica brick.

Pennsylvania is the leading ganister-producing state and accounts for about three-quarters of the domestic output. Wisconsin, Colorado, and Ohio are other producing states of lesser importance, and Illinois, South Dakota, Tennessee, Alabama, Minnesota, North Carolina, Maryland, and New York produce the material in small amounts.

One-half the ganister used in the United States is derived from the Tuscarora or Medina formation from Blair and Huntingdon counties, Pa. This formation consists of two distinct divisions underlain by the Juniata or Oneida formation. The ganister floes, as they are called, or fragments of ganister lying on steep hillsides, are formed by the unequal weathering of the components of the white and red formations of the Medina and Oneida sandstones. These floes, talus slopes, furnish the material used in the manufacture of silica brick, although the ganister may also be quarried from the solid formation. The white formation contains over 99 per cent silica and the red about 97.8 per cent.

If by "artificial" ganister is meant the silica brick which is almost wholly manufactured from ground ganister, or quartzite, then supplies may be considered to be used to the extent of over 80 per cent in the production of prepared silica refractories. Ganister resources are large, and the supply is not "limited" by artificial combination. Silica brick, being of a uniform quality and uniform size, possesses at least two advantages over the direct use of the raw material as it comes from the quarries. For a technological discussion of the manufacture of silica brick and the factors affecting their quality and methods of testing the finished ware and raw materials, the reader is referred to Technologic Paper No. 116 of the Bureau of Standards, "Silica Refractories," by Donald W. Ross. This paper also contains detailed information about the geology and occurrence of the Pennsylvania ganister.

Current-Driven Water Motors

"May I ask through the columns of *Engineering and Mining Journal* regarding the experiences of other engineers with current-driven water motors? It is not unlikely that the conditions I am meeting in this part of the world have been experienced and dealt with by others under similar circumstances elsewhere.

"I need a moderate power for trying out tests with lightweight machinery in processing material in the field. Here in Brazil there is rarely any dry fuel for steam purposes, but the rivers are large streams, and always bank full. As a class they are swift-moving, and are the usual routes of travel to new projects, whether mining, timber, or agricultural. We are not in a mountainous country, so the rivers are fairly free from rapids. The logical method is to take power from the surface of the streams. It is noticeable that our literature is almost silent on approved settings of current-driven motors mounted on scows or rafts. What have your readers to report regarding developments to meet the needs of the pioneer engineer on powerful watercourses such as these?

WILLIAM G. MERRITT

"American Chamber of Commerce,
Pernambuco, Brazil."

In Bulletin 127, published by the U. S. Bureau of Mines, Washington, D. C., "Gold Dredging in the United States," by Charles Janin, opposite page seven, is given a photograph of a current-wheel dredge in operation in New Zealand, in 1882, for the recovery of gold from river gravel. Side paddle wheels were placed on the pontoon or body of the dredge, and were driven by the current of the river and used to elevate the dredging buckets. No details of paddle construction are given, but the arrangement was considered a success, and at one time more than twelve dredges of this type were operating on the river.

The advantages were the small cost of the machinery and the elimination of fuel. Possibly an arrangement similar to this one would be suitable for the generation of power under the conditions which our inquirer outlines. If the power is to be used directly, tests would have to be made on the raft carrying the paddle wheels. Perhaps some of our readers have had experience with crude water-power mechanisms which would help our inquirer.

HANDY KNOWLEDGE

A Review of Drilling—Part V*

By George J. Young
Western Editor, *Engineering and Mining Journal*

Selected Bibliography on Rock Drilling

DRILL STEEL

"Heat Treatment of Rock Drill Steel," G. H. Gilman; A. I. M. E., February, 1921.

"What Is the Ideal Drill Steel," *Eng. and Min. Journ.*, Vol. 111, p. 668.

"Rock Drill Steels Too Short for Use Reclaimed by Welding," *Electrical World*, Vol. 77, p. 942.

"Application of Magnetic Analysis to Rock Drills," C. W. Burrows, A. I. M. E., February, 1921.

"Investigation of Fatigue of Metals Under Stress," H. F. Moore; A. I. M. E., February, 1921.

"Analysis of Some Drill-Steel Tests," F. B. Foley; A. I. M. B., February, 1921.

"Breakage and Heat Treatment of Rock-Drill Steel," B. F. Tillson; February, 1921.

"Handling and Treatment of Rock-Drill Steel at Copper Range Mines," T. T. Mercer and A. C. Paulson; A. I. M. E., August, 1920.

"Rock-Drill Steel," N. B. Hoffman; *Chem. & Met. Eng.*, April 27, 1921, p. 751.

"Drill Steel From Hollow Ingots," By P. A. E. Armstrong, *Chem. & Met. Eng.*, June 1, 1921, p. 960

DRILL BITS

"Drill Bits and Drill Steel for Metal Mining," G. H. Gilman, *Eng. and Min. Journ.*, May 12, 1917, p. 823.

"Comparative Tests of Hammer Drill Bits," C. R. Forbes and J. C. Barton; A. I. M. E., 1917.

"Relative Merits of Carr and Cross Bits," By Driller; *Eng. and Min. Journ.*, Jan. 2, 1918, p. 185.

"The Blow of the Drill Bit, Sharp or Dull," Frank Richards; *Eng. and Min. Journ.*, April 26, 1919, p. 735.

DRILL-SHARPENING OPERATIONS

"Shanking Drill Steel," C. C. Phelps; *Eng. and Min. Journ.*, Aug. 26, 1916, p. 389.

"Operating a Steel-Sharpening Shop," J. E. O'Rourke, *Eng. and Min. Journ.*, Feb. 10, 1917, p. 263.

"Drill-Sharpening Methods at the United Verde, Jerome, Ariz.," Frank Richards; *Eng. and Min. Journ.*, Feb. 17, 1917, p. 313.

"Ideal Shop for Sharpening Drill Steel," G. H. Gilman; *Eng. and Min. Journ.*, Oct. 6, 1917, p. 585.

DRILLING MACHINES

"Testing and Application of Hammer Drill," B. F. Tillson; *Eng. and Min. Journ.*, April 7, 1917, p. 582.

ROTATING HAND DRILLS

Type Symbol	Length, Inches	Cylinder Diameter, Inches	Stroke, Inches	Size Air Hose, Inches	Size Water Hose, Inches	Steel Used, Inches	Size Steel Strand, Inches	Net Weight, Lb.	Depth Hole, Feet
Ingersoll-Rand Co.									
BAR—33	15	2⅜	1½	¾		⅞	⅞ x 3¼	21½	3—6
BBR—13	17¾	2⅜	1⅞	¾		⅞	⅞ x 3¼	35	8—10
BCR—430	20	2¼	2	¾		⅞	⅞ x 3¼	45	10—12
BCRW—430	20	2⅜	2	¾	½	⅞	⅞ x 3	46	10—12
DCR—13	21¼	2⅜	2½	¾		⅞	⅞ x 3¼	55	12—14
DCRW—13	21¼	2⅜	2½	¾	½	⅞	⅞ x 3¼	55	12—14
DDR—13	25	2⅜	3	¾		1	1 x 4¼	70	12—25
DDRW—13	25	2⅝	3	¾	½	1	1 x 4¼	70	12—25
Sullivan Machinery Co.									
DP—33, solid or hollow piston	21½	2¼	3	¾		⅞ hex.	⅞ x 3¼	38	5
DP—33 air tube rotator	21½	2¼	3	¾		⅞ hex	⅞ x 3¼	38	12
DP—33 water tube rotator...	21½	2¼	3	¾		⅞ hex.	⅞ x 3¼	40	12
DR—37 auger drill	19	2½	2½	¾		⅞ hex	⅞ x 3¼	35½	8
DP—32 light rotator	17½	2¼	3	¾		⅞ hex.	⅞ x 3¼	29	4
DB—13	16½	1 1/16	1¾	5/16		⅝		14	
DC—15	19¼	1 15/16	2¼	7/16		⅞	⅞ x 3	25	
DC—19	21¼	1¾	2½	½		1 hex.	1 x 3½	44	
DB—21	27	2	3½	¾		1 hex.	None	62	
Cochise Machine Co.									
Valve rock hammer		2¼	2¼	¾		⅞ hex. hollow		42	
Chicago Pneumatic Tool Co.									
Hammer—86	19	2 3/16	3¼	¾		⅞ hex.	Shank	48	10
Hammer—86W	19	2 3/16	3¼	¾		⅞ hex.	Shank	48	10
Cleveland Rock Drill Co.									
33-SD dry	20	2¼	2¼	¾			Shank	40¾	
33-SW wet	24	2¼	2¼	¾			Shank	43¾	
33-FD dry	20½	2¼	2¼	¾			No shank	40¾	
33-FW wet	24½	2¼	2¼	¾			No shank	43¾	
Denver Rock Drill Mfg. Co.									
Waugh							Collared		
90	20	2¼	1⅞	¾		⅞—1	Shank 3½	35	
93	21½	2⅜	1¾	¾		⅞—1		39	
95	20	2¼	1¾	¾		⅞—1			
Model 50	26	2⅜	3½			⅞—1		47	
Model 50	26	2⅜	3½			⅞—1		47	
McKiernan-Terry Drill Co.									
F—2	21½	2¼	2¼	¾	½	⅞	S ⅞ x 3¼	37	

DIMENSIONS AND WEIGHT OF STOPERS

Type	Weight, Lb.	Piston Diameter, Inches	Piston Stroke, Inches	Length Extended, Inches	Length Closed, Inches	Remarks
Denver Rock Drill Mfg. Co.						
Waugh 16 A	80	2¼	3½	76	54	Valveless, dry, hand rotated
Waugh rotator	105	3	2¼	79	55½	Valveless, dry, automatic rotation
Ingersoll Rand Co.						
No. 11 CC	81	1¾—2¼	3	74¼	52¼	CCW made with water tube
No. 21 CC	90	1¾—2¼	4	77½	55½	
Sullivan Machinery Co.						
[illegible]	94	2¼	3½	79½	61½	Automatic rotation
[illegible]	97	2¼	3½	79½	61½	Automatic rotation
[illegible]	63	2¼	3½	65	47	Hand rotated
[illegible]	66	2¼	3½	65	47	Hand rotated
Cochise Machine Co.						
Cochise No. 3	73	2¼	3½			Hand rotated
Cleveland Rock Drill Co.						
[illegible]	80	2	3½	76	52	Hand rotated, dry
[illegible]	100	2½	3½	78	54	Hand rotated, dry.

---

*Continued from Sept. 17 issue.

"Progress in Manufacture of Stoping Drill," *Eng. and Min. Journ.*, May 31, 1919, p. 964.

"Development of the Rock Drill in America," C. A. Hirschberg; *Eng. and Min. Journ.*, Oct. 25, 1919, p. 677.

"Jackhammer Type Drills in Witwatersrand Mines," E. M. Weston; *Eng. and Min. Journ.*, Feb. 7, 1920, p. 395.

"Piston Drills for Use With Hollow Steel," E. M. Weston; *Eng. and Min. Journ.*, Feb. 21, 1920, p. 485.

"Care of Rock Drills," H. R. Drullard; A. I. M. E., August, 1920.

MINING PRACTICE

"Tests of Rock Drills at North Star Mine, Cal.," R. H. Bradford and W. Hague; *Transactions*, A. I. M. E., Vol. 49, p. 346.

"Zinc Mining at Franklin, N. J.," C. M. Haight and B. F. Tillson; A. I. M. E., 1917.

"Standardization of Mining Methods," C. A. Mitke; *Eng. and Min. Journ.*, Nov. 16, 1918, p. 857; Dec. 21, 1918, p. 1071.

"Standardized Crosscut Rounds," H. Drullard; *Eng. and Min. Journ.*, Jan. 3, 1920, p. 27.

(Concluded)

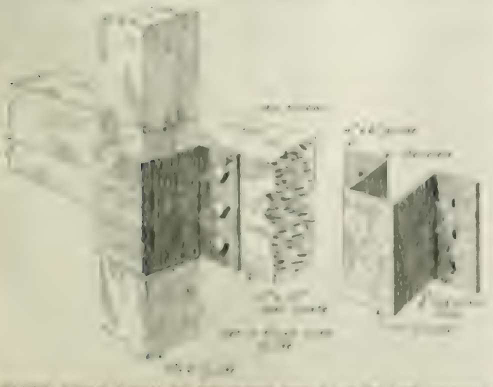
Device for Indicating Hoisting Level

At several California mines an electrical device for indicating hoisting level to the engineer is in use. The arrangement consists of a number of bell pushes placed in a convenient position near the shaft collar and wired to an annunciator placed conveniently near to the hoist engineer. Each push button connects with a drop number in the annunciator box. On operating the button for the desired level a small bell is sounded and the number drops within the glass covered case of the annunciator.

Reinforcing Shaft Guides

Written for Engineering and Mining Journal

Where two shaft guides meet upon an end plate or divider, the ends of the guides which abut become worn and more or less battered, and may even split. Usually they are fastened by a single countersunk lagscrew, one near each abutting end. The tightening up of these lagscrews also tends to wear out the ends. To avoid replacing the entire guide and also to protect the guide joint from the hammering action of skips and cages, Andrew Riley, master mechanic of the Plymouth Consolidated Gold Mines, Ltd., at Plymouth, Cal., is using a steel form, made from No. 10 sheet steel, as shown in the figure. The ends of the guides on the three rubbing sides are cut down a sufficient amount to allow the steel form to make a flush joint. The edges of the steel form are beveled to prevent any part interfering with the skip runners. The form is fastened to the wall plate by lagscrews as shown.

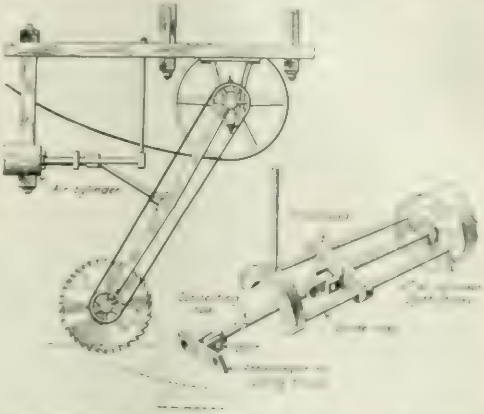


STEEL FORM USED TO PROTECT ENDS OF SHAFT GUIDES

Swing Saw

Written for Engineering and Mining Journal

The swing saw is generally used in mine timber-framing shops. It has been standardized by different manufacturers, and, outside of refinements in bearings and hanger, does not admit of much improvement. In most of the swing saws on the market, provision is made for advancing the saw into its cut by means of a hand wheel operating a gear wheel which meshes with a rack attached to a short timber, one end of which is attached to the swinging frame. Handles are attached to the rim of the hand wheel to facilitate its use. At the Plymouth Consolidated Gold Mines, Ltd., Plymouth, Cal., Andrew Riley, master mechanic, discarded the arrangement just described and substituted in its place a compressed-air cylinder as shown in the figure. The air cylinder is controlled by a valve placed in a convenient position. It is preferable both mechanically and from the consideration of safety.



AIR CYLINDER DEVICE USED FOR ADVANCING SWING SAW INTO ITS CUT

When Hebrew Meets Scot

The Jewish representative of a large Eastern firm had completed a sale of mining machinery to the purchasing agent of a mine situated some miles from a city. It had been a hard sale to close and the salesman was anxious to show his appreciation.

"Just as soon as I reach home," he said, "I am going to send you a fine box of cigars."

"Nay, nay," replied the purchasing agent, "my company does not allow the receipt of presents by its agents. I canna accept your gift, laddie."

The salesman thought for a moment. "Give me a nickel," he said. "Then you can say you bought the cigars. D'you see? Nobody need know how much you paid for them. You just buy the box for a nickel."

The Scotchman smiled slowly and then pressed a coin in the salesman's hand. "Aye, you're clever," he said. "Here, take this quarter, and ye can send me five boxes."

THE PETROLEUM INDUSTRY

The Petroleum Possibilities of Guatemala

By Arthur H. Redfield*

Written for *Engineering and Mining Journal*

IN THE WORLD-WIDE SEARCH for new oil fields, the Republic of Guatemala, in Central America, has received small share of the attention of the oil seekers. Repeated rumors of oil seepages, many of them, however, unauthenticated, and the undoubted continuance into Guatemala of formations which have proved petroliferous in the Mexican states of Tabasco and Chiapas, have lent color to the supposition that Guatemala contains oil deposits worthy of investigation. The following summary of the geology and petroleum possibilities of Guatemala is based upon the most reliable data available:

Location and Extent of Possible Oil Lands

The part of Guatemala that is of interest as a possible source of petroleum is in general the area of folded Cretaceous and Tertiary sediments in the northern half of the republic. This area includes, in general, portions of the departments of Huehuetenango, El Quiché, Alta Verapaz, El Petén, and Izabal and covers about 17,000 square miles. The portion of this area that presents structures favorable to the accumulation of petroleum in commercial quantities is only a minor fraction of the total. Indeed, the existence of a zone of faulting in central Guatemala would appear to limit the choice largely to the Department of El Petén with an area of 13,200 square miles. No part of Guatemala has yet been proved by the drill.

The Pacific coast of Guatemala is bordered by a sloping plain, ten to twenty-five miles wide, which attains at its inner edge an elevation of 820 ft. This is succeeded by mountain mass, a southeastward continuation of the Sierra Madre of Mexico, whose highest peaks exceed in elevation 11,500 ft. Central Guatemala is occupied by a series of lower ranges, in general not exceeding 8,200 ft. in altitude, composed of folded and steeply dipping sediments. These ranges are separated by low-lying structural valleys, opening generally toward the Gulf of Honduras. Northern Guatemala, comprising principally El Petén, is a flat-lying lowland, broken only by occasional groups of hills. Its altitude nowhere exceeds 1,640 ft., and for the most part is less than 820 ft.

Stratigraphy

The areal geology of Guatemala corresponds roughly to its topography. The narrow coastal plain that borders the Pacific coast is composed of Quaternary sands and gravels. The mountains which form the eastward extension of the Sierra Madre consist of a complex of effusives of various ages and pre-Cambrian crystalline rocks. The central plateau consists of folded Paleozoic and Mesozoic strata. The north-sloping plains of El Petén are composed of more or less flat-lying sediments, which are chiefly Tertiary.

The pre-Cambrian crystalline schists of Central America have their widest extension in Guatemala. They form a belt in central Guatemala which reaches its greatest breadth at the meridian of Salamá and extends east by northeast beyond Lake Izabal to the Gulf of Honduras. Smaller patches of pre-Cambrian crystalline schists occur in Alta Verapaz, north of Rio Polochic, and in southern Guatemala.

The pre-Cambrian rocks consist in their lower portion of gneiss, which grades into granite; and in their upper portion of mica-schists and slates, with local intercalations of crystalline limestone, at Rabinal and Salamá; actinolite-schists at Morazán, and quartzites, Near Lake Izabal the slates are replaced by sericite-schists.

A series of talc and chlorite-schists, green, brown, violet, or black in color, of undifferentiated Paleozoic age, occurs on the south slope of the Sierra de las Minas and in the upper valley of Rio Chixoy.

Lower Carboniferous or pre-Carboniferous (?) massive limestones and limestone and dolomite breccias with a calcareous cement occur to a thickness of 260 to 330 ft. near Santa Rosa, in Baja Verapaz, and in the Department of Izabal. These were grouped by Dolfus and Montserrat with the overlying Santa Rosa terrane (Carboniferous), but were separated from it by Sapper. In a later work, however, Sapper eliminated the "pre-Carboniferous" limestones as a separate formation.

The Carboniferous proper in central Guatemala consists of two formations. The lower, known as the Santa Rosa terrane, is constituted by 660 to 980 ft. of quartz-conglomerates, brown or red sandstones, shales, and graywackes, grading into one another. The lowest beds are in general coarse grained, whereas the upper members show a finer grain and more clayey constituents. The highest beds, chiefly shales and graywackes, are intercalated with limestones.

Gypsum strata occur by Rio Chixoy and near Santa Magdalena, in El Quiché. Sulphur is found at the former locality, and a saline spring at the latter. Fossils found in the upper horizons of the Santa Rosa terrane fix its age as Upper Mississippian or Lower Pennsylvanian. The upper formation, of Pennsylvanian age, resting unconformably on the Santa Rosa terrane, consists of 1,970 to 2,620 ft. of dark-gray dolomites and limestones which are locally highly bituminous and limestone conglomerates and breccias.

The Carboniferous appears in the hills west of Puerto Barrios in a series of horizontally bedded, metamorphic limestones. A massive bluish metamorphosed limestone of Carboniferous age crops out along the south bank of Rio Polochic, and in a quarry seven miles south of Puerto Barrios.

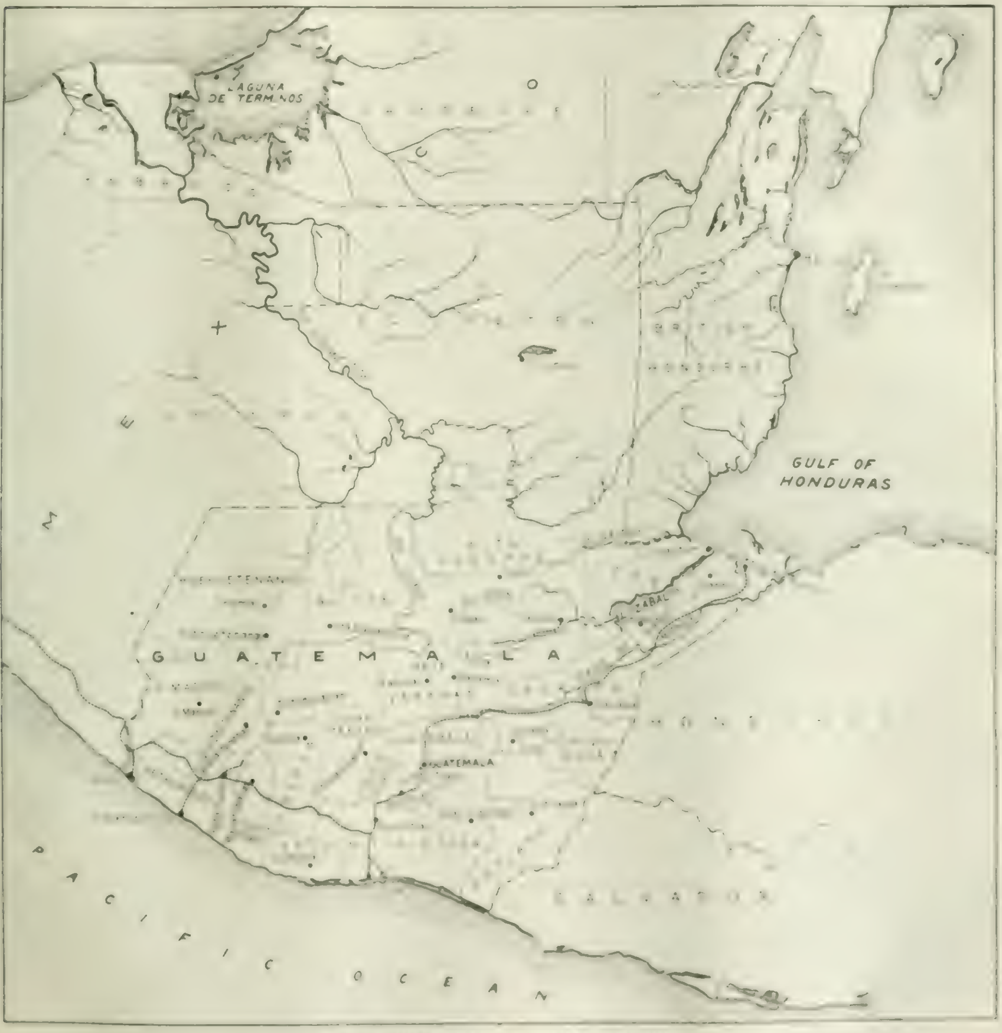
---

*Published by permission of the Director, U. S. Geological Survey.

The Triassic is represented by the Todos Santos terrane, composed of shales, coarse, yellow sandstones, marls, and quartz-conglomerates extending from the Mexican State of Chiapas into Huehuetenango. Through the greater part of northern Guatemala, however, the Cretaceous series of limestones and dolomites, with calcareous conglomerates and breccias, rest unconformably on the Carboniferous. The lower and middle stages of the Cretaceous are represented in isolated localities and in a small area on the Honduran border to the northeast of the Department of Jutiapa by the Metapan strata, which consist of marls, sandstones, shales, and conglomerates. These strata, however, have their chief extent in western Honduras, and in the northwest of El Salvador. Throughout central Guatemala, however, the Coban limestones form the lower member of the Cretaceous.

The Cobán limestones and dolomites in the south of Alta Verapaz are dark gray to black in color, and highly bituminous in composition. A similar series of limestones north of the Chicoj Range are mostly yellowish in color; and the associated conglomerates are in places colored red by iron oxide. The Cobán limestones, which contain no fossils, probably represent the Lower Cretaceous. The presence of *rudistes* in the northern terrane indicates that it corresponds to the Middle Cretaceous of the Mexican Geological Institute or the Upper Comanchean of the U. S. Geological Survey. The Cretaceous of Alta Verapaz has a total thickness of about 2,500 ft.

Tertiary deposits occur in numerous belts, for the most part narrow, in central Guatemala. They are of considerable extent in El Petén, but are totally lacking in southern Guatemala. They are extremely variable



MAP OF GUATEMALA, CENTRAL AMERICA

in their petrographic characters, consisting of sandstones and conglomerates in the Motagua Valley, and in Alta Verapaz and El Petén of shales and sandstones, intercalated in some places with limestone beds.

The oldest Tertiary strata in northern Central America, lying conformably on the Cretaceous limestones, are the Sepur strata, which have a considerable extent in Alta Verapaz and southern British Honduras. They consist principally of red or yellow marls and sandstones, alternating here and there with glauconitic limestones and with conglomerates. The Sepur strata are ascribed to the Eocene. Marls, sandstones, and limestones apparently of the same geologic horizon occur near Chemal and Yulcá, in the mountains of western Huehuetenango.

The uppermost Oligocene is represented by the almost horizontally bedded Rio Dulce limestones, which form a flat-topped ridge almost three miles wide at Livingston. Similar limestones, lacking in distinctive fossils, occur on low hills at Jocolo, on the north shore of Lake Izabal, and at Fort San Felipe. It is possible that some of the limestones ascribed by Sapper to the Cretaceous may be of Oligocene age.

Late Tertiary (Miocene and Pliocene) limestones form the bedrock of the greater portion of El Petén. Between the limestones, which in many places abound in seams of chert, beds of yellowish or gray marl, which are locally bituminous, and thick beds of gypsum or alabaster occur.

Slightly consolidated quartz gravels and clays containing fossils of Pliocene or Pleistocene age are found in the lowest of the terraces on which Livingston is built. Fossilferous white clays containing interbedded black lignite seams and chert pebbles (Pleistocene or possibly Pliocene) underlie the region between Sanhil, in the Sierra de las Minas; the Rio Dulce limestone ridge at Livingston, and Lake Izabal. Lignite beds, 2 to 3 ft. thick, occur between the Rio Dulce and Lake Izabal, and east of the Rio Dulce limestone near Livingston. The series of white clay and lignite beds attains a thickness of a few hundred feet.

Igneous rocks are confined almost entirely to the center and south of the republic. The older intrusive rocks consist of light-colored granites, which grade into diorites and other more basic igneous rocks, largely gneissic in structure. Paleozoic andesites occur in Alta Verapaz, and a broad belt of Paleozoic serpentine occurs north of Lake Izabal and in the upper valley of the Motagua. Mesozoic gabbros and diabases occur in central Alta Verapaz. Younger eruptive rocks, chiefly andesites, trachytes, basalts, and porphyries, form a continuous band across southern Guatemala, and occur as isolated outcrops in southern and central Guatemala. A narrow band of lava and ash deposits from volcanoes whose activity extended into recent times borders the southern slope of the coastal cordillera.

STRUCTURE OF NORTHERN GUATEMALA ROCKS

The Cretaceous and Tertiary sediments of northern Guatemala are folded in a series of anticlines and synclines whose major axes have a general east-west trend. These folds are parallel to those of the Tabasco-Chiapas field of Mexico. The Yucatan tectonic lines trend in the direction of the Isle of Pines; the central Guatemala tectonic lines in the direction of a 3,000 fathom deep in the Caribbean, and those of Honduras in the direction of Jamaica.

Diastrophic movements of considerable magnitude have evidently taken place in Guatemala at four different periods: (1) at or before the close of the pre-Cambrian; (2) at the close of the Paleozoic; (3) during the late Miocene; and (4) in the late Pliocene or early Pleistocene. The Paleozoic movements developed the cordilleran axes, the folding being most in the south. Miocene movements, less intense than the Paleozoic, developed the parallel Caribbean ranges. Evidences of both vertical and tangential movements are found in the Pliocene and Pleistocene sediments from Yucatan southward through Honduras.

As a result of these tectonic movements, there is in central Guatemala a belt of intensely folded strata, which rests against the metamorphic Paleozoic and pre-Cambrian crystalline rocks of the plateau; and to the north a series of diminishing folds, which give way to the comparatively flat-lying strata of Yucatan.

Great longitudinal faults with numerous cross fractures may be traced across central Guatemala. One series of faults separates the Santa Rosa series and the Upper Carboniferous from the Paleozoic serpentines and pre-Cambrian crystalline rocks in Baja Verapaz. The Carboniferous strata on their north are separated from the Triassic and the Cobán limestones by a series of parallel faults. A fault with an east-west strike forms the boundary between the Todos Santos terrane (Triassic) and the Middle Cretaceous limestones and dolomites. Similar faults, striking east and west, occur in the Cretaceous and Tertiary strata of northern Alta Verapaz.

Accordingly, Alta Verapaz consists of a system of folded mountains, whose northern portion is broken by a series of faults, striking east and west. A series of fault blocks descends, step-like, to the plain of El Petén. In southern Petén the folds are flatter and the faults fewer and of less displacement.

The remarkable alignment of the Pleistocene volcanos at the southern edge of the lava plateau is considered by Powers to point to a possible fracture zone on the Pacific side of Guatemala along which a portion of the cordillera has apparently subsided. This conclusion is borne out by the absence of a coastal plain showing uplift, by the uniformly great depths in the Pacific Ocean at no great distance from the shore, and by the remarkable parallelism of the submarine contours to the coast line. The volcanos have evidently been built up at the intersection of cross fractures.

INDICATIONS OF PETROLEUM

The possibilities of finding petroleum in Guatemala in commercial quantities are predicated principally upon the continuation of geologic formations that have been proved to be petroliferous in Tabasco and southern Vera Cruz and have given indications of petroleum in northern Honduras, and on the presence of favorable structures. This assumption is substantiated to a certain extent by the reported occurrence of asphalt seeps in the Valley of Pinula, Department of Jalapa, northeast of Jalapa, in an "island" of Cretaceous rocks.

Highly inflammable bitumen which burns with a bright flame, and emits an odor of kerosene, is said to saturate beds of the Cobán limestone (Lower Cretaceous) in the eastern part of the Department of Alta Verapaz. Arnold reports that the International Railway Co. has prospected petroleum seeps and has obtained from this source lubricants for its own consumption. The location of the seepages is not stated.

Petroleum seeps are reported to occur in El Petén, but these reports have not been authenticated.

It must be recalled that the northern provinces of Guatemala which are considered to offer the greatest probability of finding petroleum form the most sparsely populated, least traveled, and least explored portion of the republic. Moreover, the economic life of Guatemala has been based on agriculture rather than on mining. Consequently, our knowledge of the mineral resources of the republic is less detailed than might otherwise be expected.

No indications of petroleum, asphalt, or other hydrocarbons have been reported in Mexico or Central America in rocks older than the Cretaceous. The Tamasopo limestone which has furnished the phenomenal yields of the Tampico-Tuxpam fields belongs to the Middle Cretaceous, according to the Mexican classification.

The principal oil-bearing formation of the Tehuantepec and Tabasco-Chiapas fields of Mexico is a Cretaceous dolomitic limestone. The reported seepages of asphalt in Guatemala occur in Cretaceous rocks. In the Department of Comayagua, Honduras, a high-grade oil seeps from a bituminous limestone which is considered Cretaceous.

The belt of Cretaceous and younger rocks in Guatemala occurs generally north of latitude 15 deg. 30 min. N. The Cobán limestones crop out in a belt varying from six to twenty-eight miles wide, in the south of Alta Verapaz and Huehuetenango, and through the center of El Quiché, and pass to the north under the Middle Cretaceous limestones. The latter lie in a series of anticlinal and synclinal folds, whose axes strike generally east and west. In the synclinal basins bands of the Sepur strata (Eocene) occur. This area would appear to deserve investigation.

The belt of sedimentary rocks of central Guatemala between latitudes 15 deg. 30 min. N. and 16 deg. N. is, however, not only strongly folded but considerably fractured and faulted.

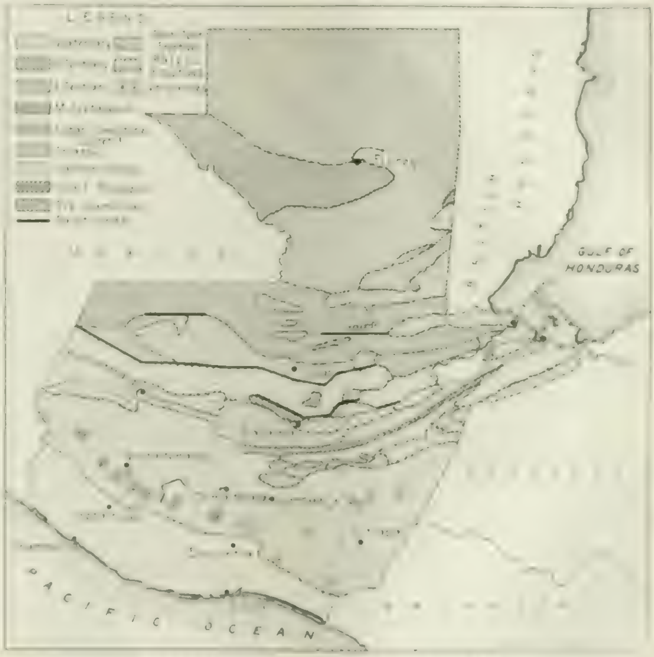
The Cretaceous and Tertiary strata of El Petén, though relatively flat-lying, give evidence of some folding. The relative positions of the Cretaceous and the Tertiary sediments of this department would appear to indicate a series of geosynclinal basins separated by anticlinal ridges in the Cretaceous. This would, however, by no means preclude the possibility of minor anticlinal folds in the geosynclinal basin. Relatively flat folds are reported by Sapper to occur locally.

On the basis of the known data on the stratigraphic and geologic structure of Guatemala, the Department of El Petén offers the most interest to the oil seeker. The Cretaceous, which is the most likely oil horizon of Central America, occurs here apparently under sufficient cover to conserve any hydrocarbons contained in it. The minor folds which occur in the flat geosynclinal structure offer possibilities of oil accumulation. Seepages of petroleum, not, however, authenticated, are said to occur in the department.

It is unfortunate that the part of Guatemala which appears on the face of the known data to present the greatest possibilities of petroleum is the part about which the least detailed information, either geographic or geologic, is available.

PRACTICAL DIFFICULTIES OF OPERATION ARE FORMIDABLE

The Department of El Petén is off the main line of travel, and the region is now accessible only by horse or mule back over rough trails from Cobán, or by crude native *chalanes* (dugouts) up Rio Usmacinta from Frontera, Tabasco. The surface of El Petén is covered by a dense tropical forest, broken only here and there by grassy *sabanas*, or chaparrel thickets. These conditions have hindered detailed geologic exploration.



[illegible] MAP OF GUATEMALA

If oil is discovered in El Petén, the questions of extraction and transportation remain to be solved. Roads in the true sense of the word cannot be said to exist. Considerable clearing of forest will doubtless be necessary before drilling material can be brought in or oil brought out. Equipment of all kinds must be imported. Labor, skilled and unskilled, will have to be brought in, as the population of El Petén, including Indians, does not exceed one per square mile.

By an executive decree dated Dec. 14, 1914, and approved by the National Legislative Assembly April 29, 1916, all deposits of petroleum and other hydrocarbons in Guatemala were declared the property of the national government. These may be acquired or exploited only through a lease not to exceed ten years in duration, contracted with the Ministry of Public Works. Leases or concessions to explore or develop such deposits are permitted only to native or naturalized citizens of Guatemala. Leases may not be transferred except by express authorization of the government, and then a transfer may be authorized only to citizens of Guatemala.

BIBLIOGRAPHY

1. Arnold, Ralph, "Conservation of the Oil and Gas Resources of the Americas." *Proc.* 2d Pan-Am. Sci. Cong., Vol. 3, p. 223. Washington, 1917.
2. Böse, E., "Reseña acerca de la geología de Chiapas y Tabasco." Bol. Inst. Geol. de México, No. 20. Mexico, 1905.
3. Bulletin of Pan-American Union, Vol. 40, p. 695, May, 1915; Vol. 42, p. 144, January, 1916.
4. *Commerce Reports*, Jan. 19, 1916, p. 269; Jan. 25, 1916, p. 337.
5. Dollfus, Auguste, and Montserrat, E. de, "Voyage géologique dans les républiques de Guatémala et de Salvador." Paris, 1868.
6. Exposition Universelle Internationale de 1900 à Paris, Rapports du jury international, Classe 63, "Exploitation des mines et carrières," Vol. 2, pp. 224-230. Paris, 1904.
7. "Fiscalización de depósitos petrolíferos." *El Guatemalteco*, Guatemala, Dec. 20, 1915.
8. "Government To Preserve Control of Petroleum Deposits." *South American Mining Journal*, March 25, 1921.
9. International Bureau of American Republics, Guatemala, Bulletin No. 32, pp. 54-55. Washington, January, 1892.
10. Pector, D., "Les richesses de l'Amérique Centrale," p. 81. Paris, 1908.
11. Powers, Sidney, "Notes on the Geology of Eastern Guatemala and Northwest Spanish Honduras." *Journal of Geology*, Vol. 26, No. 6, pp. 507-523. Chicago, 1918.
12. Redfield, Arthur H., "The Isthmian Oil Fields of Mexico." *Engineering and Mining Journal*, Vol. 111, No. 12, pp. 510-514. New York, March 19, 1921.
13. Sapper, Karl, "Grundzüge der physikalischen Geographie von Guatemala." *Petermanns Geog. Mitteilungen*, Ergänzungsband 24, Heft 113. Gotha, 1894-1895.
14. Sapper, Karl, "Sobre la geografía físca y la geología de la peninsula de Yucatán." Bol. Inst. Geol. de México, No. 3. Mexico, 1896.
15. "Ueber Gebirgsbau und Boden des nördlichen Mittel-amerika." *Petermanns Mitteil.*, Ergänzungsband 27, Heft 127. Gotha, 1899.
16. "Die Alta Verapaz—Ein landeskündliche Skizze mit 5 Karten." *Mitteil. Geogr. Gesell.* Hamburg, Vol. 17, pp. 78-214. Hamburg, 1901.
17. "Ueber Gebirgsbau und Boden des südlichen Mittelamerika." *Petermanns Mitteil.*, Ergänzungsband 32, Heft 151. Gotha, 1906.
18. "Sobre depositos de petróleo." *Diario de Centro-America*, Vol. 34, pp. 1, 12. Guatemala, Feb. 14, 1914.
19. Stephan, Chas. H., "Le Guatémala économique," p. 141. Paris, 1907.
20. Willis, Bailey, "Index to the Stratigraphy of North America." U. S. Geol. Surv. Prof. Paper No. 71, pp. 257, 401, 425-427, 500, 503-504. 579, 585-587, 590, 706, 721-722. Washington, 1912.

Geologic maps of Guatemala are found in the papers by Sapper (13), (15), and (16), and by Willis (20).

Mining Important to Bolivia

Practically 88 per cent of the total exports of Bolivia in 1919 consisted of minerals. This fact is emphasized in a report on Bolivia made by Trade Commissioner W. L. Schurz to the Department of Commerce. In the report he states that the mining industry forms the basis of the economic life of Bolivia to a degree unknown in any other South American republic. In some sections of Bolivia, Mr. Schurz states, oil seepages are so plentiful as to allow the recovery of the crude petroleum with buckets. It long has been used by the natives of eastern Bolivia for local purposes.

Esthonian Oil-Shale Industry To Receive State Aid

BY REUTERS SERVICE

J. Kukk, Minister of Trade and Industry, Esthonia, in a recent speech made in the State Assembly, said in part:

"Esthonia's third important source of natural wealth is oil shale. In Esthonia there is a stretch of land, between Narva and Rakvere (Wesenberg), about eighty versts long and ten wide, the so-called oil-shale field. The deposit contains 40 to 60 per cent of organic substances and about 30 per cent of combustible matter. The university of Tartu and the Petrograd Academy were already investigating the deposits ten years ago. During the war, when the need for fuel was the most burning question, an oil-shale board was established and is still furthering the progress of the industry under government supervision. Great hopes were placed on the industry and large sums were spent by the government in investigations.

"As a state concern, the oil-shale industry has remained a mere shale mining business. Oil shale is mined and the lumps are put into heaps and then carted to cement factories, railway pump houses or wherever there is a demand for it, and the shale is also used on certain locomotives and at the Reval gas factory for fuel.

"The entire oil-shale resources are estimated at a billion and a half tons, and centuries will elapse before they are all consumed. There is no danger in using it in its present state until a definite and practicable method of distillation and recovery is discovered. Last year three million poods of oil shale were mined. This year the output will be increased to five million poods.

"The oil shale contains from 20 to 30 per cent of raw oil, and if we can profitably distill the oil our industrial life will have taken a big step forward. Experimenting with the retort system is taking place now at Kohtla. The results will be reported in the near future, and after passing through the period of experiments we may look forward to the initiation of practical development work.

"Taking into consideration the capital that has been already invested, namely 75,000,000 marks by Esthonia and 2,000,000 roubles by Russia, and what yet remains to be done, we see that experimenting and investigations still require big sums. Together with the establishment of state concerns the government is inviting foreign capital and local business men to invest in the mines. Last year the board introduced a concessions bill, and in conformity with the terms the government has given preliminary permission to companies and individual business men to proceed with the steps that are necessary for the working of the mines.

"In connection with the oil-shale industry there arises the question of transport. If oil-shale distilleries develop into a large profitable industry, whether under state or private ownership, its production will exceed local consumption and we shall have to consider the question of export.

"Now that the government is introducing a bill and asks for 75,000,000 marks to further the oil-shale industry the members should consider the question seriously. The money will be spent building workingmen's cottages and constructing new railways along the mine areas."

Technical Papers

Radium—The September issue of *Radium* (Pittsburgh, Pa.; price, 25c.) contains a twenty-two-page article describing the different radium emanations, their effect on normal tissues, and their use in the treatment of disease. Radium emits three kinds of rays—alpha, beta, and gamma—their respective proportions being approximately 10,000 : 100 : 1. The alpha rays consist of a stream of particles carrying a positive electrical charge projected with a velocity about one-fifteenth that of light. They can be deflected by intense magnetic or electric fields, and are readily absorbed by thin metal, glass, paper, rubber, or a few centimetres of air. Their therapeutic power is negligible. The beta rays consist of negative electrons projected with velocities of the same order as the velocity of light. They are, in type, identical with the cathode rays developed in a vacuum tube. Their penetration is much greater than the alpha rays, and generally speaking they will pass through 0.2 mm. of aluminum. The gamma rays are very penetrating and cannot be deviated by a magnetic or electric field. Their true nature is still undetermined, but they are analogous in many respects to very penetrating and powerful Roentgen rays.

Mining in Colorado in 1920—The annual report of the Colorado Bureau of Mines for 1920 has been issued, and may be obtained on request to the Bureau of Mines, State Capitol, Denver, Col. The depression in the metal markets of the world caused conditions to be more depressed in this state than at any time since 1893, according to the report, although the amount of zinc, lead, and copper produced was greater than in 1919. Activity was stimulated in the carnotite districts by the increased demand for radium. Tungsten and molybdenum mining was dormant and fluorspar production fell off toward the end of the year. A small amount of mica was mined, and there is a possibility that its production may be increased. Nothing of importance is yet reported from the oil-shale field in the northwestern part of the state, though several large oil companies have acquired land and are experimenting with shale-oil [illegible] and refining. The bulletin gives a list of all operating mines by counties, also the situation of the mine, the operator, the post office address and the character of product.

Mine Ventilation—The ventilation of dead ends in mines is discussed in a three-page article in the September issue of *The Mining Magazine* (Salisbury House, London Wall, London, E. C. 2; price 1s. 6d.). The use of canvas tubes and of the Ventwal patent joint is described as being a satisfactory solution of most such mine ventilation problems.

Concrete Storage Bins—The Portland Cement Association, New York City, has issued a fifteen-page pamphlet describing concrete bins and pits for coal storage, which illustrates many of the various forms used for both open-air and under-water storage. By the use of concrete, danger of fire from external causes is removed and the structure also requires little or no maintenance. A concrete pavement greatly facilitates reclaiming, and prevents the inclusion of dirt in removing the contents of the bin.

Mineral Statistics—The Imperial Mineral Resources Bureau has issued a statistical summary of world production, exports, and imports of the principal metals and minerals from 1913 to date. This bulletin is of the same nature as those of the Metallgesellschaft and the American Bureau of Metal Statistics, reviewed in these columns on July 16, but covers a somewhat more extensive list of minerals. The bulletin contains 114 pages, and may be obtained for 3s. 2d. postpaid from H. M. Stationery Office, Imperial House, Kingsway, London, W. C. 2.

Peru—A report of the mineral industry in Peru in 1919 is contained in Boletin del Cuerpo de Ingenieros de Minas del Peru, No. 100, obtainable from the Ministerio de Fomento, Lima, Peru.

Canadian Oil Fields—The Department of the Interior, Ottawa, Canada, has recently issued an eight-page pamphlet, "New Oil Fields of Northern Canada," by F. H. Kitto. Data relative to oil regulations, transportation, climate, accommodations, and possible routes of travel to the Mackenzie district are given. A map showing the transportation routes to the region is included. This is the second edition of this pamphlet, and may be obtained on request.

Las Dos Estrellas Gold Mine—In *The Mining Magazine* for August (Salisbury House, London Wall, London, E. C. 2; price 1s. 6d.) appears a five-page article descriptive of the property of the Dos Estrellas Co. at El Oro, Mexico. The author is T. S. Saunders, who was formerly manager of that property.

Oregon Oil and Gas—A report on "Oil and Gas Possibilities of Eastern Oregon," by John P. Buwalda, has recently been issued by the Oregon Bureau of Mines and Geology (Vol. 3, No. 2). The survey covers about half of the state, the western portion having been investigated and reported upon last year by the bureau in Vol. 3, No. 1 of the "Mineral Resources of Oregon." The report states that eastern Oregon cannot be regarded as impossible territory for oil and gas in commercial quantities, but is rather improbable. The possibility of a commercial gas supply is somewhat better, the Ontario-Vale region affording the best chances. The likelihood of developing a large output does not seem very good, however.

Petroleum Laws—The U. S. Bureau of Mines, Washington, D. C., has issued Bulletin 206, "Petroleum Laws of All America," by J. W. Thompson, obtainable on request from the Bureau. The main source of this report has been the State Department, which obtained, through its consular service, the laws relating to Mexico, Central and South America, the various states of this country and Canada. The collection includes those laws now in force as far as possible, considering the agencies engaged and the time required for the transmission of mail. The bulletin is somewhat voluminous, containing [illegible] pages of data covering the subject under discussion.

African Mining Laws—Vol. 1 of the series devoted to the "Mining Law of the British Empire and Foreign Countries" was devoted to Nigeria, and was reviewed in the *Engineering and Mining Journal* of Dec. 25, 1920. Vol. 2 is now available, this being devoted to the mining laws of West Africa. It may be obtained for 15s. 6d. from H. M. Stationery Office, Imperial House, Kingsway, London, W. C. 2. The third volume, on the Transvaal, is now in preparation.

Tunnel Driving—The Michigan College of Mines *Alumnus* for June 1921 (Houghton, Mich.), contains an article, "Mohawk and Wolverine Tunnel at Gay, Michigan," by W. R. Bolley, superintendent of the Wolverine Copper Mining Co. at Kearsarge, Mich. The article describes the driving of a tunnel 2,468 ft. into Lake Superior. Costs of the work are included.

Mineral Resources—Recent publications in the Mineral Resources series include "Platinum and Allied Metals in 1920," thirteen pages; "Copper in 1919," seventy-seven pages; "Peat in 1920," three pages; "Abrasive Materials in 1919," six pages; "Fuel Briquets in 1920," three pages; "Graphite in 1920," six pages; "Strontium in 1920," three pages; "Arsenic, Bismuth, Selenium, and Tellurium in 1920," twenty pages; "Fluorspar and Cryolite in 1920," fifteen pages; and "Cement in 1919," seventeen pages.

Limestone—Producers and users of limestone and lime will be interested in the Sept. 10 issue of *Rock Products* (Chicago, Ill.; price 25c.), which has several articles on this subject. These include "Lime in the Chemical and Allied Industries"; "Speedy, Accurate and Reliable Analyses of Limestone"; "A New 'Wet' Process of Lime Manufacture"; "[illegible]," and "[illegible]," as well as several others.

Geology and Resources of Trinidad—In *The Mining Magazine* for September (Salisbury House, London Wall, London, E. C. 2; price 1s. 6d.) H. B. Milner summarizes the present knowledge of the geology of the Island of Trinidad, with special reference to the mode of occurrence and storage of its oil.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Meeting of Canadian Institute in Edmonton, Alberta

Three-Day Sessions Include Discussions of Government Mineral Resources, Mining Laws, and Petroleum Possibilities

SPECIAL CORRESPONDENCE

THE Third Annual Western Convention of the Canadian Institute of Mining and Metallurgy was held Sept. 14-16, at the Macdonald Hotel, Edmonton, Alberta, with an attendance of nearly one hundred members, including several from eastern Canada. O. E. S. Whiteside, of Coleman, Alberta, occupied the chair. Addresses of welcome were delivered by Mayor D. M. Duggan on behalf of the city, and by Premier Greenfield, representing the provincial government of Alberta, who spoke on the research work of the government in connection with the mining industry. Chairman Whiteside in reply said that the Institute would be glad to co-operate in this work with the government.

A paper on "Canada's Coal Problem," by C. V. Corless, president of the Institute, was read by George C. McKenzie. At the afternoon session Dr. Edgar Stanfield read a paper on the air drying of coals, which was followed by an interesting discussion. Dr. K. S. Clark gave an address on bentonite, or soapstone, expressing the opinion that its use might provide a solution of Alberta's road problems. He stated that a number of experiments with the object of utilizing it for road construction were now in progress at the University of Alberta.

President Henry M. Tory of Alberta University spoke on research, contending that the future of the British Empire depended on men of the engineering type. In the years to come the place of the man of science would be greater in the affairs of the world than it had been in the past A smoker and concert was held in the evening.

On the second day the morning session was devoted to ten-minute talks on the coal field of Alberta. Dr. D. B. Dowling, of Ottawa, who presided, outlining the various formations and the possibilities of the several fields. In the afternoon Prof. Robert C. Wallace, of the University of Manitoba, gave an address on "The Control of the Mineral Resources of the Prairie Provinces," strongly advocating decentralization of control. He referred to the spirit of initiative and resourcefulness in developing their natural domain which had sprung up in Ontario and British Columbia through ownership and administration of their natural wealth, and argued that like results could not be expected in the West until the power was vested not in far-off Ottawa, but in the provincial governments.

Thomas W. Gibson, Deputy Minister of Mines for Ontario, indorsed many of the suggestions made by Dr. Wallace. He foresaw many difficulties in the way of framing mining laws when the control of mineral resources was transferred to the Western provinces, and suggested that the Institute should draft a model mining law and recommend its adoption by the provincial legislatures before the transfer was made.

Dr. J. A. Allan, of the University of Alberta, thought that the collection of information on natural resources was the duty of the federal rather than the provincial authorities. He said that during the last summer not a single geological party had been centralized in Alberta, whereas no less than seven had been engaged in British Columbia.

Dr. M. Y. Williams, of Vancouver University, in reply to this statement, said that the present condition was due to the resignation of a number of federal geologists, including two who had spent their whole time in Alberta. He thought there could be a satisfactory adjustment between the federal and provincial departments. There was, however, some danger that when the mineral resources were handed over to the prairie provinces, a lessened interest would be taken in these provinces by the Department of Mines.

Dr. John McLeish, of Ottawa, read a paper on "Mineral Industry," showing the necessity for Canada seeking to develop her resources. The country was importing minerals greater in amount than her total mineral production, being dependent on outside services for 50 per cent of the coal supply, and in iron Canada furnished only 5 per cent of her own needs, and in petroleum less than that proportion.

The session closed with a discussion on "Dominion Mining Legislation," led by W. Dixon Craig, N. C. Pitcher, and Dr. J. A. Allan.

In the evening a banquet was held at the Macdonald Hotel, with O. E. S. Whiteside in the chair, the principal speakers being ex-Premier Charles Stewart, Hon. George Hoadley, Mayor Duggan, and A. U. G. Bury.

The third day's proceedings opened with a paper by George Sheppard, geologist for the Imperial Oil Co., on "Recent Development Work Relating to Petroleum in Western Canada," dealing with operations in the Northern fields, Central Alberta, the Irma district, and southern Saskatchewan. He estimated that by the end of the year, with the results of at least four wells in the Northern field and one at Windy Point nearing completion, there will be a chance to give a fair estimate of the potentialities of this great Northern field. Until the results of the present season's drilling are available it will be impossible to say whether the Norman field will be a commercially practicable development or not.

In summarizing the results of the drilling at Czar, Alberta, he stated that from a commercial point of view they were of no value. Little gas and negligible traces only of oil were observed, and therefore the well was abandoned after all the possible oil horizons had been penetrated at a depth of 3,500 ft. As yet the foothills zone of the Western provinces had proved to be the most satisfactory area for possible oil development, as there the most favorable structures occur for the accumulation of petroleum.

Dr. D. B. Dowling spoke on "The Geological Structure in the Fort Norman District," describing the formations entered by the Mackenzie River at Fort Simpson, and the mountains paralleling the river, which has the Mackenzie range on the west and the Franklin range on the East far below Fort Norman.

Dr. M. Y. Williams gave an account of the field work done by Dr. Hume, Mr. Whittaker, and himself in the Mackenzie River district during the last summer. These explorations were carried on on both sides of the river between the foot of Great Slave Lake and Fort Wrigley, the Horn Trout, Beaver, North Nahanni, Root and Willow rivers being traversed and mapped for a considerable distance.

Mining and Electrical Engineers Hold Joint Meeting

The San Francisco Section of the A. I. M. E. met on Sept. 23 with the local section of the American Institute of Electrical Engineers. The following papers were presented: "Rates of Electricity in Mining Industry," by R. E. Fisher; "How Operations About a Mine or Metallurgical Plant Can Be Scheduled To Fit a Power Contract," by B. B. Beckett; "The Application of Electric Equipment in Connection With Mining and Milling Operations of the Alaska Gastineau Mining Co.," by B. L. Thane, and "Prevention of Electrical Accidents in Metal Mines," by R. L. Eltringham.

MEN YOU SHOULD KNOW ABOUT

Walter X. Osborn has been appointed manager of the Rowley Copper Mines Co. at Gila Bend, Ariz.

R. A. Bryce has been appointed consulting engineer of the Comfort-Kirkland Mining Co., of Ontario.

William Myers has been engaged by the U. S. Bureau of Mines as a member of its non-metals investigating staff.

Harry T. Hamilton, general manager of the Moctezuma Mining Co., recently inspected mines on the Mesabi iron range.

George H. Clark, of Birmingham, Ala., has gone to northeast Texas to report on an oil property for New York interests.

A. W. Newberry has returned to New York from the West, where he examined mining properties in Montana, Idaho and Colorado.

Virgil Kirkham, Idaho State Geologist, was at Hope, Idaho, in September, investigating oil indications near the mouth of the Clark's Fork River.

Frank G. Stevens, consulting engineer, in Canada, of Makeever Brothers, has been placed in charge of the mining and oil operations of that company, with headquarters at Boston.

F. W. Farnsworth, president, and **K. F. Williams**, vice-president, of the Chippewa Iron Mining Co. were in Duluth, Minn., last week on business relative to the operation of the Armstrong Bay mine.

Frank Ayer, superintendent of mines for Phelps Dodge Corporation at its [illegible] Mines, in Sonora, Mexico, is in Jerome, visiting the United Verde and the United Verde Extension copper mines.

R. C. Allen, geologist for Oglebay, Norton & Co., was a recent visitor in the Lake Superior district, where he examined some of the mines of his company, including the Miller mine, at Aurora, Minn.

I. O. Jones, assistant superintendent of furnaces for the Wisconsin Steel Co., Chicago, accompanied by **B. W. Batchelder**, general superintendent of mines, recently inspected the company's properties on the Mesabi range.

Ernest N. Patty, of the Washington State Geological Survey, has gone to the Washington State College, Pullman, Wash., to take care of the classes of **Dr. Shedd**, head of the geology department, who is on leave of absence.

Walter J. Eaton, for the last four years with the American Metal Co. interests in Mexico, has resigned as superintendent of the [illegible] and Santa [illegible] of the Cia. Minera de Peñoles, S. A., to accept the position of mine superintendent at the Smuggler Union at Telluride, Col.

F. H. Wells, who conducted special geological investigations for the Chino Copper Co., at Santa Rita, N. M., in 1920 and this year, is the new president of the New Mexico State School of Mines at Socorro. Other newly elected members of the faculty are: **W. T. Quayle**, mining and metallurgy; **J. W. Jourdan**, civil engineering; **R. E. Bowman**, chemistry; **W. C. Ramlow**, instructor in civil engineering; **C. W. Vaupell**, geology and mineralogy; and **F. C. Studley**, who will teach academic subjects and coach the athletic teams.

W. J. Woolsey, Thetford Mines, Quebec, leaves soon for California, where he will build an asbestos mill for the Pacific Asbestos Corporation, in Calaveras County. Mr. Woolsey has been prominently associated with the asbestos and chrome industry for the last five years on the engineering staff of the Asbestos Corporation of Canada, Ltd., and previously as manager for the Robertson Asbestos Co., Thetford Mines, and traveling salesman for the Johnson Asbestos Co., in the United States and Europe. He is a graduate of the School of Mining, Kingston, Ontario, and after graduation took a post-graduate course in McGill University, Montreal, and in the Mining Academy at Clausthal, Germany. He has contributed several papers on [illegible] and mining, and is a member of the C. I. M. M. and the A. I. M. E., and has acted as secretary for the Thetford Branch of the C. I. M. M. from its inception.

W. J. WOOLSEY

Mining and metallurgical engineers visiting New York City last week included: **W. A. Rukeyser**, Montreal, Quebec; **S. I. Shaw**, [illegible], Mex.; **H. H. Howry**, Chicago, Ill.; **E. H. Jones**, [illegible], Ontario; **C. B. Murray**, Cleveland, Ohio; **J. W. Brooke**, Philadelphia, Pa.; **H. Kamura**, Japan; **J. A. Mylius**, [illegible], Ill.; **E. A. Holbrook**, Washington, D. C.; **Herbert A. Tumin**, Buffalo, N. Y.; **A. E. Dahlke**, Portland, Ore., and **O. U. Bradley**, Muskogee, Okla.

SOCIETY MEETINGS ANNOUNCED

Utah Metal Mine Operators' Institute will hold meetings at the Salt Lake Commercial Club on Oct. 7 and 8. The institute is under the auspices of the American Mining Congress and the Utah Section of the American Institute of Mining and Metallurgical Engineers. A number of interesting papers will be presented.

American Institute of Mining and Metallurgical Engineers will hold the regular monthly meeting of the New York Section at the Machinery Club, 50 Church St., on Oct. 5, at 8 p. m., following an informal dinner. Brief talks on the subject of "The Problems and Progress of Iron and Steel Metallurgy" will be given by the following: **J. Cavalier**, professor of metallurgy, University of Toulouse, France; **John Vipond Davies**, president, United Engineering Society; **John A. Matthews**, president, Crucible Steel Co. of America; **Bradley Stoughton**, consulting metallurgist, New York, and **William Campbell**, professor at Columbia University.

OBITUARY

Alton L. Dickerman, aged seventy-one years, died at his home in Sioux City, Iowa, on Sept. [illegible]

Thomas J. Chope, of the Anaconda Copper Mining Co., died last week in Butte of peritonitis. He was one of the best-known mining men in the Northwest, and long had been identified with the Anaconda. He was the first [illegible]

Henry J. Kimman, [illegible] manager of the Cleveland plant of the Chicago Pneumatic Tool Co., died in Cleveland, Ohio, on Sept. [illegible] He was born in Harlem, Holland, in 1863, and [illegible] In collaboration with his brother, T. P. Kimman, he designed and built the first practical portable power air drill. [illegible]

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

LEADING EVENTS

WEEKLY RÉSUMÉ

From the Birmingham district of Alabama it is reported that the iron-making industry is beginning to show signs of definite improvement. Here and there the unemployment situation seems a little brighter elsewhere, particularly in the Joplin-Miami district, where several properties are resuming. In Butte, Anaconda is said to be easing the situation somewhat by taking on some men. Increasing activity in the gold-mining district of the Black Hills of South Dakota and in southwestern Oregon is reported. Elsewhere, also, this industry appears improving. In view of this, it is interesting to hear from Washington that twenty-two Western Senators are seeking to get speedy action on the McFadden gold bonus bill. Mr. Wooton, our Washington correspondent, also gives in this issue a list of the numerous co-operative agreements just signed by the Bureau of Mines for the current year.

In Mexico, conditions are looking very promising, now that the menace of Article 27 of the Constitution is removed. In this issue much activity is reported in those districts in Sinaloa and Durango tributary to Culiacan. The A. S. & R. Co. is reported to have bought the San Juan de Gracia mine.

Two interesting discoveries of ore are reported this week: one of high-grade iron ore in the Kennedy mine on the Cuyuna Range, greatly adding to the company's reserves, and the other of rich silver ore in the Old Dominion mine, near Colville, Wash., a mine thought to be almost worked out.

Date Set for Butte & Superior Hearing

The hearing on the accounting in the suit of the Minerals Separation company against the Butte & Superior Mining Co. has been set for Oct. 31 at New York, where it will be easier for counsel engaged in the case to assemble than it would be in Butte. Several months ago Federal Judge G. M. Bourquin named Louis P. Donovan, an attorney of Butte, as master in chancery to hear evidence. The hearing will be had on the damages the Butte & Superior must pay for infringement of the flotation patents held by Minerals Separation.

The Sylvanite Gold Mine in Southern Oregon

Oregon-Pittsburgh Mining Co. Organized To Work Properties in Gold Hill District Credited With Moderate Production in Past—Proposed To Erect 100-Ton Milling Unit

BY A. E. KELLOGG

Written for *Engineering and Mining Journal*

A DEAL that is the forerunner of a general resumption of gold mining in the district of Gold Hill, Ore., was announced recently, whereby a new company organized under the laws of Arizona as the Oregon-Pittburgh Mining Co. has taken over the Sylvanite group, three miles north of Gold Hill. The history of this group dates back to the early 90's, when Cox and Lyman, two local miners, recovered many thousand dollars in gold only a few feet below the surface on what is now known as the Cox and Lyman vein, a stringer of the main Sylvanite vein. The Sylvanite group also includes the Cheney, the Simmons, as well as several groups held by Ray and Haff, local operators. All these properties were producers before the Cox and Lyman strike. It is safe to say that from the various strikes made by all operators a total of $150,000 in gold has been taken from the property.

The first attempt to consolidate these properties was made about twelve years ago, when, with the exception of the Ray holdings, they were leased to the Sylvanite Mining Co. This undertaking failed. In 1914, G. L. Haff and H. A. Ray, holding several adjoining properties, leased the Cox and Lyman, Cheney, and the Simmons mine, and undertook to develop the whole group, with fair success.

In March, 1916, tungsten was discovered by the lessees in the Haff tunnel, which they were driving. The tungsten was found with the gold ore in the form of scheelite. It occurs in small stringers with quartz and averages less than 2 per cent tungstic acid. The tungsten resources of the property have not yet been determined.

In 1916, J. G. Davies, of Sacramento, Cal., and local investors bought the Ray and Haff interests. They succeeded in recovering about $50,000 in the course of development work. This was spent on further development and in building the present ten-stamp mill, used for treating the free-milling ores.

In 1919, Victor W. Brown and associates, of Pittsburgh, Pa., took an option on the property and continued development until recently. Following this the present company was organized. According to L. H. Van Horn, engineer in charge, a mill of at least 100 tons' capacity is to be erected.

A large area of northwestern California and southwestern Oregon has been designated by the United States Geological Survey as having been an island in the ocean during Cretaceous times. It is termed by Winchell the "great Siskiyou batholith." Most of its mass is granite, or granitic in character, accompanied with other intrusive and igneous rocks, such as diorite, porphyry, and other intrusions of ancient origin. The elevation in places reaches an altitude of 7,000 and 8,000 ft. Observation shows that all of the placer deposits in this section of the country were along the shore line of this old island. Hence, in these mountains judgment dictates that the source of the gold be sought. The searches thus prompted have proved correct, and numerous mineral deposits are found in the seams and fissures of this old island.

Rogue River Valley lies east and northeast of the Siskiyou Mountains, and the more recent Cascade range of mountains lie east of the valley. The placer deposits occur along the shore line of the valley, and are not found on the Cascade side.

The Sylvanite group is located on this "Siskiyou batholith," on its extreme northeastern shore line. It is on the north bank of Rogue River. From this point the main Sylvanite vein extends to the north for a distance and has been definitely located for about three miles.

The main vein of the group is known as the Sylvanite, or "Big" vein. It strikes N. 22 deg. E. and dips 65 deg. E. It has an average width of 40 ft. The hanging wall is a porphyritic slate. The foot wall is lime carrying other material. The vein carries altered argillite and serpentine, which also is characteristic of the country rock. The main contents of the vein are quartz carrying pyrites and what appears to be a shistose material with sulphides. There is much gold, sometimes free-milling, but often in sulphides. The vein also contains large boulders, carrying some amphibole and often rich in gold. Galena and occasionally copper stains are found. Silver is also present.

A large number of lateral veins, lying approximately east and west, strike toward the "Big" vein and dip north. As these veins approach the "Big" vein, they curve toward it, turning north, and at the junction are always rich in gold. Five or six of these cross veins have been traced to the junction, and in every instance large bodies of high-grade ore have been recovered. The work which has resulted thus has been very irregular and chiefly near the surface. Many shafts have been sunk, of varying depth up to 400 ft. A large number of drifts have been driven on both the "Big" vein and the crosscut veins, generally with promising results.

What is known as the Doan tunnel was driven early in the history of operations on the "Big" vein. This is the lowest tunnel on this vein and was driven 1,330 ft. on the vein, and throughout its length the vein maintained a width of 40 to 45 ft. Many high-grade shoots were found. Suspension of the work permitted caving and rendered further operation difficult. The tunnel was abandoned, but near one end it was tapped by a shaft. Good ore was taken out during this operation, which still remains on the dump.

Work is now progressing through the Haff tunnel, which is a crosscut tapping the "Big" vein at 630 ft. from the portal, and it is 64 ft. above the Doan level and 330 below the surface. This follows the Hammersly vein for about 135 ft. through rather loose mixed formation of the country rock, largely schistose and broken metamorphosed material. This formation carries no value except where this vein is cut. From the Haff tunnel northerly on the "Big" vein a drift has been driven 375 ft., and the vein continues to maintain its width of 40 to 45 ft. The whole mass is highly mineralized and silicified, bearing gold both free and base, together with occasional bunches of high-grade ore.

About 120 ft. in from the portal of the Haff tunnel a crosscut is driven north 108 ft., and at 28 ft. this crosscut intercepted a vein called the Blind vein. A drift on this vein uncovered an important body of high-grade ore. Continuing this drift 82 ft. further uncovered the Scheelite vein, so called because at the surface it yielded scheelite ore. At this point, however, it has developed into a well-defined quartz vein carrying high-grade gold ore, with the scheelite but little in evidence.

Further north and 100 ft. higher than the Haff tunnel on the Iron Dike, a tunnel 525 ft. long has been driven on the Cox and Lyman vein. This vein is from 2 to 5 ft. wide and noted for high-grade ore. At the point where the tunnel cuts this vein there is an upraise into the old workings 130 ft. above. About $40,000 was taken from this upraise.

At the surface along the line of the "Big" vein are many excavations of varying depths, from which a large quantity of ore has been milled, varying from $17 to $100 per ton. Up near the "Saddle" at an altitude of 2,600 ft. and about 1,000 ft. above the lower workings, there has been considerable work in shafts and drifts. Here have been some of the richest developments in the mine, both in free gold and sulphides. The work on this hillside, extending over a period of forty years by various individuals and companies, has been of such erratic and irregular character that it is impossible to give a description as will carry any definite conception of the situation.

SYLVANITE PROPERTY NEAR GOLD HILL, ORE. ROGUE RIVER IN FOREGROUND. VIEW TAKEN FROM MAIN LINE OF SOUTHERN PACIFIC RAILWAY

After the closing of the Doan tunnel there seems to have been little system in any of these efforts, until the opening of the Haff, and Cox and Lyman tunnels. The operators seemed to be seeking for bunches of free-milling ore, and on striking sulphides quit. Development shows a remarkable system of veins, all more or less rich, with free gold at or near the surface and great bodies of rich sulphides as depth is reached.

The Oregon-Pittsburgh Mining Co. has a capital stock of $1,000,000. Its main office is at 901 Bessemer Building, Pittsburgh, Pa. W. H. Stroup is president and L. C. Palmer, secretary-treasurer. The directors are J. C. [illegible], A. J. Gould, and F. N. [illegible], all of Pittsburgh; Samuel [illegible], of Portland, Ore.; and Herbert [illegible], of Sacramento, Cal.

Arizona Copper Co. Stockholders To Vote on Sale Oct. 3

The plan of the Arizona Copper Co. to sell its holdings to the Phelps Dodge Corporation has been approved by the directors of the former company. It will be voted upon by the stockholders of the Arizona Copper Co. at a meeting to be held on Oct. 3.

Oil Companies in Galicia To Build Power Station

By Cable From Reuters to "Engineering and Mining Journal"

London, Sept. 26 — A message from Warsaw states that a group of petroleum companies in Boryslav, Galicia, has decided to construct a great electric station to provide current for boring and working the pumps and for other operating purposes. The Minister of Commerce has promised to co-operate for the purpose of creating an electric system for the whole petroleum base.

Americans Get Gold Concession In Far East

By Cable From Reuters to "Engineering and Mining Journal"

Moscow, Sept. 27—The Sovnet government of the Far East has granted a concession to an American financial group to exploit the gold fields in the Amur region, according to an announcement in the *Krasnaia Gazeta*.

Pyrites Found in Czechoslovakia Near Pressburg

By Cable From Reuters to "Engineering and Mining Journal"

London, Sept. 23 — Dispatches from Prague report that extensive deposits of pyrites have been discovered near Pressburg. It is estimated that the annual yield will amount to about 20,000 wagon loads, which would be sufficient to meet the requirements of the various industries established in Czechoslovakia.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Western Senators Seek Action On McFadden Gold Bill

Secretary of Treasury Urged, If Opposed to Measure, To Formulate Substitute To Protect Industry

Twenty-two Western Senators, led by Senator Oddie, of Nevada, have launched an aggressive movement looking to the stimulation of gold mining. They have called upon the Secretary of the Treasury for definite and detailed comment on the McFadden gold bonus bill (H.R. 5025). They hope to be able to influence prompt consideration of that measure. More than $80 000,000 worth of gold, says Senator Oddie, is being used in the arts and lost from various causes.

The appeal to the Secretary of the Treasury was made in the form of a resolution, as follows:

Resolved, That the undersigned, members of the United States Senate, urge upon the Secretary of the Treasury the significance of his reply to Chairman Fordney in determining the status of the gold-mining industry, which is vitally important to the maintenance of the gold standard and the financial security of the nation; and be it further

Resolved, That if upon the analysis of the Secretary of the Treasury reasons cannot be definitely assigned for opposing the provisions of H.R. 5025 (the McFadden gold bonus bill), the Secretary is requested to indorse the same in order to expedite the action of the House and permit the bill to be considered by the Senate; and be it further

Resolved, That if the Secretary of the Treasury has specific reasons for opposing the provisions of H.R. 5025, he is hereby urgently requested to formulate a proposal for enactment by Congress: first, to protect the gold-mining industry from destruction, which is a serious matter irrespective of the fact that its operation is necessary as the basis of our monetary system; and second, in anticipation of the heavy foreign drain upon our gold reserve, to provide for augmenting said reserve from sources of domestic production and thereby lessen the need for the further and extensive curtailment of credit which otherwise would result.

Bureau of Mines Signs Many Co-operative Agreements

Scope of Research Greatly Widened Despite Small Appropriation

Practically all of the co-operative agreements between the U. S. Bureau of Mines and the outside agencies for the fiscal year ending June 30, 1922, have been signed. Co-operative agreements with the Bureau are made for one year, and are terminated or renewed at the beginning of each new fiscal year. Though the actual cash which in this way is added to the Bureau's appropriations probably will not exceed $250,000 during the current fiscal year, the scope of the Bureau's research is increased greatly by contributions of supplies, power, technical men, and general expenses which otherwise would have to come from the Bureau's appropriations.

The co-operative agreements of direct interest to the metal-mining industry are as follows:

University of Alabama—To study the problems peculiar to the mineral industry in the Southern States, particularly those problems relating to iron and steel, coal, coke, non-metallic minerals and byproducts.

University of Arizona—To study problems connected with the mining and smelting of low-grade copper ores in the Southwest, particular attention being paid to the sulphur dioxide leaching of low-grade copper ores and the precipitation of copper from sulphate solutions.

University of California—To handle the chemical end of problems sent in by the mining experiment stations at Reno, Seattle, and Salt Lake City.

State of Colorado—To make investigations and disseminate information with regard to the production of oil from oil shales.

Cornell University, the Vanadium Corporation of America, and the Welsbach Company—To study alloys and electric furnaces.

University of Idaho and the Idaho Bureau of Mines—To study and devise new processes for the better recovery of the values from low-grade and complex gold, lead, silver, zinc, and copper ores of Idaho, especially those of the Cœur d'Alene and Pend' Oreille districts.

University of Illinois and the Illinois Geological Survey—To study mine ventilation and the utilization of Illinois coals for the production of gas.

University of Minnesota—To study the iron ore problems of the United States.

University of Nevada—To study the rare and precious metal problems of the United States.

University of Missouri—To study existing processes and to devise new ones with a view to increasing the recovery of values from lead and zinc ores.

Ohio State University—To increase efficiency in the utilization of mineral substances necessary to the ceramic industry.

University of Utah—To study the volatilization process as applied to the low-grade lead and zinc ores of Utah; the application of the volatilization process to the reduction of lead fumes and to the recovery of silver, lead and copper from low-grade and complex ore, and to study various ore-dressing problems of the West.

University of Washington—To study electrometallurgical problems of the Pacific Northwest, and problems in washing Alaska and Washington coals.

Arizona Copper Co.—To study problems relating to the leaching of partly oxidized copper ores.

Central of Georgia Ry. Co.—To conduct investigations of Georgia kaolins, clays and bauxites.

Morris P. Kirk, Harbor City, Cal.—To study volatilization of silver and lead from ore and the reduction of the volatilized fume into metallic bullion.

Utah Industrial Commission—To investigate sanitation and safety conditions and appliances best adapted to prevent accidents and improve health in mines, mills and smelters.

E. I. du Pont de Nemours & Co.—To study explosives for detonating.

National Safety Council—To conduct technical safety service work.

War Department, Navy Department, and National Research Council—To continue research work on explosives.

The purchases of silver by the Bureau of the Mint during the week ended Sept. 24 totaled 164,436 fine ounces, making the total purchases under the Pittman Act 73,228,866 oz.

Mine Taxation Bill Introduced in Senate

The following provisions of the tax bill introduced in the Senate Sept. 21 by Senator Penrose, of Pennsylvania, chairman of the Senate Finance Committee, are quoted by a bulletin of the American Mining Congress:

"Sec. 204. (a) That as used in this section the term 'net loss' means only net losses resulting from the operation of any trade or business regularly carried on by the taxpayer (including losses sustained from the sale or other disposition of real estate, machinery, and other capital assets, used in the conduct of such trade or business); and when so resulting means the excess of the deductions allowed by section 214 or 234, as the case may be, over the sum of the following: (1) the gross income of the taxpayer for the taxable year, (2) any interest received free from taxation under this title, (3) the amount of deductible losses not sustained in such trade or business, (4) amounts received as dividends and allowed as a deduction under paragraph (6) of subdivision (a) of section 234, and (5) *so much of the depletion deduction allowed with respect to any mine, oil or gas well as is based upon discovery value in excess of cost.* Paragraph (b) provides that such a net loss sustained by any taxpayer may be deducted from the net income of the taxpayer for the succeeding taxable year.

"Sec. 211. (b) In the case of the bona fide sale of mines, oil or gas wells, or any interest therein, where the principal value of the property has been demonstrated by prospecting or exploration and discovery work done by the taxpayer, the portion of the tax imposed by this section attributable to such sale shall not exceed, for the calendar year 1921, 20 per centum, *and for each calendar year thereafter, 16 per centum*, of the selling price of such property or interest.

"Secs. 214 (a) (10) and 234 (a) (9) In the case of mines, oil and gas wells, other natural deposits, and timber, a reasonable allowance for depletion and for depreciation of improvements, according to the peculiar conditions in each case, based upon cost including cost of development not otherwise deducted: Provided, that in the case of such properties acquired prior to March 1, 1913, the fair market value of the property (or the taxpayer's interest therein) on that date shall be taken in lieu of cost up to that date; Provided further, That in the case of mines, oil and gas wells, discovered by the taxpayer, on or after March 1, 1913, and not acquired as the result of purchase of a proven tract or lease, where the fair market value of the property is materially disproportionate to the cost, the depletion allowance shall be based upon the fair market value of the property at the date of discovery, or within thirty days thereafter; And provided further, *That such depletion allowance based on discovery value shall not exceed the net income, computed without allowance for depletion, from the property upon which the discovery is made, except where such net income so computed is less than the depletion allowance based on cost or fair market value as of March 1, 1913*; such reasonable allowance in all the above cases to be made under rules and regulations to be prescribed by the commissioner, with the approval of the secretary. In the case of leases the deductions allowed by this paragraph shall be equitably apportioned between the lessor and lessee."

It is stated unofficially by representatives of the Bureau of Internal Revenue that the above change will not affect mines and that it will be applicable under certain conditions only to oil companies, according to the bulletin of the Mining Congress.

Assessment Work Year Bill Signed

The bill changing the assessment work year so as to coincide with the fiscal year instead of the calendar year was signed on Aug. 24, 1921, and is now Public Law 64. Announcement of this important event was accidentally omitted from the Aug. 27 and succeeding issues.

NEWS BY MINING DISTRICTS

London Letter

Roodepoort United Proposes Copartnership Basis of Operation to Men—White Hope, at Hampton Plains, To Liquidate

By W. A. DOMAN

London, Sept. 13—An indication of the state of affairs on some of the older low-grade mines of the Rand is to be found in the case of the Roodepoort United. This property has been kept alive for a long time only by the high price obtained for the gold produced. Hopes were entertained that expenses of working would be lowered. Unfortunately, such hopes are unfulfilled; in fact, the tendency seems to be for the level of costs to increase. The mine is one of the General Mining and Finance Corporation group, and, being in the Roodepoort district, no high-grade ore is being taken out.

More than a year ago the chairman uttered a note of warning, and indicated that in certain circumstances it would be necessary to cease operations. Later, the serious position was explained to the white miners, who were told that the only hope of keeping the mine going was to retrench [illegible] per cent of the men, and leave the others to maintain the efficiency at the old rate. Rather than be deprived of employment the men accepted the scheme and decided among themselves who should be retrenched. To their credit be it said the experiment has worked remarkably well.

With costs on the up grade, however, and with the price of gold lower, a new situation has arisen. Again the men have been appealed to. It was a question either of shutting down immediately, or of the workers shouldering a greater part of the burden. The proposal is that the mine should be worked on a copartnership basis. The men are to forego half the union rates of pay; next, the interest on the company's debt is to be paid; then the first charge on the proceeds is to make up wages. Any remaining surplus is to be divided between the men and shareholders. There is certainly a spice of speculation in this arrangement, and if it should lead to economy and clean mining there would seem to be a fair prospect for the company.

The shutting down of the Roodepoort United would, of course, affect more than the mine workers and shareholders. It would create a housing problem for, say, the Durban Deep, which is an expensive mine to work, the costs being between [illegible] and [illegible] a ton, an impossible figure without the gold premium. There are no high grade mines in the Roodepoort district, so that the closing down of the Roodepoort United would be a serious matter.

It has been evident for several months that numerous mining companies floated to test the new gold field in Western Australia at Hampton Plains were not meeting with the success expected, and some have gone under. The latest, and one of the best known in London, is the White Hope. It had a capital of £80,000 in 10s. shares; a block of them being introduced to the London market at 5s. As gold cannot be found in paying quantities, the directors have decided to wind up. The White Hope was a gamble at the outset, but the public have not made the running. Some of them are still wondering why they paid so [illegible] for it.

Johannesburg Letter

Transvaal's Gold Output for July Shows Increase—Drilling Largest Item of Underground Costs

By JOHN WATSON

Johannesburg, Aug. 16—The Transvaal's output of gold in July was made known by the Chamber of Mines on Aug. 10. The total for the month was [illegible] of fine gold, having a value of [illegible], or an increase over June of [illegible] fine ounces and an increase in value of [illegible]. The value for Ju is taken at £5.625 per fine ounce, whereas in June the value was £5 7s. 6d. per fine ounce. It must be remembered that July had a day more than June. The principal increases were shown by the Crown Mines, with 4,762 oz. increase over June; Government Areas, with 1,645 oz. increase, and East Rand Proprietary Mines, with 1,218 oz. increase.

The native labor report for July shows that the gold mines of the Transvaal employed 166,999 natives, the collieries 14,688, and the diamond mines 1,246. These figures show a total decrease of 1,240 natives, as compared with June.

The South African Institution of Engineers held its monthly meeting on Aug. 10, when the newly elected president, R. C. Atkinson, gave his inaugural address. He is mechanical engineer to the Central Mining & Investment Corporation, known locally as "The Corner House." In his address, Mr. Atkinson dealt with industrial economics, the study of which he commended to the engineers and to the white workers, generally, on the mines and the reef. Among employees here, he said, the questions of more wages, fewer working hours, and holidays were continually to the front. The question of the amount of work done for wages paid or benefits received was not so much in evidence. He hinted at some of the results which were being achieved through the official investigations now being made on behalf of the industry into the actual running of rock drills underground. Drilling has been found, for example, to be the heaviest item of underground costs, averaging no less than 20 per cent of the whole, with shoveling and tramming second, at 15 per cent. These important trials are not yet complete, but the final results are likely to be published within the next twelve months. Alluding to the report of the Low Grade Mines Commission, the president was in favor of the removal of the color bar and declared his conviction that the white man would benefit mainly and ultimately by the adoption of this measure.

AUSTRALIA

Mount Morgan Appeals Against Assessment on Income Tax for Gold Premium

Melbourne, Aug. 22—The net premium earned during the last half year, after making necessary provision for contingencies, was £444,636, which represents £1 per oz. of standard gold (approximately £1 1s. 10d. per oz. fine) produced by members, as shown by mint certificates lodged with the association during the last accounting period. Of that amount £144,523 10s. was distributed as an interim payment on May 30, and the balance will be payable on Aug. 25.

During July, the association sold 89,888 oz. of standard gold (mint par value, £350,000) at an estimated average net price of £5 1s. 9. per oz., which is equal to £5 11s. per oz. fine. The average gross price quoted in London for the same month was £5 12s. 9d. per oz. fine.

The Mount Morgan Gold Mining Co., Ltd., has lodged an appeal against its assessment by the Queensland Commissioner of Taxes for income tax on gold premium, and the case will soon come before the Queensland court.

CANADA

British Columbia

Bond on Van Roi Property Relinquished—Ottawa Mill Running on Dump Ore

Silverton—Clarence Cunningham has relinquished the bond held by him on the Van Roi property.

Slocan City—The new mill at the Ottawa mine has been running on dump material since completion, with satisfactory results.

Nelson—The California Mining Co., controlling a considerable acreage of gold-bearing claims on Giveout Creek, made a test run of the remodeled Athabasca mill, which it has under lease, about the middle of September. It is believed that the plant will be able to handle about fifty tons per day, but some additional underground work will have to be done in the mine before that tonnage is continuously available.

Trail—Ore received at the Consolidated smelter during the week ended Sept. 14 totaled 5,115 tons. Shippers were as follows:

Name of Mine	Locality	Net Tons
Company Mines		4,981
Knob Hill	Republic	100
Providence	Greenwood	29
C. N. Trevitt	Republic	5

Ontario

Hollinger Increasing Milling Capacity—Ontario Kirkland's Mill Building Completed

Porcupine—The Hollinger is installing rolls at the shaft to follow the primary crushing. This will reduce the size of the material going to the stamps, and will increase their capacity. It is expected that with this additional installation the mill will be able to handle 4,000 tons per day. The company has declared a 1 per cent dividend, payable Oct. 7.

The Marsh mines is installing a mining plant, and will do underground development.

At the annual meeting of the McIntyre held in Toronto recently, the manager stated that, based on the first two months of the year, the present fiscal year would show a record for the company. The main shaft is down 1,750 ft., and a good grade of ore has been proved to persist to this depth.

Cobalt—The Oxford-Cobalt has decided to continue sinking No. 2 shaft.

At the annual meeting of the Temiskaming held recently it was stated that though the mine at Cobalt was nearly exhausted, the company's holdings in the Blue Diamond coal mine, in Alberta, pointed to a bright future. During July the Blue Diamond made profits of $14,433; in August they were $37,474. The present output is 1,100 tons per day, practically all of which is sold to the railway. This output can be substantially increased if the market improves.

The Reliance Lease will soon start shipping ore to the Bailey mill.

The Temiskaming Testing Laboratories, which was taken over in July by the Department of Mines from the T. & N. O. Ry. Commission, is handling a considerable amount of ore, and if this tonnage is maintained there is no reason to fear that this valuable enterprise will be lost to the mining industry of northern Ontario.

The report of the T. & N. O. Ry. Commission for the month ended Aug. 31 shows that only two cars of ore were shipped out of the camp over the railroad. This report, however, gives little information as to the real output of the camp, as the Nipissing and Mining Corporation ship nothing but bullion, and practically all of the O'Brien ore also goes out in the form of bullion. At the present time both the Coniagas and La Rose ore is being treated by the plant of the Mining Corporation, and the resultant product is shipped out in the form of bullion.

At the Frontier mine, in South Lorraine, good ore has been found on the 300 level.

Kirkland Lake—During August the Lake Shore milled 979 tons of ore, and recovered $42,274, or an average of $21.36 per ton.

It is reported that a promising surface discovery has been made on the LaBelle lode claims.

The Kirk Gold Mines, Ltd., has increased its capitalization from 2,000,000 shares to 4,000,000 shares of $1 par.

The Comfort-Kirkland is installing a new compressor, and has started to sink a shaft.

The Sylvanite is sinking a new shaft west of the old one, which was considered to be too small for the scale of operations that has been planned.

The mill building of the Ontario Kirkland is practically finished, and most of the machinery is on the ground. The company believes that it will be able to start producing by Jan. 1.

Teck-Hughes is making an addition to its mill, which will bring the capacity from 100 to 160 or 180 tons per day. The recovery, including New York premium, is in the neighborhood of $11 per ton, and the costs are approximately $6. It is understood that there is no possibility of the bond holders taking the property over.

Development work on the Argonaut property continues to be satisfactory. The company's mill was burned down some months ago, and it is not expected that rebuilding will start until winter, when timber can be obtained from the bush.

MEXICO

Sinaloa

San Jose de Gracia Mine Reported Sold to A. S. & R. Co.

Culiacan, Sept. 12—The San Jose de Gracia mine, in the Sinaloa district of the State of Sinaloa, is reported to have been purchased by the American Smelting & Refining Co. for $150,000. This property has a record of having produced a large amount of gold in the last twenty-five years. It is equipped with a 100-ton stamp mill and cyanide plant. An all-sliming process is used and a good extraction is made. This property was confiscated by the Carranza government in 1914. The government worked the property to full capacity as long as supplies and bonanza ore were in sight. When these began to run low it turned the property back to the owners, Tarriba and Paraza. Undoubtedly the mine was left in bad condition.

Mocorito — The Potrero Mining Co., in the Mocorito district, is working its ten-stamp mill at full capacity. This is a gold property.

The Palmarito Leasing Co., in the same district, is crosscutting from the 100 level of its three-compartment shaft. There is native silver at that depth, and the whole vein is running about 20 oz. silver. This ore carries only about 1 oz. in gold to 5,000 oz. in silver. It is planned to enlarge the mill to 500 tons' daily capacity. With the installation of a new power plant the company will eventually be one of the large silver producers of Mexico.

Badiraguate—The San Luis Gonzaga mine, in the Badiraguate district, which is under option to F. E. Avery and associates, of Columbus, Ohio, is continuing development work on a large scale. The company has developed water power and will soon install compressors and air drills. This property has been a large silver producer, and has large tonnage of milling ore available for treatment by a combination of flotation and cyanidation. E. B. Holt is manager.

Santiago de los Caballeros—The Los Tajos group of mines, in Santiago de los Caballeros, is under option to Eastern people who will soon begin examination, with a view to purchase. This mine was caved by the owner when he was obliged to leave the country on account of the revolution in 1912. It is claimed there is a large tonnage of high-grade silver ore, and because of the caving of the openings there is little likelihood of any of the high-grade having been stolen.

Santa Cruz de Ayala—In the district of Santa Cruz de Ayala, Sinaloa, Frank H. [illegible] and associates have installed a cyanide plant to treat about [illegible] tons of mill tailings. These tailings are residues from concentrates made in years past by the old West Coast Co. A good extraction is obtained by regrinding and treating everything as slimes.

Early recognition of the Mexican government is being anticipated by a number of reliable mining companies and individuals, which is evident in the number of new denouncements being made and of the properties being taken under option and actually bought outright by far-sighted investors.

Durango

Rich Ore Opened in San Juan de Mata Mine—Zalate Mine Sold

Copalquin—In the Copalquin district of extreme western Durango the San Juan de Mata mine, which was recently sold by the Rocha company, of Mexico City, to Filer & Innes, of San Francisco, is said to have opened up some wonderfully rich new orebodies. Development work and cleaning out of the old workings has been going on continuously since the option was taken early this year. It is said that the net valuation of the ore developed while cleaning up the workings is many times that of the price of the mine.

Tamazula — The Zalate mine, in the Tamazula district of western Durango, has been sold to Ramon Espinosa. This property has been held for a number of years by the commercial house of Wohler Bartning. The mine is one of the famous *antiguas*, and has produced millions of ounces of silver, mainly by the patio, amalgamation and chloridization processes. The shipping ore carries from 1,500 to 2,000 oz. silver, with a good ratio of gold, per ton. The mine has been abandoned for a number of years, but Mr. Espinosa has installed a boiler and modern pumping plant. This with the hoist installed will permit 40 to 50 tons of ore per day to be handled. Metallurgical experiments are being made to determine the best method of treating the milling ore.

The La Bajada mine, also in the Tamazula district, has recently been examined by the American Smelting & Refining Co., with a view to purchase. This is one of the largest mines in the district and is credited with a big production. The price on this property is not known.

The Providencia and Olvidada mines are under option to an English syndicate. These properties are in the Tamazula district, and are gold-copper producers.

ALABAMA

Iron Making Industry Showing Improvement—Seven Stacks in Blast, Twenty-Six or Twenty-Seven Normally

Birmingham—The general iron-making situation in Alabama may be said to be just beginning to show definite signs of improvement. Progress, however, toward normal will, it is generally conceded, be gradual unless material improvement is noted in present market conditions. There are in the state forty bituminous and coke pig-iron furnaces, which have in the past represented a possible annual output of [illegible] tons. Of this number there are twenty-seven stacks in and immediately contiguous to Birmingham. Four charcoal furnaces have been recently active under favorable conditions, none of them, however, being now in blast.

Of the forty coke furnaces, six or seven are probably permanently shut down, being either too small or definitely outclassed by reasons of location to be ever worked at a profit under the type of plant construction that is favored at present. Approximately thirty stacks therefore represent the present average maximum of capacity in the state, twenty-six or twenty-seven being the usual fair average of normal operations. The average daily capacity of these stacks is [illegible] tons, although some of the large and modern stacks of the Tennessee Coal, Iron & Railroad Co. at Ensley have made over 600 tons.

The seven stacks at present in blast probably represent recent increases in excess of approximately [illegible] per cent of normal output. Of this number, four are of the large modern type, being recently constructed furnaces of the Tennessee Coal, Iron & Railroad Co. at Ensley; two are similar modern furnaces belonging to the Woodward Iron Co. and situated at Woodward; and the seventh stack is the furnace of the Central Iron & Coal Co. at Holt, Ala.

During the period of inaction, relining and general repairing has been going on to some considerable extent, so that the general revival of the iron trade will probably find Alabama furnaces prepared immediately to make if not exceed their average annual output of pig iron.

Resumption of activity in the ore mines has naturally kept pace with furnace requirements.

The only definite announcement of the blowing in of new stacks is made by the Alabama company as to its No. 1 furnace at Gadsden, which is scheduled to resume operations on Oct. 1.

MINNESOTA

Cuyuna Range

New High-Grade Ore Reserves Discovered in Kennedy Mine

Cuyuna—An important new reserve of high-grade ore has been discovered in the Kennedy mine which will give this old Cuyuna Range property a much extended life. The new ore was discovered by drilling on the [illegible] level south from the present workings, and has been subsequently checked up by drilling. The [illegible]

[illegible]

W. [illegible] Crosby, and [illegible] of Duluth, are among the fee owners of the Kennedy. It has been operated since 1911 by the [illegible] Ore Co. and has produced a total of 2,022,275 tons. Captain G. A. Anderson is general superintendent.

The Rogers-Brown Ore Co. will ship a part of its 100,000 ton stockpile at the Kennedy mine, and will also make a small shipment from the Meacham mine stockpile. Both properties have been inactive for several weeks.

Crosby—The Inland Steel Co. took on a night shift of seventy men at its Armour No. 2 mine recently, and will push active mining up to the close of navigation. A demand has been made on the property for a considerable tonnage in excess of its yearly minimum requirements, which had already been mined and shipped.

Ironton—The Hillcrest mine has completed the shipment of 100,000 tons of iron ore and 15,000 tons of manganiferous ores and has suspended active operation for the season. The operators, Coates & Tweed, are planning to sink a new drainage shaft for the open pit and to do some check diamond drilling during the winter.

Daily shipments are being continued from the Mahnomen mine by Clement K. Quinn & Co. with one shovel. The Mahnomen produces both manganiferous and straight iron ore grades.

Trommald—The new washing plant of the Marquette Ore Co., which has been in operation for the past month at its Maroco mine, is reported to be giving excellent results. The Maroco orebody is the first deposit of wash ore to be worked on the lower horizon of the Cuyuna formation, and in consequence the operations at this property are being watched with interest by mining men of the district. Already exploration work is under way to locate extensions of this wash ore along the quartzite base of the formation. R. M. Adams, of the Adbar Development Co., is one of those most actively interested in drilling for wash ore.

Brainerd—A suit filed in the district court here against the Merritt Development Co. by the Dower Lumber Co. and various other lien claimants has been postponed from Sept. 20 to Oct. 1, to allow the defendant company to establish its right to being represented by a receiver. The defendants were the operators of the Merritt mines, at Trommald.

Mesabi Range

Railroad Spur To Be Built to Armstrong Bay Mine

Hibbing — In attempting to prevent serious seepage from Mud Lake to the Sweeney pit, the Oliver company has built several 4 to 6-in. siphons about 2,000 ft. long to lower the lake.

The Laura stockpile is being rapidly loaded, and daily shipments are being made

Virginia—The ore in stock at the Madrid mine is being shipped steadily.

Nashwauk — Additional stripping work has been started at the York mine.

The Patrick and Harrison concentrators, operated by Butler Bros., have increased their operations to double shifts. The Patrick is taking ore from the Patrick and Mace No. 2 mines, and the other is working on Harrison ore.

Ely — The stockpiles at the Oliver company's Pioneer and Zenith mines, operated by the Vermillion Mining Co., are being shipped to Two Harbors. Several other stockpiles in this district have been shipped. Most of the mines have been active part of the time this summer.

A contract has been let for building a four and one-half mile spur from the main line of the Duluth & Iron Range R.R. to the Armstrong Bay mine, of the Chippewa Iron Mining Co. The present plans call for laying the steel early next spring.

Mountain Iron — Operations at the Pitt Iron Mining Co.'s Wacootah mine have been resumed. Daily shipments of ore from the open pit are being made.

MICHIGAN

Gogebic Range

Oliver Company's Mines Working Eight Shifts Per month

Ironwood—Mining operations in this district continue at a low ebb. The mines of the U. S. Steel Corporation (Oliver Iron Mining Co.) are working eight shifts per month, and shipments from stockpiles are being made at a reduced rate. Most of the other large mines are shut down completely or are doing only development work. The Steel & Tube Co. recently started filling a 40,000-ton order from its stockpiles at the Anvil and Newport mines; otherwise there has been no work at these big properties. The Davis mine is shut down except for the work necessary in connection with the building of the electrical pumping plant on the 26th level. The pumps have all been taken underground and are now being erected, as is the electrical apparatus in the mine and on surface.

Menominee Range

Hanna Co. Drilling Judson's Unexplored Lands—Little Ore in Stock in Crystal Falls District

Iron River—The shipment of 50,000 tons of ore has been started from the Tully mine. A steam shovel is doing the loading from stockpile.

Alpha—The E. J. Longyear Co. has two drills at work for the M. A. Hanna Co. on lands owned by the Judson Land Co. When the Hanna interests took over the operation of the Judson mine an agreement was made that the former were to have first opportunity to drill the unexplored lands of the Judson company, with the privilege of leasing. It is known that an iron formation exists on the lands now being drilled, and the chances of finding commercial ore are considered good. The Judson is making regular shipments of ore from stock.

Amasa—The Palms-Book Co. is now putting down the second hole on lands under option near Amasa. A large tract was secured early in the year and is to be thoroughly tested. The first hole was put down 500 ft., the formation being encountered.

Crystal Falls—All ore in stock at the Carpenter is to be shipped. A shovel is now at work. New levels are being opened up underground. It is thought that mining will be resumed in the fall.

Ore was shipped from the Monongahela recently. Some underground work is being carried on at this property. The shaft is being trimmed down, and mining will be resumed when the repair work is completed.

The Balkan and Porter are both making shipments. It looks now as though little ore would be left in stock in the Crystal Falls field by the time navigation closes. This should encourage the operators to carry on mining work throughout the winter.

JOPLIN-MIAMI DISTRICT

Oklahoma-Kansas-Missouri

Labor Situation Fairly Satisfactory—Commerce M. & R. Co. Building New Mill—Several Properties Resume

Joplin — The labor situation is considered fairly satisfactory in the district. Although there is no surplus of helpers, it is felt that even such activity as is at present being enjoyed will give employment to all the miners who have remained in the district, and that there will be no suffering or hardships on account of unemployment during the coming winter. The operators would rather that there should exist a slight shortage in help than that there should be a surplus, as that would almost certainly bring distress to the field during the winter.

In referring to the recent transfer of the High Five mine, at Waco, in *Engineering and Mining Journal* of Sept. 10, p. 434, it was stated erroneously that "it is felt certain the Barnsdall people will *not* be able to co-operate with the American Zinc, Lead & Smelting Co. for this deeper drainage." This was exactly the opposite of what it was intended to say. That is, the negative should have been omitted. Our apologies are due the companies mentioned.

Picher—Construction of a new concentrator has been begun by the Commerce Mining & Royalty Co. on its lease a short distance north and east of the Vinegar Hill Zinc Co.'s Barr mine, in Kansas, north of Picher, Okla. Preliminary development has disclosed a good-sized orebody, and it is expected the mine will prove fully as good as the Commerce company's Webber mine, a short distance to the west, and the Blue Mound mine, also near by, which has been one of the district's bonanzas.

Baxter Springs—The Chanute Spelter Co. has almost completed construction of its new mill a mile north of its Hartley mill, west of Baxter

Springs, Kan., but it is understood the plant may not be started up before Jan. 1 if ore prices do not improve.

Several mines have started, the betterment in lead ore prices being the excuse. The Underwriters' Land Co. started its No. 2 mine, at St. Louis, Okla., on Sept. 19. The Skelton Zinc & Lead Co.'s No. 7 mill, its largest, and situated at Douthat, Okla., and the Fort Worth mill, at Picher, have been started in the last ten days. It is also understood that the Manhattan mine, owned by the United Zinc Smelting Co., in which Charles M. Schwab is interested, will be placed in operation soon.

ARKANSAS

Silver King Lead & Zinc Co. Operating Sure Pop No. 2

Yellville—The Silver King Lead & Zinc Co., which lately purchased the Sure Pop No. 2 mine, producing zinc carbonate, from W. E. Layton, of Yellville, has started operations on the property. The mine is on Water Creek, in Marion County, and during the period of high prices produced a good tonnage. The new owners have cleaned out the tunnels and overhauled the mill, and have it in operation. They will ship their output from Yellville.

Little Rock—The Arkansas Fuller's Earth Refining Co. is exploiting a deposit comprising about 1,500 acres of fuller's earth lands lying in Saline County, Ark., about twenty-three miles northeast of Hot Springs, Ark.

The deposits run in fissure veins, unlike other deposits in the United States. These veins are from 2 to 4 ft. thick, about one-half mile long, and at least 200 ft. deep, dipping at an angle of about 70 deg. southeast. The estimated tonnage will run around 5,000,000 tons at this depth. The property is opened by vertical shafts and crosscuts. Thus the method of mining fuller's earth in Arkansas differs considerably from the practice in Florida, Georgia, and Texas, where sedimentary deposits may be mined with steam shovels. The expense, however, amounts to about the same with the proper equipment.

SOUTH DAKOTA

Gold Feather Building Mill—Cutting Mining Co. To Resume Work

Deadwood—The Gold Feather Mining Co. has nearly completed excavations for a twenty-stamp mill. The equipment for the first unit of ten stamps is on the ground and this will be installed and in operation before Jan. 1. Amalgamation and concentration by Wilfley tables is the present plan for treatment. A cyanide annex will be added later. The mine, which adjoins the Monarch, is opened to a depth of about 150 ft. and most of the development has been done at this level. The ore occurs in the flat formation. Considerable ore has been shipped from the adjoining property in past years, and much of this was of high grade.

The Cutting Mining Co. has nearly completed plans for a resumption of work at its property near Lead, and development started on Oct. 1. Work was stopped a year ago when the water could not be handled by the equipment then on hand. New pumps will be placed, and the driving of laterals from the bottom of the 500-ft. shaft will be started.

The Golden Crest Mining Co. is continuing the development of its mine. A crosscut is being driven on the 200 level to tap the orebody. The cyanide plant will not be placed in operation until after Jan. 1.

UTAH

Tintic Standard To Pass Next Dividend To Provide Cash Surplus

Salt Lake City—Lead furnaces operating at Salt Lake Valley plants Sept. 20 were: United States company at Midvale, three lead and one furnace on matte concentration. A. S. & R., at Murray, two lead furnaces. International, at Tooele, closed down.

Pictures of Utah mining camps taken from an airplane will form a part of the state's exhibit at the coming meeting of the American Mining Congress, which will be held in Chicago during the week of Oct. 17 to 22.

Eureka—Shipments from the Tintic district for the week ended Sept. 17 amounted to 158 cars. Shippers were: Tintic Standard, 45 cars; Chief Consolidated, 35; Victoria, 12; Eagle & Blue Bell, 11; Dragon, 8; Centennial-Eureka, 5; Mammoth, 5; Swansea, 5; Bullion Beck, 4; Sunbeam, 3; Gemini, 2; Colorado, 3; Alaska, 2; and Tintic Drain Tunnel, 1.

The directors of the Tintic Standard, with a view to establishing a substantial cash surplus, have decided to pass the coming quarterly dividend. The mine is in excellent condition, producing a large tonnage of both first-class and milling ore, and the new mill is a success.

Park City—Shipments for the week ended Sept. 17 amounted to 3,927,620 lb. Shippers were: Silver King Coalition, 1,427,620 lb.; Judge allied companies, 1,096,930; Ontario, 923,130; and Naildriver, 480,000.

MONTANA

Anaconda Adding Men To Ease Unemployment Situation—Anselmo Mining Co. To Deepen Trifle Shaft

Butte—Drifting is under way on the [illegible] level of the Black Rock mine of the Butte & Superior Mining Co. on the recently opened copper ore and the results attained will govern the program for developing this orebody below the [illegible]. From 2 to 3 ft. of ore is showing on the [illegible] level, assaying from 7 to 8 per cent copper and from 8 to 9 oz. silver. The mineralized ground is wider than this, but the rest is lean and is being given no consideration except for the fact that there exists a chance that it may show improvement either with depth or by drifting. The deepest level at the Black Rock is the 2,600, and it will be necessary to drive about 800 ft. on this level to reach a point where the copper vein should be found, if it extends downward on what appears to be its present line of projection.

The Anaconda Copper Mining Co. is putting more men to work, but it is explained that this is a measure to help relieve the unemployment situation and does not reflect any improvement in the copper situation. The company is continuing its repair work, particularly at its smelters. The Great Northern Ry. Co. has started repair work on the ore cars employed in transporting ores from Butte to Great Falls. The first shipments on the recently announced 10,000,000-lb. wire order received by Anaconda from the Pacific Gas & Electric Co., of San Francisco, have been made.

The Anselmo Mining Co., back of which are the Beer, Sondheimer interests, will sink its Trifle shaft from the 1,200 to the 1,700 level. This property is on the western edge of the Butte district proper, and is fairly close to the larger producers. Good ore has been found on the 1,200 level. It is in this territory that the Anaconda company, on its 2,800 level of the West Gagnon, has opened a body of copper ore in a vein which nearer the surface shows silver-zinc-lead ore. The change has encouraged the Anaconda to continue its exploratory work. The Beer, Sondheimer and the Anaconda companies are working in conjunction and sharing the territory north and east of the Anselmo's property.

Installation of an electrically operated hoisting plant at the shaft of the West Butte company is well under way. An air compressor is in position.

WASHINGTON

Rich Ore Found at Old Dominion Mine

Colville—W. H. [illegible], manager of the company developing the Old Dominion mine, near here, reports an important strike of silver ore assaying as high as 1,140 oz. of silver over a width of 3 ft. This strike has just been made on the [illegible] level. Twenty years ago the Old Dominion mine was the best known property in Washington, and produced over [illegible] in high-grade silver ore. During the early history of the mine it was so extraordinarily rich that the first ore was freighted 100 miles to Spokane on pack horses. Later a railroad was built within [illegible] miles of the property. This encouraged the erection of a concentrator, and the mine was profitably operated for a number of years.

[illegible] and it has been generally supposed that the property was worked out. Two years ago Mr. [illegible] took over a lease on the property and began new exploration work. He has recently made several shipments of ore, and if the new strike holds out the mine will come to the front as a profitable producer.

THE MARKET REPORT

Daily Prices of Metals

Sept.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
22	12@12.125	26.625	26 875	4.65@4.70	4.45	4.175@4.20
23	12@12.125	26.625	26.875	4.70	4.45	4.20@4.25
24	12@12.125	26.625	26.875	4 70	4.45	4.25
26	12.125	26.625	26.875	4.70	4.45@4.50	4.25@4.30
27	12 125	26.50	26.75	4 70@4.75	4.45@4.50	4 35@4.40
28	12.125@12.25	26.125	26.50	4.70@4.75	4.45@4.50	4.40

*These prices correspond to the following quotations for copper "delivered": Sept. 22, 23 and 24, 12.25@12.375c ; 26, and 27, 12 375c. ; 28, 12.375@12.50c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Sept.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
22	67⅝	68½	72	156⅛	158⅛	22¾	22⅝	25¼	25⅝
23	67¾	68¼	72	156¼	158¼	22¾	22½	25⅜	25¾
24	...	...	...	....	....	...	...	..	..
26	68	68¾	72½	157½	159¾	23¼	23	25⅝	26⅛
27	68	68¾	72½	157⅛	159¼	23⅛	22⅞	26	26½
28	68⅜	69¼	72½	156½	158½	23	23	26¾	26¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver			Sept.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York, Foreign Origin	London
22	372½	99¼	68⅝	41⅛	26	372	99¼	68⅝	41¾
23	373¼	99¼	68¾	41½	27	372¼	99¼	71⅝	43⅜
24	372½	99¼	68⅝	41½	28	372¾	99¼	71⅜	43⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, Sept. 28, 1921

Conditions in the non-ferrous metal market continue to improve. Producers are optimistic and believe that the gradually increasing prices, which are general, are not merely a flurry but will persist. Copper, lead, and zinc are all firm, and producers show no inclination to cut prices to attract business, for they feel that waiting will now redound to their advantage. Silver has advanced rapidly in the last two or three weeks, the jump of 3c. yesterday being startling. A reaction is not unexpected. The tendency is likely to continue upward, and for some of the metals, such as zinc, which has long been depressed, would be particularly well deserved.

Copper

Few of the large producers are selling any copper except through the Copper Export Association, for they are keeping their prices just ahead of an advancing market. Some are willing to sell at 12.50c. delivered, but they may possibly withdraw from the market when business can be booked at this figure. Some of the smaller interests who have been willing to sell in the neighborhood of 12.375c. delivered have done a fair amount of domestic business, and inquiries have been numerous. We believe November copper is now unobtainable under 12.50c. Export demand has been of fair volume, but Germany continues a poor customer, owing to disturbed financial conditions in that country. France and Japan have taken small lots. The price in general has ranged between 12.50 and 12.75c., c.i.f. European ports.

We believe that copper has taken a definite turn for the better and that the present movement is not a flurry such as occurred in May. (See the curve on page 559). Surplus stocks of refined copper are probably not as great as is generally considered, and stocks of scrap brass have also been depleted to such an extent that prompt supplies are difficult to obtain, and the quality is becoming poorer. Brass makers have contracted for important tonnages of copper in the last week or two; newspaper reports have minimized rather than exaggerated this demand. Too much must not be expected from foreign buyers, however, and a somewhat limited export demand for some time to come is likely. Germany is in no position to take much copper until financial conditions have been straightened out. We expect a gradually increasing price level for copper and believe that consumers will make no mistake in laying in moderate stocks at current levels.

Lead

The American Smelting & Refining Co. again advanced its official contract price on Thursday, Sept. 22, from 4.65 to 4.70c.

Business has been of about the same volume as during the last few weeks. Most of the inquiries are for prompt supplies, and one or two producers are out of the market. Outside dealers in small lots of spot metal are demanding 5 to 10 points premium. The market in the St. Louis District is comparatively quiet, particularly for chemical and the poorer grades of desilverized. Corroding lead is in more active demand. Producers continue disinclined to quote on later deliveries than November, but in cases where they do, slight premiums are being asked. It is reported that the lead market is firm in Europe. Spanish supplies have been curtailed somewhat by labor troubles.

Zinc

The market has shown an improvement of about one-quarter cent during the week, owing to the greater demand from galvanizers. The Pittsburgh iron and steel industries are reported to be in better condition, and running about 60 per cent of capacity, with comparatively small stocks of zinc on hand. The market is looking stronger than for many weeks, and producers generally are refraining from doing anything which would disturb the upward trend of prices. It is felt that stocks of zinc are generally in strong hands, and that the market will not collapse as easily as it has in the past, because of the forced disposal of weakly held stocks. High grade zinc has been sold in larger quantities at unchanged prices—6c. per lb. delivered.

Tin

The tin market has been devoid of interest most of the week, though there was mild activity on one or two days. The price remained at almost a constant figure. Most inquiries are for forward delivery, though there is no great accumulation of spot metal. About 1,500 tons are due in the next few days on two boats, but most of this is already sold. Tin-plate business is gradually improving. Forward deliveries are quoted at the same prices as spot to ½c. higher. The supplies of 99 per cent grade continue to be largely in the hands of one interest.

Arrivals of tin, in long tons: Sept. 20th, Australia, 10; 22d, London, 275; 26th, London, 25; Straits, 40.

Gold

Gold in London: Sept. 22d, 110s. 11d.; 23d, 110s. 9d.; 26th, 110s. 11d.; 27th, 110s. 11d.; 28th, 110s. 11d.

Foreign Exchange

German marks continue to be the center of interest in the foreign exchange market. On Tuesday, Sept. 27, francs were 7.13c.; lire, 4.13c.; and marks, 0.8125c. New York funds in Montreal, 10$\frac{5}{16}$ per cent premium. Sterling cables continue to be quoted one-half cent higher than the figure given on page 556.

Silver

Buying by China and the Indian bazaars advanced the price of silver on the 27th to a new high level for the year—London quoting 43¾d. and New York 71⅛c. At these rates buyers were satisfied, and silver reacted slightly in consequence. However, with Eastern exchanges firm, the market is likely to fluctuate near present levels, although the speculative nature of operations creates an uncertain tendency.

Mexican Dollars—Sept. 22d, 52⅞; 23d, 52⅞; 24th, 52⅞; 26th, 52⅞; 27th, 55¼; 28th, 55.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 18@20c. per lb.; 18½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 4.60@4.70c., market dull. W.C.C. brand, 5¼@5¾c. per lb. Cookson's "C" grade, spot, 9c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6¾@7c.

Bismuth—$1.50@$1.55 per lb.

Cadmium—Range $1@$1.10 per lb., in 1,000 lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb., black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $150@$170 per oz.

[1]**Molybdenum Metal** — In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominal, $55@$60 per oz.

Platinum—$78 per oz. Market firm, but trading light.

Quicksilver—Market weaker at $40@$42 per 75-lb. flask. Largely a jobbing business. San Francisco wires $43.75. Dull.

[1]**Rhodium**—$150 per troy oz.

Selenium — Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $25@$26; ground, $28; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—20@22c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 50c. per lb. of contained sulphide, New York. Quotation purely nominal.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 2 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

Zircon—Washed, iron free, 3c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 24—Zinc blende per ton, high, $23.50; basis 60 per cent zinc, premium and Prime Western, $21; fines and slimes, $19@$17; average settling price, all grades of zinc, $21.48.

Lead, high, $61.50; basis 80 per cent lead, $60@$61; average settling price, all grades of lead, $56.53 per ton.

Shipments for the week: Blende, 5,927; lead, 1,303 tons. Value, all ores the week, $20[illegible]. Shipments for nine months: Blende, 197,740; calamine, 102; lead, 43,900 tons. Value, all ores nine months, $5,922,410.

Sellers endeavored to maneuver the market up a dollar per ton, but buyers would offer no higher than prices current a week ago, and 6,200 tons sold on $21 basis for practically all but fines and slimes. Shipments are now about consuming the weekly production.

Platteville, Wis., Sept. 24—No sales of zinc or lead ore. Shipments for the week none. Shipments for the year: Blende, 8,461, lead ore, 1,171 tons. Shipped during the week to separating plants, 665 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,500@$2,000; No. 2, $850@$1,250; spinning fibers, $350@$850; magnesia and compressed sheet fibers, $[illegible]@$400; shingle stock, $95@$110; paper stock, $[illegible]@$70; cement stock, $16@$27.50; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton and Black Lake mines, Quebec, Canada.

Barytes—Crude, 88 to 94 per cent barium sulphate, $10@$12 per net ton; ground (white) $24@$28 in bags, carload lots; (off color) $21@$22 in bags, carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $[illegible] per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude crushed $8@$10 per long ton, f.o.b. Cartersville, Ga.

Bauxite—French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $[illegible] per gross ton, f.o.b. shipping point.

Borax—Granulated, crystals or powdered, in bags, carloads, 7c. per lb., in bbls. [illegible]

Chalk—English, extra light, 5c. Domestic, light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

---

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

China Clay (Kaolin)—Crude, $6.50@$8.50; washed, $9@$10; powdered, $13@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $25@$30, f.o.b., quoted at New York.

Emery—Turkish emery, 6@6½c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b., from New England points.

Feldspar—No. 1 soap grade, $7@$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, $6@$6.50; No. 2, $5@$5.50. Market dull. Large stocks are available and quotations are nominal. Producers report cancellations of orders. No. 1, Canadian, ground, $26 f.o.b. cars.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; lump, $12.50, f.o.b. Lordsburg, N. M. Ground, acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, ¾@2⅛c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $45@$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (**Magnesite brick—See Refractories.**)

Mica — India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $11.65; 75 per cent, $10.65; 75@74 per cent, $10.15; 70 per cent, $6.25; 68 per cent, $5.75; 68@66 per cent, $5.50.

Pumice Stone — Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 13c.; Spanish lump, 13@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic; $18@$20 for export, f.o.b. Texas and Louisiana mines.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $7.50@$11 per ton; less than carload, $25, f.o.b. cars. Imported, $30@$40; Canadian, $18@$40 per ton.

Mineral Products

Arsenic—5¾c. per lb.

Sodium Nitrate—$2.30@$2.40 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $12.50 per ton, f.o.b. in bulk, Western mines, spot and six months' contract; $20@$22 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.20 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 11½c. per lb. of chromium contained; 4 to 6 per cent carbon, 11@12c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $60@$63, f.o.b. furnace; resale, $90, delivered; English, $60@$63, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $25@$26, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.25 per lb. of contained metal, f.o.b. works. Imported material, $1.70@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $38@$40; 50 per cent, $60@$65; 75 per cent, $130@$135.

Ferrotungsten—Domestic, 70 to 80 per cent W, 40@45c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$4.25@$4.50 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 19.50c. per lb.; wire, 13.75c.

Lead Sheets—Full lead sheets, 7¾c.; cut lead sheets, 8c. in quantity, mill lots.

Nickel Silver—29.50c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets, 16.25c.; sheathing, 15.25c.; rods, ⅝ to 3 in., 13.25c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $50 per ton; 76 per cent, $90@$95 f.o.b. works.

Chrome Cement — 40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—$52@$55 per net ton.

Fire Brick—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $65@$70 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000; $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Sept. 27, 1921

The advance of $5 a ton in sheet prices by the American Sheet & Tin Plate Co. (Steel Corporation), predicted last week, was made effective on Sept. 22, practically all the independents having previously advanced. The new prices are: Blue annealed, 2.50c.; black, 3c.; galvanized 4c.

Bars, shapes and plates have been steady for several weeks at about 1.65c., with slight concessions on large orders, and the price may soon take a turn for the better. The best demand is for the lighter products, and thus ingot production does not increase greatly, being now about 35 per cent of capacity. A rate of between 40 and 50 per cent is likely to obtain in the last quarter of the year.

Pig Iron—The market is quiet but firm, and the next buying of any consequence is likely to advance prices a trifle. The market stands at $20 for bessemer, $19@$20 for basic, and $21 for foundry, f.o.b. Valley furnaces.

Steel—Billets are nominal at $30. Several mills have announced an advance in sheet bars from $30 to $32.50, and others are expected to follow, this being predicted on the sheet advance.

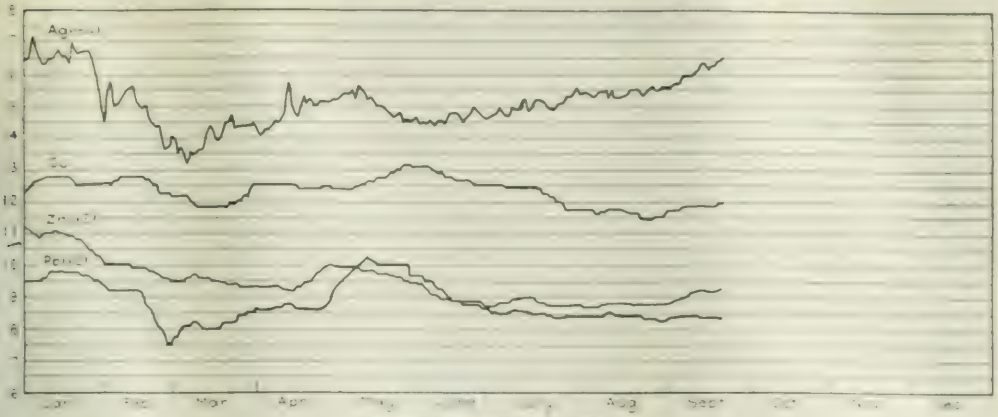
Coke

Connellsville—Furnace, $3.25@$3.50; foundry, $4.25@$4.50.

---

[1] Foote Mineral Co., Philadelphia, Pa.

1921 Prices of New York Copper, Silver, Lead, and St. Louis Zinc



Ore and Metal Movements for August, 1921

IMPORTS, AUGUST, 1920, AND AUGUST, 1921

(In Pounds Unless Otherwise Stated)

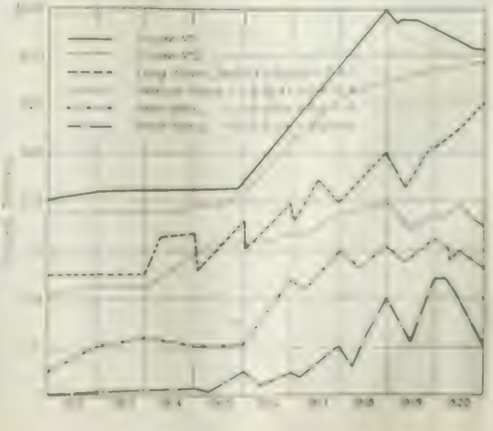
	[illegible]	[illegible]
[illegible] ore, contents	[illegible]	
[illegible]	2,570,743	2,718,285
[illegible]	[illegible]	2,563,467
Copper		
[illegible]	5,752,146	6,834,291
[illegible] contents.....	5,287,911	2,300,197
[illegible]	130,588	1,753,938
[illegible]		
[illegible]	[illegible]	457,428
[illegible]	3,831,447	61,674
[illegible]	2,134,787	723,209
[illegible]	4,123,917	2,726,241
[illegible]	203,257	5,828,650
[illegible]	17,971,202	12,574,740
[illegible]		
[illegible]	[illegible]	12,124
[illegible]	1,844,706	320,486
[illegible]	4,905,979	1,604,588
[illegible]	[illegible]	4,122,415
[illegible]		271,916
[illegible]	[illegible]	5,662
[illegible]	[illegible]	385,307
Lead		
[illegible]	1,500,484	5,151,595
[illegible]	5,139,435	7,819,123
[illegible]		
[illegible]	745,597	4,432,747
[illegible]	5,873,237	8,301,796
[illegible]	21,085	236,175
[illegible]	7,403,826	3,254,013
[illegible]		
[illegible]	[illegible]	3,254,013
[illegible]	445,861	
[illegible]	3,474,142	
[illegible]	28,900	
[illegible]	664	
[illegible]	[illegible]	28,939
[illegible]		
[illegible]	[illegible]	
[illegible]	88,776	[illegible]
[illegible]	4,900	
[illegible]	131	[illegible]
[illegible]	48,832	10,892
[illegible]		
[illegible]	19,201	10,892
[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	5,200,504
[illegible]		
[illegible]	[illegible]	2,138,972
[illegible]	[illegible]	2,836,434
[illegible]	[illegible]	225,098
[illegible]	181,440	
[illegible]		
[illegible]	[illegible]	26,228
[illegible]		
[illegible]	166,162	
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	

EXPORTS OF COPPER, LEAD AND ZINC

	[illegible]	[illegible]
[illegible]		
[illegible]	61,437	[illegible]
[illegible]	[illegible]	41,249,258
[illegible]		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]
[illegible]		[illegible]
[illegible]	2,882,617	[illegible]
United Kingdom	[illegible]	1,234,428
[illegible]	2,961,714	[illegible]
[illegible]		[illegible]
Other countries	1,510,977	6,274,452
[illegible]	[illegible]	[illegible]
[illegible]		1,136,766
[illegible]	123,907	
[illegible]	653,994	75,602
[illegible]	3,901,891	164,406
[illegible]	2,056,285	[illegible]
Lead		
[illegible]		
[illegible]	187,057	90,804
Produced from foreign ore.	[illegible]	6,086,575
[illegible]		
[illegible]		[illegible]
[illegible]	[illegible]	6,013
[illegible]	[illegible]	224,202
[illegible]	[illegible]	
[illegible]		448,[illegible]
[illegible]	[illegible]	[illegible]
Zinc		
[illegible]	82,100	1,832
[illegible]	16,268,344	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		
[illegible]		[illegible]
[illegible]	[illegible]	[illegible]
[illegible]		[illegible]
[illegible]	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]

Asbestos Price Curves

The following copyrighted curves, published by permission of Asbestos & Mineral Corporation, New York, show how greatly the various grades of asbestos have fluctuated in price during the war and after.



MINING STOCKS

Week Ended September 24, 1921

Stock	Exch.	High	Low	Last	Last Div.	
			COPPER			
Ahmeek	Boston	47	46½	47	Sept. '20, Q	$0 50
Alaska-Br. Col.	N. Y. Curb	*43	*32	*40		
Allouez	Boston	†19½	†18	19	Mar. '19	1 00
Anaconda	New York	38½	36¼	38⅛	Nov. '20, Q	1.00
Arcadian Consol.	Boston	1¼	1½	1⅜		
Ariz. Com'l.	Boston	8¼	8	8⅛	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*27	*20	*23		
Bingham Mines	Boston	12¼	11¼	11⅝	Sept. '19, Q	.25
Calumet & Arizona	Boston			45½	June '21 Q	50
Calumet & Hecla	Boston	238	230	230	June '20, Q	5.00
Canada Copper	N. Y. Curb	*36	*30	*32		
Centennial	Boston	8½	8½	8½	Dec. '18, SA	1.00
Cerro de Pasco	New York	26¼	25½	26¼	Mar. '21, Q	.50
Chile Copper	New York	11⅛	10¼	10⅞		
Chino	New York	23¼	23	23¼	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*17½	*17½	*17½		
Con. Arizona	N. Y. Curb			*1	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	*1 5/16	*1	*1¼		
Copper Range	Boston	34½	33	33½	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*27	*23	*23		
Davis-Daly	Boston	6⅞	6¼	6½	Mar. '20, Q	.25
East Butte	Boston	9¼	9	9	Dec. '19, A	.50
First National	Boston Curb	*75	*55	*75	Feb. '19, SA	.15
Franklin	Boston	1¾	1¼	1⅝		
Gadsden Copper	Boston Curb	*45	*45	*45		
Granby Consol.	New York	18¼	16	17	May '19, Q	1.25
Greene-Cananea	New York	21½	21½	21½	Nov. '20, Q	.50
Hancock	Boston	†3	†2½	2		
Howe Sound	N. Y. Curb	2½	2¼	2¼	Jan. '21, Q	05
Inspiration Consol.	New York	34¼	33⅜	34¼	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6½	6½	6½	Sept '20, K	.25
Isle Royale	Boston	19½	19	19⅜	Sept. '19, SA	.50
Kennecott	New York	20¼	19⅞	20¼	Dec. '20, Q	.50
Keweenaw	Boston	*98	*98	*98		
Lake Copper	Boston	†2¼	†2⅛	2¼		
La Salle	Boston	†2	†1½	1½		
Magma Chief	N. Y. Curb	*4	*3	*3		
Magma Copper	N. Y. Curb	*21¼	*20	*21¼	Jan. '19, Q	.50
Majestic	Boston Curb			*8		
Mason Valley	Boston	1¾	1¼	1¾		
Mass Consolidated	Boston	1¾	1¾	1⅝	Nov. '17, Q	1.00
Miami Copper	New York	21½	20	21¼	Aug. '21, Q	.50
Michigan	Boston	†2	†1¼	1½		
Mohawk	Boston	50	48¼	50	Nov. '20, Q	1 00
Mother Lode Coa.	N. Y. Curb	4¼	3⅞	4⅛		
Nevada Consol.	New York	11¼	10¾	11	Sept. '20, Q	.25
New Baltic	Boston Curb			3		
New Cornelia	Boston	14	13½	13¾	Aug. '20, K	.25
North Butte	Boston	10	9¼	9½	Oct. '18, Q	.25
North Lake	Boston	†*50	†*25	*25		
Ohio Copper	N. Y. Curb			*6		
Old Dominion	Boston	23½	21½	23	Dec. '18, Q	1 00
Osceola	Boston	26⅛	25	26	June '20, Q	.50
Phelps Dodge	Open Mar.	†1 60	†1 45		July '21, Q	1 00
Quincy	Boston	36	36	36	Mar. '20, Q	1 00
Ray Consolidated	New York	13	12	13	Dec. '20, Q	25
Ray Hercules	N. Y. Curb	*20	*15	*20		
St. Mary's Min. Ld.	Boston	38	35	38	June '20, K	2 00
Seneca Copper	Boston			13½		
Shannon	Boston	*90	*90	*90	Nov. '17, Q	.25
Shattuck Arizona	New York	6½	6½	6½	Jan. '20, Q	25
South Lake	Boston	†1½	†*50	1		
Superior & Boston	Boston	1½	1½	1½		
Tenn. C. & C. cfs.	New York	8⅛	8	8⅛	May '18, I	1.00
Tuolumne	Boston	*40	*40	*40	May '13	.10
United Verde Ex.	Boston Curb	27	23½	25	May '21, Q	25
Utah Consol.	Boston	3½	3¼	3½	Sept '18	.25
Utah Copper	New York	50⅞	48⅞	49	June '21 Q	50
Utah Metal & T.	Boston	1¼	1	1½	Dec. '17	30
Victoria	Boston	†1¾	1¼	1⅛		
Winona	Boston	†*50	†*45	*45		
Wolverine	Boston	12	12	12		
			NICKEL-COPPER			
Internat. Nickel	New York	14	13½	13	Mar. '19	50
Internat. Nickel, pf.	New York			80	Aug. '21, Q	1 50
			LEAD			
National Lead	New York	75½	75	75½	June '21, Q	1 50
National Lead, pfd.	New York	102	102	102	Sept '21, Q	1 75
St. Joseph Lead	New York	12⅛	11⅞	12⅛	Sept. '21, Q	25
			QUICKSILVER			
New Idria	Boston	†*50		*50		
			ZINC			
Am. Z. L. & S.	New York	8½	8	8⅜	May '20	1 00
Am. Z. L. & S. pfd.	New York			26¼	Nov. '20, Q	1 50
Butte C. & Z.	New York	4⅞	4½	4¼	June '18	50
Butte & Superior	New York	14	13	14	Sept '20	1 25
Callahan Zn-Ld.	New York	4⅛	3½	4⅛	Dec. '20, Q	50
New Jersey Zn.	N. Y. Curb			115	Aug. '21, Q	2 00
Success	N. Y. Curb			2	July '16	03
Yellow Pine	Los Angeles			*55	Sept. '20, Q	03
			GOLD			
Alaska Gold	New York	½	⅜	⅜		
Alaska Juneau	New York	1½	1	1		
Carson Hill	Boston	14¼	13¼	14⅛		
Cresson Consol. G.	N. Y. Curb	1¼	1½	1 9/16	June '20, Q	$0.10
Dome Extension	Toronto	*75	*65	*75		
Dome Mines	New York	20¼	17¾	20	July '21, Q	.25
Florence Goldfield	N.Y. Curb	*41	*38	*40		
Golden Cycle	Colo. Springs	*68½	*67	*67½	June '21, Q	.02
Goldfield Consol.	N. Y. Curb			*6	Dec. '19	05
Hollinger Consol.	Toronto	7 50	7 35	7 45	Sept. '21, 4 wks.	.05
Homestake Mining	New York	58	56⅞	57¼	Aug. '21, M	.25
Kirkland Lake	Toronto	*35	*30	*31		
Lake Shore	Toronto	1 35	1 29	1 35	Aug. '21, K	.02
McIntyre-Porcupine	Toronto	1 98	1 93	1.98	Sept. '21, K	05
Porcupine Crown	Toronto	*17½	*15	*17½	July '17	.03
Porcupine V. N. T.	Toronto	*19	*16	*19		
Portland	Colo. Springs	*35	*34	*34	Oct. '20, Q	01
Reorgan. Booth	N. Y. Curb			*4	May '19	05
Schumacher	Toronto	*25	*21	*25		
Silver Pick	N. Y. Curb	*10	*9	*9		
Teck Hughes	Toronto	*16½	15	*16½		
Tom Reed	Los Angeles	*73	*63	*70	Dec. '19	.02
United Eastern	N. Y. Curb	2¼	2¼	2⅜	July '21, Q	15
Vindicator Consol.	Colo. Springs	†*25	†*20		Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*4	*2	*4		
Yukon Gold	N. Y. Curb	*85	*80	*81	June '18	02½
			SILVER			
Arizona Silver	Boston Curb	*20	*18	*19	Apr. '20, M	03
Batopilas Mining	New York	¼	½	⅜	Dec. '07, I	12½
Beaver Consol.	Toronto	*27	*25	*26½	May '20, K	.03
Comagas	Toronto	1 65	1 64	1 65	May '21, Q	12½
Crown Reserve	Toronto	*12	*8	*11	Jan. '17	05
Kerr Lake	N. Y. Curb	3⅝	3½	3⅝	July '21, Q	.12½
La Rose	Toronto	*32	*31	*32	Apr. '18	.02
McKinley-Dar.-Sav.	Toronto	*22	*16	*19½	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1 14	1 00	1 05	Sept '20, Q	.12½
Nipissing	N. Y. Curb	5	4½	5	July '21, Q	.15
Ontario Silver	New York	4¼	4	4¾	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb			*11	Jan. '12	.10
Temiskaming	Toronto	*25			Jan. '20, K	.04
Trethewey	Toronto	*12	*10½	*12	Jan. '19	.05
			GOLD AND SILVER			
Barnes-King	Butte			60	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	*86	*73	*86		
Cash Boy	N. Y. Curb	*5	*5	*5		
Consol. Virginia	San Francisco	*37	*34	*37		
Dolores Esperanza	N. Y. Curb	1⅞	1¼	1⅞		
El Salvador	N. Y. Curb	*17	*14	*15		
Jim Butler	N. Y. Curb	*7	*7	*7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*4	*3	*3	June '16	.05
Louisiana Con.	N. Y. Curb			⅛		
MacNamara M. & M.	N. Y. Curb	*15	*13	13	May '10	02
N. Y. Hond. Rosar.	Open Mar.			4	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1½	1⅛	1⅛	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*67	*54	*62		
Tonopah-Extension	N. Y. Curb	1½	1 7/16	1 7/16	July '21, Q	.05
Tonopah Mining	N. Y. Curb	1 3/16	1 3/16	1 3/16	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	*87	*80	*86	Dec. '19, SA	.05
			SILVER-LEAD			
Caledonia	N. Y. Curb			*7	Jan. '21, M	01
Cardiff M. & M.	Salt Lake	†1 15	†1 00	1 07½	Dec. '21	15
Chief Consol.	Boston Curb	2⅜	2¼	2¼	Aug. '21, Q	05
Consol. M. & S.	Montreal	15	15	15	Oct. '20, Q	62½
Daly Mining	Salt Lake	†2 00	†1 25	...	July '20, Q	.10
Daly-West	Boston	†2⅛	†2¼	2⅛	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb			2	Apr. '21, K	.05
Electric Point	Spokane	*7	*6	*6½	May '20, SA	03
Eureka-Croesus	N. Y. Curb	*37	*30	*33		
Federal M. & S.	New York			7	Jan. '09	1.50
Federal M. & S., pfd	New York	22½	22½	22½	Sept. '21, Q	1.00
Florence Silver	Spokane			*10	Apr. '19	.01½
Grand Central	Salt Lake		†*15	....	June '20, K	.03
Hecla Mining	N. Y. Curb	4 3/16	4	4 3/16	June '21, Q	.08
Iron Blossom Con.	N. Y. Curb	*18	*17	*18	Apr. '20, Q	02½
Judge M. & S.	Salt Lake	†3 00		....	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*3	*3	*3	June '21, I	.02
Prince Consol.	Salt Lake	*8½	*6¾	*6¾	Nov. '17	02½
Rambler-Cariboo	Spokane	*2½	*2	*2	Feb. '19	.01
Rex Consol.	N. Y. Curb	*9	*7	*9		
South Hecla	Salt Lake	†*35			Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb			*8	Oct. '17	.05
Stewart Mining	N. Y. Curb	*3	*3	*3	Dec. '15	.05
Tamarack-Custer	Spokane	1 65	1 60	1 60	Jan. '21 K	.04
Tintic Standard	Salt Lake	1 87½	1.60	1 85	July '21, Q	.05
Utah Apex	Boston	2¼	2¼	2⅜	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb			*2	Nov. '17	.01
			VANADIUM			
Vanadium Corp.	New York	33⅞	30	32¼	Jan. '21, Q	1 00
			ASBESTOS			
Asbestos Corp.	Montreal	48	44½	48	July '21, Q	1 50
Asbestos Corp., pfd.	Montreal			69	July '21, Q	1 75
			MINING, SMELTING AND REFINING			
Amer. Sm. & Ref.	New York	37	35½	36¼	Mar. '21, Q	1 00
Amer. Sm. & Ref. pf.	New York	72	70⅛	72	Sept. '21, Q	1.75
Am. Sm. pf. A	New York	66¼	66	66	July '21, Q	1 50
U. S. Sm. R. & M.	New York	32½	30	32½	Jan. '21, Q	.50
U.S.Sm. R. & M. pf.	New York			40	July '21, Q	87

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. [illegible]
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
[illegible]
Consulting Editors

Volume 112 New York, October 8, 1921 Number 15

The Outlook for Our Mineral Industries

ARE INDUSTRIAL CONDITIONS IMPROVING? More particularly, have the mineral industries passed through the worst of the depression? These questions can be answered in only a qualified way. Without a doubt some manufacturing industries are on the mend, and as all forms of activity use minerals and metals in some way, an improved demand for them will be, or is, evident. The number of idle freight cars is less than it was; the stock market shows indications of having passed the low point, though of this we cannot yet be sure; wage levels are slowly but surely coming back to normal; retail prices are still excessively high, but they are coming down; and commodity prices are becoming more stable. All of these are good signs, and there are others.

Metal prices were among the first to be reduced, and in many cases, as with copper, zinc, tin, antimony, and aluminum, the depression has carried prices below pre-war figures. With such early and complete deflation it is only fair to expect that these raw materials should be among the first to show an improvement with a return to normal industrial conditions. Why, then, have not metal prices already shown more of an upward tendency? To answer this it will be best to consider each metal separately.

Silver and lead are the only two important non-ferrous metals which have at no time since the Armistice been produced much faster than they have been sold. Consequently, no large surplus stocks have accumulated. In fact in the case of silver, the Pittman Act has had just the opposite effect from that of a surplus. It might be considered a sink hole in which 207,000,000 oz. must be placed which will never come upon the market. Silver then should have been the first to respond to the better feeling, and looking back over metal prices for the year we find that this has been the case. The low price of silver of 52½c. was reached on March 5. Except for a reaction in May, there has been a constant rise since that time until Sept. 22, when a sudden spurt upward occurred. There may be a slight reaction but probably not a permanent one. We are, of course, referring to silver of foreign origin, for domestic silver is all being taken by the U. S. Government at the same price at which an equal amount was released during the war.

Lead is in the next best position. No stocks have accumulated, and with manufacturers of lead products showing increased activity the lead market is firm, and prices are slowly going up. The low figure of 3.7[illegible] was passed seven months ago. No violent advance is expected, for consumers are buying only as their needs arise, from month to month. Lead producers have little cause for worry. Their business should be increasingly profitable, and most of them are also benefited by the satisfactory price of silver.

The remaining three major non-ferrous metals, copper, zinc, and tin, are all suffering from the same malady—overproduction during the last three years. Until the surplus metal so accumulated can be marketed, there is little likelihood of a satisfactory price level being reached. Copper is in possibly the best position of the three, because of a violent cut in production and the funding of 400,000,000 lb. for export over a period of four years.

Regarding the copper surplus, our guess, and it is an uninspired one, is that stocks of refined and blister now amount to 900,000,000 lb. They should normally be slightly under 400,000,000 lb., thus leaving 500,000,000 to be sold. Of this, however, 300,000,000 will be taken care of in the last three years in which the funding plan of the Copper Export Association operates, from February, 1922, on. This leaves only 200,000,000 lb. to be marketed before a gradual resumption of copper mining and a return to more normal conditions will be indicated.

Sales during the last five months have averaged about 75,000,000 lb. per month, or, if we deduct say 8,000,000 lb. as coming from the funded stock, 67,000,000 lb., and production marketed in this country is now about 50,000,000 lb. If no improvement in the demand exists, between eleven and twelve months would therefore be required to clean up the available surplus, provided our assumptions are correct. However, we have a right to expect an increased demand; in fact, it has already been in evidence abroad, so that spring should see a resumption of activity in the copper camps, at least in those of the lower-cost producers. Every copper producer will, of course, wish to get under way at the earliest possible time, for several reasons: To obviate the expense incident to maintaining a dormant property; to take care of faithful employees; and to have the best choice of new men. It is greatly to be desired, however, that patience be shown; otherwise a flood of copper may be thrown on the market before it is in position to absorb it.

Zinc has begun to show an improved position also. Consumption during August exceeded production by about 6,000 tons, but on the first of September a surplus of about 80,000 tons was recorded, compared with a normal surplus of 5,000 to 10,000 tons. About thirteen months would be required to absorb this under conditions existing in August, but here, as with copper, demand should gradually improve.

Tin is not of so much interest to American producers, there being no domestic tin ores of economic importance and only three reduction works. The tin stocks are held in the Far East; they are almost certain to hang over the market for months to come.

A year from now practically all of our mineral industries should be able to carry on at capacity. It will take more time for some industries than others, and the time will be dependent largely upon the world's surplus stocks of the material in question. Runaway markets are not to be expected, for the return to normal conditions is now seen to be a slow process, particularly in Europe, and things which were almost necessities in 1914 will, for some time to come, be luxuries in many countries.

Competition, both domestic and foreign, promises to be keen, and the greatest prosperity will go to those who, during the next few months, see that their plants are put in the best possible condition for economical production.

Attitude of Mining Students

THIS IS A TIME when many mining students are resuming their work in college. Although resumption of such work is often attended by about as much disturbance as is evoked by starting a certain well-known brand of automobile on a sandy stretch of hilly road, we doubt whether more than a comparatively few students seriously plan their year in an effective manner, despite the gratuitous advice offered by various presidents and faculty members. Nevertheless, the year does bear a definite relation to the course as a whole and is an appreciable part of the lifetime of the individual. Sports and social and student activities obtrude themselves upon the student to such a degree that he must be strong-willed indeed who can sit down in the quiet of a study and run over the prospective year in detail. Definite purpose is a strong factor in success. The student who can form such a purpose and sensibly consider the whole régime of college life in relation thereto is certainly laying substantial foundations and will undoubtedly be successful in a high proportion of the things he undertakes.

One of the mistakes made by some students is to be too critical of the school, of the course, or of the individual instructor. Instead of being critical of and holding himself to a strict and efficient performance of the daily tasks, he wastes his own time and that of others in ungenerous attacks upon the system of which he is a part and the success of which depends primarily upon his own effort. Worse than that, if persisted in, the practice creates a state of mind which rapidly produces that peculiar byproduct of higher education, the intellectual "sour brow." A hard-working, cheerful student can get something out of any course, no matter how poor the personnel or deficient the equipment, if he will only dig in. He should avoid too close association with the soured student, for the disease is infectious. As a corrective we would advise him to associate with "digs" or else to get interested greatly in his instructors.

Independent study or collateral reading in conjunction with any subject is of great value in getting the perspective of a subject. An instructor presents a single point of view, while parallel independent study gives an additional angle. Curiously enough, this self-effort does more to develop the individual than any other thing. We have heard students complain of lack of time for such study, but this is only an excuse. Careful planning will find time. Some sacrifices are necessary, but character is the byproduct of self-sacrifice, so that nothing is lost in the end. If a student will work out a personal time chart, he will find a surprising number of things which can be eliminated and in their places something of real value substituted. It is said that gulls will not follow a Scotch ship, and it is equally true that a busy student will not be long annoyed by the type of student who merely serves to perpetuate the college atmosphere—as it is commonly taken to be.

Wholesome physical exercise is vitally essential where there is intensive study. It should not, however, be so strenuous as to create a deficit in the sum total of the individual's vitality. The modern college gladiator cannot also be a satisfactory student. Here the student can find scope for an intelligent division of his energy between work and play. One can play any time, but few have an opportunity of going more than once to college. There are eight months utilized in the year, and what the student misses by cutting the "play" he can catch up on in the vacations.

"The soul beholdeth the likeness of things that are absent." Imagination and vision can be developed. Out of them develops initiative. To visualize the mining industry, a substantial background needs to be cultivated. There are no adequate histories of mining except the continuous record found in the best mining periodicals. A consistent reading of them over the four college years is sufficient to give the student a fair background. We strongly advise the student to do this and keep it up.

Let the mining student visualize his entire course each year, and look upon his time in college as capital to be conserved and wisely apportioned. A student who can do this and render an accounting of the stewardship of his own affairs will make a good man and one who will be in demand.

Tax Exemption in Mexico

A CARTOONIST might well picture the mine operator in Mexico in his relations to the federal government as a lovelorn swain picking a daisy apart and murmuring "She loves me, she loves me not." For a few months this year, through the remission in whole or part of import and export taxes on mining supplies and products, the government apparently sought to lighten the burden on the mining companies. For example, beginning with April 1 for a period of four months a considerable reduction was made in the export tax on silver. The hoped-for extension of this period did not materialize, however, for by a decree effective Aug. 1 taxes were restored on exports and imports as under the old decree that became effective on June 15, 1919.

Just what the influences were that caused this sudden stand can only be conjectured. First, the government undoubtedly needs the money, a fact which usually outweighs all other considerations. The Minister of Finance has announced that the government does not intend to change the taxes, either now or soon. But whether it is to camouflage the financial need of the government or not, there is much chatter to the effect that the mining industry must henceforth work out its own salvation, that any tendency to lean on the government for support must be discouraged, and that the lightening of the tax burden, though temporary, should have enabled the operators to readjust themselves to the changed conditions. In other words, the industry must paddle its own canoe, even if its paddling is confined to the bath tub.

An official of the Department of Industry and Commerce is quoted as saying: "It must be recognized that the mining industry cannot claim exclusive rights to be carried when it is known that all the other industries of the country are having their individual problems in the general reorganization of economic conditions." The official further expresses his belief that tax exemption as a medium of relief is an economic error and that the companies will let the government do the worrying if permitted to lean on it.

Whatever the cause, there is nothing in the situation to alarm the operator. It is better in the long run that the industry should stand on its own feet. Conditions are actually improving gradually. We believe that the majority of operators in Mexico expect to pay their fair share of taxes and that they ask nothing more than to be permitted to work out their own salvation unhampered by the social disorder that so long disturbed their country and its relations with the other nations of the world.

Wages and Commodity Prices

IT IS INTERESTING to watch certain applications of the so-called "law of averages." We refer particularly to a condition, which may be regarded as a ratio, that exists between wages and commodity prices. Generally speaking, in sections where a particular industry is the mainstay of a community, it is possible to draw comparisons between these two which will be of more value than those made in districts having a number of varied industries. Those of us who have at some time or other cast our lot in certain of the mining regions for extended intervals have been aware of periods of inflation or deflation of wages and salaries (increases and cuts are perhaps the more polite terms). It was always, of course, with a feeling of pleasure that we learned of a blanket 10 per cent increase; and accordingly made our plans to spread out a little more, supply ourselves with some of those things that we had felt were beyond us, and get a bigger and broader outlook on the world in general. But immediately we found that the baker, the butcher, and the candlestick maker had anticipated this new addition to our fortunes and accordingly had tilted their prices. So we immediately began to figure just what proportion of the increase was our allotted [illegible]

During the last year, practically all of the metal-mining districts have been experiencing the reverse process, and wages have been retreating rather than advancing. In many communities commodity prices have dropped commensurately with the deflation of wages. Such communities are indeed fortunate, and the retailers, if they have the foresight to realize that they can better afford to make small profits with sales than attempt to hold out for high prices with the possibilities of no sales at all, are consequently on a more stable business basis.

[illegible] Sometimes we attempt [illegible] bookkeeping in keeping track of expenses, and again we may view the outgo from the corner of our eye and merely feel when we have paid the monthly bills that we are striking a fair average—so much for this, so much for that, and the check book shows the balance, if any. [illegible] between wages and commodity prices. [illegible] the advantages of such a plan is that we are [illegible] the conclusion that an increase in the price of one commodity means that our entire expense is proportionately raised.

We recently heard of a miner who declared that his expenses had doubled because the price of beans had jumped from 9c. to 18c. since the pre-war days. And yet during the period included in this man's calculations, the rent on the house, which he secured from the mining company at $12 per month, had not been changed, and several other items which totaled the greater portion of his living expenses had varied but little. Certainly if employees adopt such imperfect methods of calculation and draw corresponding conclusions, any attempt on the part of the company to keep pace in the matter of compensation will spell ruination.

It seems to us that there is an opportunity for mining companies to encourage systematic cost accounting among the employees. We hear a great deal of educational programs, the development of community interests, and the furtherance of loyalty of employees. Surely a better understanding of the relative percentages of expense items that go to make up the monthly or annual budget would be a valuable addition to such [illegible]

Small Profits and Many Sales

INDUSTRY, in its various ramifications, is like a linked chain. Extended, a pull at one end will cause an effect throughout the chain. Every link will respond. The present condition of industry is like a piled-up chain in a chain locker. Only a long sustained vigorous pull will extend it and draw it out from its rusty pile. During the war the industrial chain was extended to its utmost length, and the individual links were almost at the breaking point under the tremendous demand of war. Prices and the resultant profits became out of all proportion as compared with those prevailing during normal industrial growth. Along with this there were lost several merchandising principles, one of which should be recovered and nailed up where all who buy and sell can see it. It should be the head-liner over every business street. We refer to—yes, we venture to resurrect—this moth-eaten, worm-holed, and moss-covered business slogan that has carried many a merchant to success: "Small profits and many sales." It should rule in every line of business, small or large.

Our friends the metal producers have marked their [illegible] down to the point where profits are like the pot of gold at the end of the rainbow; but they are waiting for the many sales. And they will wait until the building contractor, the city merchant, the country store, and the seller of goods, whether wholesaler or retailer, [illegible] this vital principle of business. [illegible] volume of sales [illegible] is the only kind of a pull that is going to drag the industrial chain out of its locker. A long pull and a strong pull and everyone working on this fundamental principle and for the [illegible] good will do the trick.

[illegible] principle in [illegible] federal, state, county, and municipal expenditures [illegible] taxes may be progressively reduced and every dollar made to count. [illegible] Then will the mining industry resume its stride along with all other industries.

WHAT OTHERS THINK

Asbestos Mining at Black Lake

In your issue of Sept. 3 appeared a four-page article by Wyant D. Hubbard, which casts serious and totally unwarranted aspersions on the Quebec asbestos industry. I don't know who Mr. Hubbard is, but as I know, in my official capacity, all the managers and most of the technical staffs of the various asbestos operating mines, I take it that he must be a visitor, who from casual observations on a hurried trip collected wrong and half-baked impressions.

He criticizes the management of the mines, and "wonders how long it will be before most managers will recognize that changes, making for a higher efficiency, are needed."

Let me quote figures from our official report, "Mining Operations in the Province of Quebec for 1920." In 1914, the total tonnage of serpentine mined and hoisted in the Quebec asbestos industry was 2,127,395, with an average content of 111 lb. of asbestos, representing a value of $1.43. In 1917, these figures were 2,634,410 tons, with an average content of 109 lb., of a total value of $3.08. In 1920, 3,123,370 tons, containing 109 lb. each, valued at $4.53.

If the average manager can mine, hoist, and mill one ton of rock, and grade and bag the asbestos produced, and pay dividends, at costs of $1.43 in 1914 to $4.53, or less, in 1920, the inefficiency of the management is not apparent to me.

The greatest slur of the article, however, is on the French-Canadian labor, and I have no hesitation in stating that the majority of skilled workmen, foremen, mechanics, drillers in the asbestos industry are French Canadians, and that the aliens, Czechs, Russians, Austrians, and Italians, employed in the asbestos mines, and praised and vaunted by Mr. Hubbard, are practically all muckers.

THEO. C. DENIS,
Superintendent of Mines
of the Province of Quebec.
Quebec, Canada.

A Correspondent Concurs

I have just been reading your editorials on the tariff in the Aug. 6 issue of the *Journal* and your editorial on the War Minerals Relief matter in the issue of July 2. I want to say it is refreshing to see somebody stand up and talk common sense about the former and tell the truth about the latter. It requires some courage for a man in your position to place the general welfare of the country above that of a few interests, and you are to be congratulated on your stand. I happen to have put in considerable time during and after the war period in some of the manganese districts of the country, and consequently know a good deal about many of the manganese war mineral claims. About some of them I know a whole lot. Your editorial on the claims in your issue of July 2 was mild.

You are probably receiving so many kicks on your stand in these matters from the parties interested that I thought you might be interested to know that most thinking engineers agree with you.

This is a government by noise. As it is a fact that the manganese district which during the war produced 2 per cent and less of the country's production, and which at any time could scarcely produce enough to keep one fair-sized furnace going, now is making nearly 100 per cent of the noise for the tariff, so it is that the criticisms of your editorials on this subject which you have printed represent but the merest fraction of the thought of the fraternity.

I hope you will continue to stand for what you think is right and present the case for the other 98 per cent of us who are inarticulate and whose sense of values is not clouded by the pocketbook. SATISFIED.

New York City.

Conditions Now Favorable for Mining In Bulgaria

At the end of the war Herbert Hoover arranged for American Technical Missions at various European capitals to study conditions and advise the governments as to the best plan of organizing transportation and developing resources. Commissions went to Belgrade, Vienna, Prague, Paris, and Warsaw.

The Belgrade commission went to Jugo-Slavia in September, 1919, and returned to the United States in September, 1920. It contained a number of railroad experts and one mining engineer, who has turned out voluminous reports on the mineral wealth of Jugo-Slavia.

I arrived in Belgrade in June, 1920. I soon saw the impossibility of doing anything in that country until the various provinces of the confederation were able to agree on and adopt some form of constitution and settle down to business.

I then went to Bulgaria, where I have accomplished a great deal during the last year. I was agreeably surprised to find Bulgarian conditions so unusually favorable for mining at the present time. (They really are, in spite of doubts I encounter among the uninformed.) The mining law is more favorable than that of any other country in the world. It was passed in 1910 after a thorough study of the various mining laws of the world, and the formulators have escaped the defects of most of the older laws, including those of the United States of America. Bulgaria being a very young nation, the same thing applies to most of the country's other laws. An American likes to think that perhaps the intelligence and sturdy character of the Bulgarian is due in part at least to an American college in Bulgaria, and the fact that a large proportion of the students of the American Robert College at Constantinople come from Bulgaria. Ground is now being broken for an American college in Sofia. Bulgaria has a public school system that compares favorably with that in this country.

During a year's work in Bulgaria, I accomplished a great deal, and did not give a penny of graft to anyone, which experience would be impossible in any of the neighboring countries. I sometimes think that the ever-present example of graft and rottenness among her neighbors has something to do with the thorough manner in which anything of the kind is stamped out in Bulgaria.

All foreigners are respected in Bulgaria, and given equal or more rights than the Bulgarians themselves. At the present time there are special inducements and protection for foreign capital.

Rolla, Mo. PAUL R. COOK.

Decay of Timber in Return Air Courses

Fungus Growth Produced by Deposition of Spores on Moist Wooden Structures, Supersaturation Being Caused by Heated Air Coming in Contact With Cooler Rock Surfaces—Prevention of Decay by Creosote Treatment and Application of Gunite

By D. Harrington*
[illegible]

AMONG NUMEROUS INTERESTING PROBLEMS which I have noticed in a study of metal-mine ventilation for the U. S. Bureau of Mines, extending over the greater part of the last five years, is that of the rapid decay of timber in a return air course of the North Butte mine at Butte, Mont., with some of the measures taken to overcome an abnormal situation.

During the late fall of 1916, the North Butte Mining Co. completed a long crosscut on the 2,000 level in hard Butte country rock ("blue" granite), connecting with the Rainbow shaft, and upon completion of this crosscut it was immediately made one of the main return air courses of the North Butte mine. An electrically driven fan at the collar of the Rainbow shaft pulled about 20,000 cu.ft. of air through this crosscut from the lower portion of the mine (2,000 to 3,000 levels), with numerous heavily timbered stopes, raises, drifts, and other workings, including many miles of workings in the North Butte as well as from those of adjoining mines.

This crosscut, which was of about 7 ft. by 7 ft. or 8 ft. original cross-section, though driven in hard country rock, intersected a number of fissures, and it was found necessary to timber about one-third of the distance, using 10-in. to 12-in. or 14-in. round-peeled Douglas fir sets about 5 ft. apart, sometimes with 3-in. or 4-in. top and side lagging, or, in places with only the top lagging. The crosscut was in virgin ground, with no workings above, below, or around it, and, though some water drippers were occasionally found, there were no unusual amounts of water, the water was not mineral impregnated, the rock was not hot or hard to mine or support, and, in fact, in the driving no unusual problems that would be considered worthy of mention were encountered.

REDUCTION OF AIR TEMPERATURE BY TRAVEL

The 20,000 cu.ft. of air per minute which entered this crosscut at the top of a raise from lower and hotter levels had a temperature 82 deg., wet bulb; 82½ deg., dry bulb; relative humidity, 98 per cent, and as it flowed at a velocity of from 400 ft. to 800 ft. per minute along the crosscut, which had a rock temperature of 72 deg., the air temperature at a point within 200 ft. of the top of the raise was reduced to 81½ deg., both wet and dry bulb, and deposited moisture along the timbers, sides, and other surfaces of the crosscut for its entire length, and entered the Rainbow shaft at the end of the half-mile of crosscut at 79 deg., saturated.

I obtained the above data on Nov. 15, 1916, soon after the crosscut had been put into operation as an air course, the connection to the Rainbow shaft not having been completed on my previous visit on Sept. [illegible], 1916.

Almost immediately after placing the crosscut in operation as a return for the hot, humid air from the lower parts of the mine, the exposed rock in the crosscut began to "slough off," and numerous small falls had to be cleaned up, two men being engaged in this work on Nov. 15, 1916, soon after starting to use the air course. I had occasion to visit this crosscut again on April 9, 1917, to obtain ventilation data, and noticed that though all timber was distinctly wet, and there was still about 20,000 cu.ft. of air per minute, with the same temperature as before noted, moving through the crosscut at a velocity of about 400 ft. to 800 ft. per minute, the timber was decaying rapidly, as timbermen were even then engaged in replacing sets which had fallen of their own weight, and the timbermen pointed out timbers that had been newly placed less than a month previously that were already practically white with luxurious growths of fungus. At that time I entered the following in my notebook: *"Why should new timber decay so fast or fungus form so fast in a crosscut with air velocity over 600 ft. per minute?"*

LIFE OF TIMBERS OF SHORT DURATION IN AIR COURSE

During 1917 this crosscut caused much trouble through failure of timbers, with accompanying small caves, and it was noted that sound new timbers lasted only from six to eight months. There was little weight or pressure, as after the timbers fell there would rarely be much more than a few carloads of rock to load out. However, the swelling of the rock upon absorption of moisture from the air did cause some pressure, as shown by side buckling of posts and later on by breaking of concrete posts. Meanwhile, the sloughing of the exposed rock compelled placing of additional timbers, until over half of the length of the crosscut was timbered, as against one third originally, and this, with the replacement of decaying timbers, by the beginning of 1918 compelled almost constant services from four repair men in order to keep this important half-mile air course open. Meanwhile, the timber being placed was largely creosote-treated at the Bonner, Mont., plant of the Anaconda Copper Mining Co.

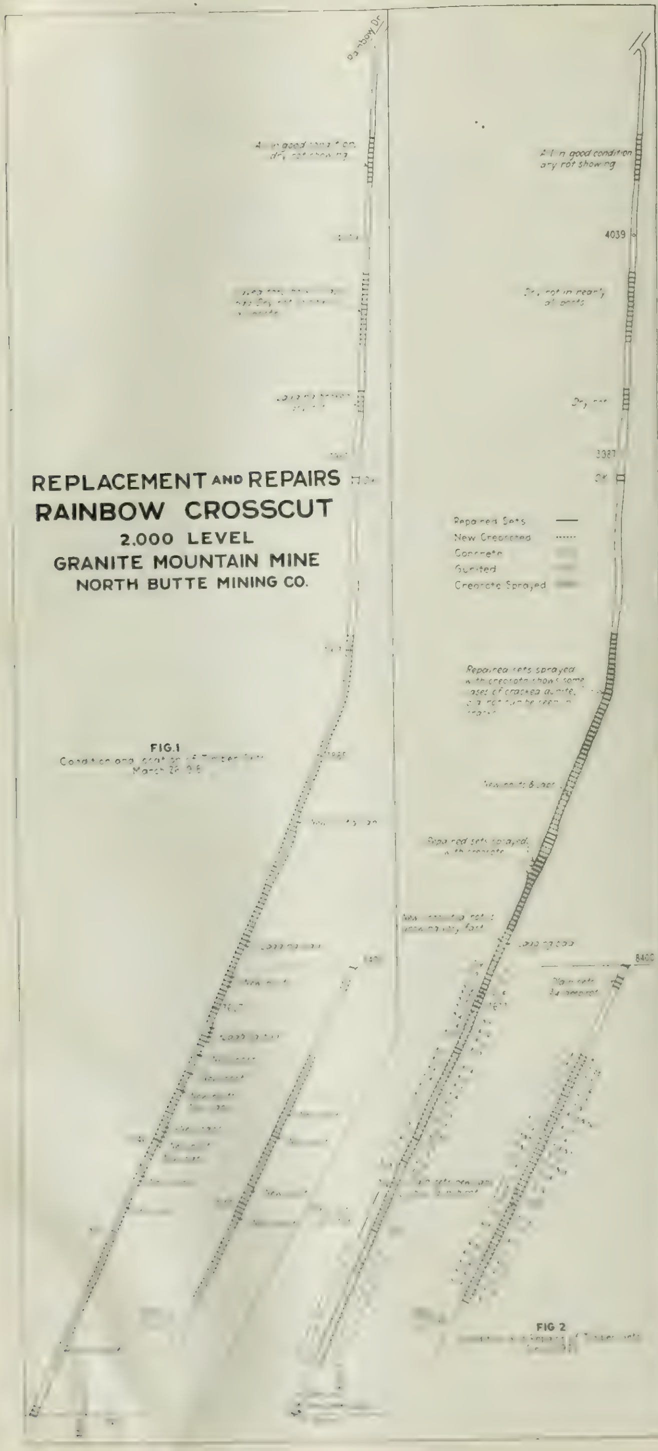
Early in 1918, the management of the North Butte mine, with customary progressiveness, determined to experiment with various methods of timbering and timber protection in this abnormal place, and a survey was made of the location, condition, and other factors affecting timber sets, as shown in attached Fig. 1, dated March 26, 1918. A record was then kept of date, material used, and other available information as to replacements and other measures taken, and Fig. 2 shows some of the data collected.

WORK OF REPLACING TIMBERS

As shown in Fig. 2, during the spring, summer, and fall of 1918 much work was done in replacing decayed timbers. Some were replaced with creosote-treated timber, some being replaced by new timbers creosote-sprayed after being set, and others were simply replaced by new sound timbers. In some instances the

---

*Published with permission of the Director, U. S. Bureau of Mines. [illegible]


Rainbow Dr.
All in good condition dry rot showing
4039
Dry rot in nearly all posts
3387
Repaired Sets
New Creosoted
Concrete
Gunited
Creosote Sprayed
Repaired sets sprayed with creosote
8400

REPLACEMENT AND REPAIRS
RAINBOW CROSSCUT
2,000 LEVEL
GRANITE MOUNTAIN MINE
NORTH BUTTE MINING CO.

FIG. 1
Condition and [illegible] of Timber [illegible]
March [illegible]

FIG 2

newly placed timbers were almost immediately covered with gunite to a thickness of ½ in. to 1 in. of cement mortar, and this included creosote-treated and creosote-sprayed timber as well as new untreated timber, and also timber treated and untreated which had been in place some months and which, though covered with fungus, was apparently sound. In addition, some timbers were newly placed but not covered with gunite, these being creosote treated, creosote sprayed, and some wholly untreated timbers thus left untouched by gunite to observe the effect as compared with the covered timbers. Two reinforced concrete sets were also placed at this time, and these failed because of side pressure. The concrete lagging, however, seemed to hold securely.

I accompanied N. B. Braly, general manager of the North Butte, into this crosscut in August, 1918, while the work was in progress, and did not again see it until Nov. 29, 1919, when, in company with Mr. Braly, a trip was taken and much interesting information gained. Also, on this trip, Mr. Braly took the accompanying photos illustrating conditions.

It was found that whereas the exposed untreated timbers had utterly failed in most instances in less than eight months, there was no instance of absolute failure of gunite-covered timber in less than a year, though photo No. 3 shows partial failure after slightly over a year of gunite covering of an untreated post, which had stood about three months before guniting, and though apparently sound when "gunned," was well covered with white fungus. Photo No. 4, taken of partial failure of a gunited creosote-treated post situated about ten feet from the post shown in photo No. 3, shows the effect of weight on this solid post as well as on the partly decayed post in photo No. 3. The creosote-treated post in photo No. 4 had been gunited just after being placed, and although its exposed surface showed white spots of fungus, the post was apparently solid after slightly over a year's standing.

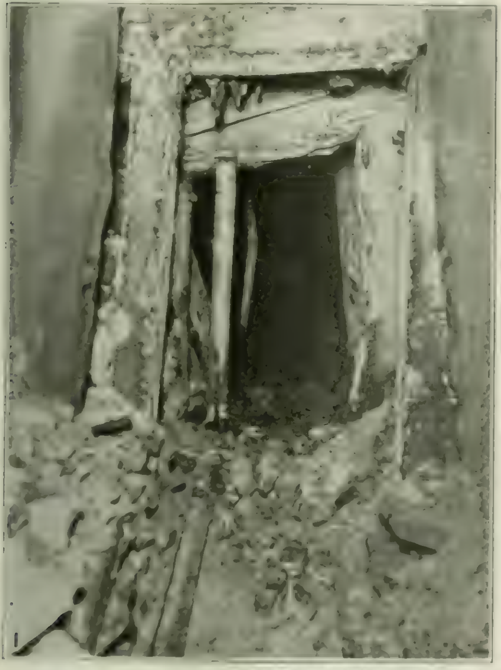
Photo No. 1 shows in the foreground two gunite-covered posts apparently solid after over eighteen months' standing, and in the background is seen unprotected timbers badly decayed, fungus covered, and ready to fall, the uncovered top lagging between the gunited sets and those not so treated having already failed and let some loose material through to the floor.

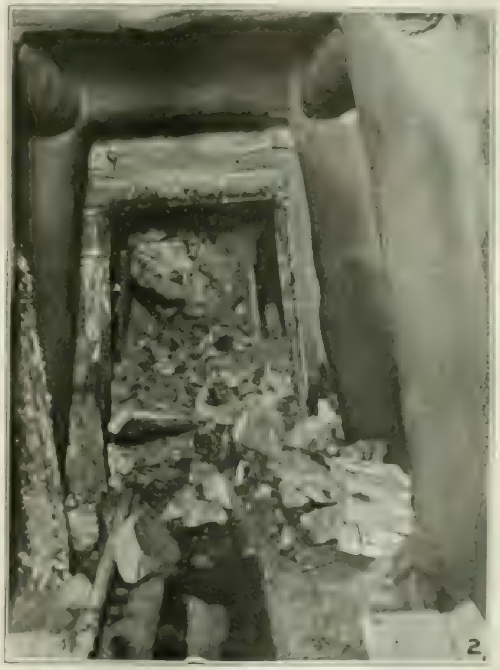
Photo No. 2 shows some creosote-treated gunited sets in the foreground apparently almost as solid as when they were placed, over eighteen months previously, and in the background is seen an untreated, uncovered set, showing the effect of decay, and the cave farther on shows the effect when the timbers fall out. Standing near one of the gunite-covered posts there is seen an untreated comparatively new girt completely covered with white fungus.

Photo No. 5 shows two creosote-treated girts which stood loose in this crosscut exposed for fifteen months to fungus attack from the hot, humid air. Though these are nearly covered with white specks of fungus, the sticks are apparently sound, and the fungus has been unable to penetrate to an appreciable distance.

Photo No. 6 shows a portion of the crosscut with creosoted gunite-covered timbers in place and in good condition after standing over eighteen months. A few white blotches show where fungus has attacked the creosoted timber in a few places where the gunite covering was thin. The ladder and spiling timbers on the floor were untreated and uncovered, and had been so badly attacked by decay as to be practically worthless.

Though there have been some instances of failure of gunite-covered timber sets in this crosscut, as far as can be learned these failures have invariably been of untreated sets which had stood some time exposed to decay before being covered with the gunite. In company with Superintendent Frink of the North Butte company I went through this interesting crosscut to its end at the Rainbow shaft on March 28, 1921, and though there were evidences of fungus growth occasionally through the gunite covering, the gunited timbers appeared absolutely sound [illegible] except a remarkably few places, though most of them had been in place more than two and a half years, and some of the timbers had nct been previously treated with creosote or even creosote sprayed. In those places, however, where any kind of untreated timber (posts, caps, lagging, girts, or other timbers) had been left or set and not covered with cement, there was invariably abundant evidence of decay. However, instead of now having four men continually at work to keep this crosscut open, as in 1917 and early in 1918, repair men are now sent into the crosscut only on rare occasions.


1

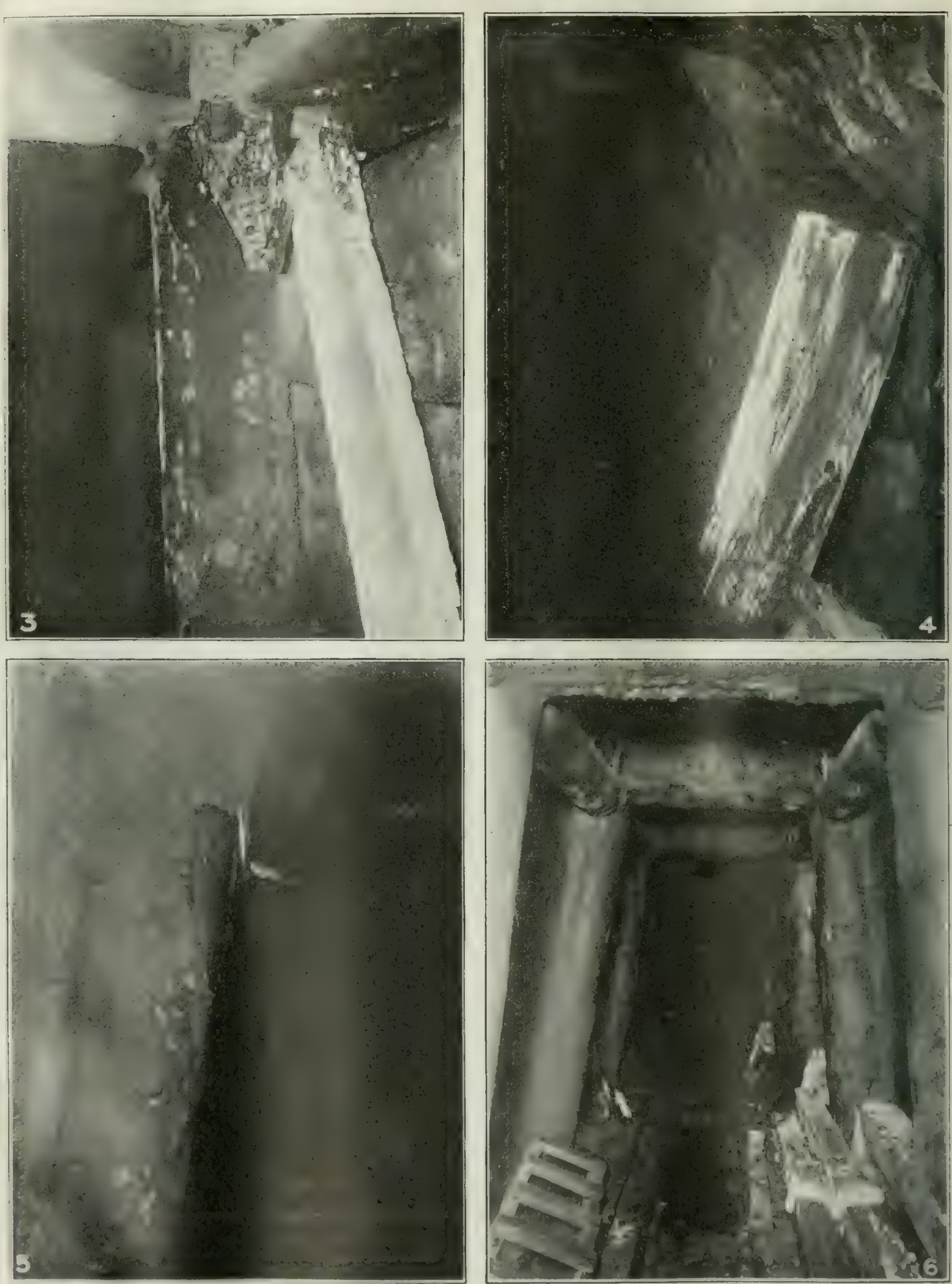

2.

TREATED AND UNPROTECTED TIMBERS AT NORTH BUTTE MINE

(1) [illegible] posts in foreground apparently in first-class condition. [illegible] timber in the background so badly decayed as to be almost ready to fall out.

(2) [illegible] side walls and other parts in first-class condition, with unprotected badly decayed [illegible] [illegible] fungus on unprotected [illegible] gunited post.

There has been comparatively little variation in the air conditions in this crosscut since its completion in the fall of 1916. On Nov. 16, 1916, there was flowing in this crosscut at a point about midway between the raise from the 2,200 level and the intersection of the drift with the Rainbow shaft, about 20,000 cu.ft. per minute at a velocity 400 to 500 ft. per minute, and a temperature of 80½ deg. wet bulb, [illegible] deg. dry bulb, and a relative humidity of 100 per cent. Samples of this air showed CO_2, 0.20 per cent; O_2, 20.48 per cent; CO, 0.00 per cent; CH_4, 0.00 per cent, and N_2, [illegible] per cent. At the same place on March 28, 1921, the quantity was still 20,000 cu.ft. per minute, with a velocity of 600 ft. per minute at the point of reading, and temperatures as follows: Wet bulb, 79½ deg.; dry bulb, 79½ deg., and relative humidity 100 per cent. Air analysis was as follows: CO_2, [illegible] per cent; O_2, [illegible] per cent; CO, 0.00 per cent; CH_4, 0.00 per cent, and N_2, 79.43 per cent. Hence it is seen that there has been little change in the air conditions, and as the fan



CONDITION OF TIMBER IN CERTAIN SECTIONS OF NORTH BUTTE MINE, BUTTE, MONT

(3) Partial failure (after eighteen months) of post gunited over fungus growth, the post having been exposed to decay for about three months before guniting. (4) Partial failure of creosote-treated post, which was also gunited. (5) Section of crosscut practically without timber. Also shows method of fungus attack on creosote-treated girts which have been exposed for fifteen months, standing against side of crosscut. (6) Gunited section which had stood well over eighteen months. Note occasional fungus growth through the gunite on creosoted timber beneath.

has been running practically continuously, pulling saturated air through the crosscut, the exposed timber has been kept moist or wet *at all times*, and hence there has been no question of alternate drying and wetting.

CHARACTERISTICS OF MINE FUNGUS GROWTH

The fungus growth is usually almost snow white, resembles cotton, generally is from one-half inch to one or two inches thick, and covers much of the surface of the timber attacked. In places it forms a species of inverted cone and hangs down twelve to eighteen inches. It may be found at the foot of a post or at the top of the post, on a cap or on a piece of timber lying on the floor. It is as likely to be found in a place with high velocity (400 to 800 ft. per minute) air striking it direct, as in a sheltered place with no velocity. And the decay is fully as rapid near the Rainbow shaft as it is near the raise from lower workings from which the air comes at the opposite end of the crosscut from the Rainbow shaft. However, there is not much decay in the timbered Rainbow shaft, which is *distinctly wet*, owing to falling water from supersaturated air cooled as it nears the surface.

The following are my conclusions, which also embody in large measure those of the management of the North Butte Mining Co., or which I have deduced from the data given to me by that management:

1. The excessive decay in this crosscut is caused by the circulation through it of comparatively hot, humid air, supersaturated, and hence depositing moisture. When the air comes in contact with lower temperature rock of the crosscut, the fungus spores are drawn with the air from decaying timber in the lower parts of the mine and caught or filtered from the air by coming in contact with the moist timber of the crosscut.

2. It is probable that these spores continue to come from lower parts of the mine now in almost the same quantity as when the crosscut was first used, though mine officials seem to think that exposed timber does not under present conditions decay as rapidly as it did three years ago.

3. Though, in general, unprotected timber in this crosscut, with comparatively pure air moving 400 to 600 ft. per minute, decayed completely in eight months or less, the covering of new sound timber (treated or untreated) with one-half inch or over of gunite results in increased life of timber to considerably over two and one-half years (the limit not being yet known).

4. Timber, even when not treated by creosote or otherwise, and even when covered to a considerable extent by fungus after two or three months' exposure in this crosscut, but apparently still solid, had its life prolonged to over a year (in some instances to over two and one-half years) by efficient guniting.

5. Timber treated with creosote by pressure process or creosote sprayed immediately after being placed in this crosscut, though apparently attacked by fungus, seems to resist complete decay for over two years, even when not gunited, and appears to be almost as good as new after two and one-half years' standing when gunited, provided that the guniting is effective and that a condition producing undue weight does not destroy the guniting.

6. In guniting timber, it is necessary to cover first with some kind of metal lath or chicken wire, and the mixture of 1 part of cement to 2½ to 4 or 5 parts of fine sand should cover the timber to a thickness of at least one-half inch, and should be so "shot" as to exclude air wholly from the timber. Spots of shallow thickness of gunite almost certainly show fungus growth, even when the timber beneath has been creosoted.

7. In working in this crosscut, two men would in general take out a decayed set, muck out the loose material involved, and place the new set in one shift. In guniting, three men operating a cement gun would, in general, complete the exposed surface in about thirty feet of crosscut each shift, or two sets per man per shift. Costs are not available.

8. In general, it appears to be the opinion that in this place, with its abnormal conditions, efficient, immediate guniting over new solid timber (treated or untreated) will prevent decay for at least two and one-half years, probably for several additional years, whereas uncovered, untreated timber generally lasts less than one year. In replacing timber now, however, creosoted timbers are used, as it is not convenient to gunite unless considerably more than one set can be covered at the same operation. The use of guniting is much safer from a fire prevention point of view than creosoting; moreover, it has not the objectionable odor of creosote, nor does it cause objectionable stains on skin and clothing when water drops from it.

I wish to acknowledge the numerous courtesies extended me by the management of the North Butte Mining Co., not only in the making of this study, but at all times during the last five years in connection with the making of many kinds of underground investigations and inquiries.

Dust Prevention and Ventilation Decrease Lead Poisoning

The metal-mining camps of Utah furnished in 1919 264 cases and in 1920 184 cases of lead poisoning, or 71.2 per cent and 82.1 per cent respectively of all cases of lead poisoning reported in that state, according to Serial No. 2274 of *Reports of Investigations*, U. S. Bureau of Mines. These figures do not take into consideration the cases of lead poisoning sent to medical centers for treatment or cases which were removed to farms or ranches with a view to recovery. It is probable that could all the cases be traced to the source where contracted, the metal mines would account for approximately 90 per cent of all cases of lead poisoning in Utah.

The principal controlling factors in lead poisoning in mining, namely, the nature of the lead ores mined, the dryness of the mine, dust in the atmosphere, and the ventilation, naturally have a great influence on the number of cases of lead poisoning produced. The carbonate and oxide ores are much more prone to cause lead poisoning than sulphide ores, hence, although a mine may produce considerable lead, if the relative percentage of carbonates and oxides to sulphides are low, the resulting disabilities due to lead poisoning will be fewer.

Testing Non-Metallic Minerals as Fillers

An investigation of various deposits of clay, mica schist, slate, marble, talc and kaolin in Alabama, Georgia, Tennessee, and North Carolina, with regard to their suitability for use as mineral fillers is being undertaken by the Southern Experiment Station of the U. S. Bureau of Mines at Tuscaloosa, Ala.

War Problems in Minerals

II—Overseas War Mineral Movements. A Record of Activities Of the Committee of Mineral Imports and Exports

BY C. K. LEITH.

OF THE MANY serious disturbances in the mineral industry during the war, there were perhaps none so unexpected and far-reaching as those caused by shortage of ocean shipping. A hundred years had passed since wars had profoundly changed overseas trade. During that interval, and especially in its last quarter, the ocean movement of minerals had reached huge dimensions. Minerals had come to constitute perhaps a little less than one-third of the international trade of the world. More minerals had been consumed throughout the world in the last twenty-five years than in all preceding history; more varieties of minerals had been used; more distant sources had been drawn upon; more countries had been using large quantities of minerals; the world's per-capita consumption had multiplied—in the United States fifteen times in thirty-five years.

Nature seems to have concentrated its principal mineral resources so irregularly over the globe as to make no country entirely self-supporting in regard to all minerals and to require great overseas movements in order to insure each country of its quota. High-grade ores so restricted as to be easily and cheaply mined and transported have been available from far distant sources at a lower cost than domestic supplies disadvantageously circumstanced for one reason or another. It is estimated that approximately one-third of the world's mineral resources move between international boundaries. Of this third a considerable fraction is ocean borne.

When, therefore, the German submarine campaign caused an acute shortage of shipping, it became necessary for the Allies to take careful stock of the purposes for which ships were being used, with a view of eliminating cargoes not vitally necessary to the prosecution of the war. Where domestic supplies of minerals could be secured, even though of lower grade and higher cost, these were substituted for importations from abroad. Where transoceanic supplies could be located near at hand, these sources of supply were drawn on rather than more far-distant sources.

The problem, reduced to simplest terms, was, first, to ascertain what minerals and what quantities were needed for the prosecution of the war—a difficult problem with the ever-changing and widening demands of the Army and Navy; second, the canvass of domestic sources, with their possibilities of rapid development, and to ascertain the possible changes in metallurgical and manufacturing practice allowing use of domestic supplies, and possibilities of substitution; third, to the extent to which domestic supplies fell short of requirements, to arrange for importation of needed amounts from the nearest or most available foreign source, and, as a corollary, to eliminate all other overseas mineral shipments.

The rapid development of the mineral industry in the last two decades before the war had brought economic geologists and mining engineers into wide and diversified service, and they had become used to calls from most unexpected sources. When, however, they were charged by the Shipping Board with the duty of presenting a specific list of mineral tonnages to be eliminated from transoceanic shipments, and this within a few weeks, they were confronted with a task for which data and previous preparation were meager. Neither business nor professional men had been thinking broadly along these lines. Information as to overseas trade in minerals had not been brought together. The story of the effort made to meet the complex and ever-changing problem thus presented constitutes an interesting episode in the history of the mineral industry and in the new participation of the United States in world affairs. The scope and diversity of this work were far greater than the routine of any one of the existing Government agencies. Thus it was that a special agency was created, the Committee of Mineral Imports and Exports, working officially and unofficially with all of these organizations. As only a part of this story has been told in the reports of war-time activities issued by the several official agencies, it seems desirable that a record should be made of the work of this committee.

THE COMMITTEE OF MINERAL IMPORTS AND EXPORTS OF THE U. S. SHIPPING BOARD

The U. S. Shipping Board recognized in the latter weeks of 1917 the necessity of curtailing imports and exports as a means of ship saving. A preliminary survey of the problem was undertaken by the Division of Planning and Statistics, under the able leadership of E. F. Gay, Dean of the Graduate School of Business Administration of Harvard University. Later he was also made a member of the War Trade Board, with a view to facilitating action on embargoes; still later, Director of Planning and Statistics for the War Industries Board, and, finally, Director of the Central Bureau of Planning and Statistics, operating through all the special war boards and some of the permanent departments.

On Jan. 7, 1918, Mr. Gay called on C. K. Leith, Professor of Geology at the University of Wisconsin, to take charge of the investigation of the possibilities of mineral embargoes. He was given a free hand in the selection of a staff. It was the impression of the Shipping Board that the exigencies of the situation required immediate organization of a large professional staff outside of the existing Government departments. Knowing, however, the personnel of the U. S. Geological Survey and the Bureau of Mines, and the scope of their work, Mr. Leith decided it was unwise to attempt to develop a large new organization, which would duplicate so much of the work done by these agencies. They were ready and anxious to co-operate in every possible way, and did so throughout. Mr. Leith, therefore, confined his organization to a small committee of qualified men, with a view of utilizing the various existing agencies both within and without the Government.

The first selection was Mr. J. E. Spurr, now Editor of *Engineering and Mining Journal*, who had a long record of successful business and professional experience in the mineral field in various parts of the world. Later Mr. Pope Yeatman, Chief of the Section on Non-Ferrous Metals of the War Industries Board and a mining engineer of world-wide experience, joined the committee. Mr. Hennen Jennings, of Washington, acted in an advisory relationship. Mr. Leith was chairman. From time to time technical assistants were taken on to meet special problems. The personnel of this force was: F. W. Paine, F. F. Grout, D. A. Hall, C. M. Farnham, H. H. Porter, R. S. Schultz, E. A. Kronquist, and Paymaster C. P. Storrs (Navy). In addition to these men, the committee was able to use a considerable part of the valuable services of E. C. Harder, E. S. Bastin, B. F. Hewitt, and others, through a co-operative arrangement with the U. S. Geological Survey.

The sixty-seven mineral commodities to be investigated were divided among this group, it being the duty of each man to ascertain the status of the group of minerals under his charge. Geologists, mining engineers, and business men connected with the industry were called on for data, reports, and advice. Before the end of the war perhaps one hundred people had been engaged directly or indirectly in this effort for a considerable fraction of their time.

The committee started as a Shipping Board agency, and its principal power throughout came from its connection with the control of shipping. However, the field covered by the committee soon reached into the War Trade and War Industries boards, and even into some of the permanent Government departments. Though the Shipping Board had the power to control the situation by its allocation of ships, the War Trade Board also had power through its control of embargoes. The War Industries Board was charged with securing the necessary supplies for the War and Navy departments, and, therefore, overseas shipments could not be eliminated without ascertaining from the War Industries Board what their requirements were. The result was that the Committee on Mineral Imports and Exports soon had official relation with the War Trade and War Industries boards.

The method of procedure was this: The Committee on Mineral Imports and Exports would investigate a mineral commodity figuring in international trade, and call on the experts of the Geological Survey and Bureau of Mines for reports on domestic supplies and possibilities and for such information as to foreign sources as they could supply. Concurrently, section chiefs of the War Industries Board were consulted to ascertain their estimates of war requirements. With this information in hand, other specialists were called in for consultation both from within and without Washington. Then the principal people in the trade involved were called in for conference, with a view of getting as broad and accurate a view as possible of all the possibilities in the situation and agreement as to the proper course of action.

There was investigation, also, of shipping needs on the particular routes affected by possible changes, the time lost in loading and unloading ballast cargoes, the question of return cargoes or "back haul," deviation from shortest routes, and other commercial and military considerations, and such factors were balanced against needs of mineral shipments.

Having ascertained, then, the requirements and the possible sources of supply, the committee wrote a report on the given commodity, indicating the nature, location, and amount of domestic and foreign supplies, the overseas movements, the war requirements, and ending with a specific recommendation either for the reduction of overseas shipments by specified amounts from certain localities, or for the maintenance or increase of overseas shipments.

The next step was to secure the personal approval of Mr. B. M. Baruch, Chairman of the War Industries Board. This he gave only after consultation with his section chiefs. He was responsible for supplies to the Army and Navy, and no embargo could be put through until he was satisfied that it did not interfere with maintenance of necessary supplies.

Effort was then made to find out whether the proposed step ran counter to existing international agreements as embodied in treaties, trade agreements, or special war understandings. This was done usually by consultation with the State Department.

The recommendation, thus fortified, went forward to the Division of Planning and Statistics of the Shipping Board, where it was considered in relation to similar recommendations relating to non-mineral commodities. After approval, the recommendation finally came up through Mr. Gay for action in the War Trade Board, where it was embodied in official embargo and restrictive orders.

The enforcement of these measures lay in the field of the War Trade Board. As a matter of fact, however, even before they were formally embodied in official acts of the War Trade Board, they had in some cases substantially gone into effect through the inability of the Shipping Board to supply necessary cargo space. Also, throughout the life of the restrictions, there were various modifications of the program arising from the inability of the Shipping Board to allocate ship tonnage to the precise amount necessary to cover the War Trade Board wants. For some routes and for some commodities, extraneous conditions of back haul, ballast, and retention of ships on the route for a variety of reasons made it possible to carry amounts of minerals in excess of those indicated by the War Trade Board rulings. For other routes and commodities the shipping was short of the required amount.

Though the Committee on Mineral Imports and Exports had no authority to issue executive orders, its recommendations, as a matter of fact, were almost always accepted and put into effect, with only such modifications and delays as were inevitable in a complex situation of this kind.

After embargoes and restrictions were officially in effect for a given commodity, the committee was by no means relieved of its responsibility, for the situation was in rapid flux, and all factors required current scrutiny and revision to prevent [illegible] of effort, also to see that minimum requirements were being met. Where reductions of shipments were made on the assumption of a given domestic output, it was necessary to watch the progress of that output to see whether it was running on schedule. Where it ran behind, every effort was made, through conference with the trade and with various experts connected with it, to find out what the difficulties were and the possible remedies. The domestic [illegible] of manganese, for instance, was often hindered by embargoes and restrictions of the Railway Administration, due to misunderstanding of the vital importance of this mineral in the war. Conferences with the Railroad Administration usually resulted in elimination of these difficulties, though sometimes after vexing delays. Shortage in output of Cuban manganese, which was depended upon for a certain amount, was traced to embargo orders holding up certain machinery or supplies for the mines on order in the United States, and the situation was remedied by representation to the War Trade and Shipping boards.

The erratic movement and distribution of ships furnished another difficult problem. When the needed minimum quantities from overseas failed to arrive on schedule, it was necessary to look into the situation to see what ships had been allocated, and for what time, and under what conditions. There was an astonishing complexity of factors in this field, which in itself would furnish material for monographic treatment. Often commodities would continue to arrive, in spite of restrictions, in quantities greater than needed, due to the plea of ship managers that the material could be carried back as back haul and ballast, without delaying the ship movement. Investigation of these cases sometimes developed the fact that this was largely a matter of habit and inertia, not to be justified under war conditions. For instance, salt cargos were brought back from the Mediterranean on the plea that loading this commodity for back haul and ballast involved no delay in ship movement. Investigation disclosed the fact that such ships often required a week or more to load and two or three weeks to unload.

One of the considerable difficulties was in the loading of ships. A cable would arrive from some far-distant port saying a ship of certain tonnage was ready to load and asking what selection of tonnage should be made from the considerable variety available. This required hurried conference with the Food Administration and other Government agencies to see which commodities were most needed, and then consultation with shipping experts to see what combination of commodities was possible in a load. For instance, it was impossible to load manganese or chromite on a half cargo of wheat or coffee, and some other combination had to be found. It was necessary through Shipping Board connections practically to watch the schedule of every boat carrying minerals, in order to be sure that schedules of amounts to be imported should be even approximately met. Specially interested importers were naturally vigilant to secure maximum quantities, and these activities had to be watched and balanced in the interest of the net results sought. It must not be inferred that these special interests were always trying to get the better of the Government. With a few exceptions, they co-operated cordially, but there were naturally wide differences of opinion as to what was vital and what superfluous.

Changing war requirements had to be carefully watched. Although requirements were normally focused in the War Industries Board, so many boards were directly and indirectly concerned that requirements would sometimes be essentially changed by one agency without notification to others. Steps would therefore be taken in one organization based on a given assumption of needs, while the Shipping Board was operating on a schedule based on another estimate. For instance, the amount of nitrates necessary for explosive purposes was currently calculated by the War Industries Board in co-operation with the Army and Navy departments, but the situation was often upset by demands of the Allies and by the action of Congress and the Secretary of Agriculture in setting aside certain amounts for use as fertilizers. There were interesting conferences of considerable variety of interests as to the amount and allocation of nitrates to be imported.

Another changing factor was in the utilization of the raw material by the manufacturer. In order to use miscellaneous domestic supplies, many of them of low grade, it was often necessary to urge the manufacturer to purchase and use these supplies in preference to the overseas commodities, which might be better adapted for his practice. Here, again, there was cordial co-operation, but sometimes an inevitable lag, due to the natural disinclination to change practice, and to the manufacturers' feeling that this particular corner of the field was more vital and less open to restriction than some others. For illustration, the steel manufacturers agreed to use a variety of low-grade domestic supplies of the various steel-alloy minerals, formerly imported, thus adding a considerable burden of cost and lowering efficiency of their plants. This involved changing many specifications and practices. In some cases it was found that these modifications were barred by unnecessarily rigid specifications of Government contracts. Conferences with Government agencies concerned were then necessary to change the specifications.

It is not meant to imply that the Committee on Mineral Imports and Exports had sole responsibility and exerted direct pressure in all these different directions. It worked through and in co-operation with a considerable variety of governmental agencies, principally the Shipping Board, the War Industries Board, Geological Survey, and the Bureau of Mines. The committee, however, was able to use the powerful leverage of the shipping situation, and was in a better position than any other of these organizations to visualize conditions in the entire mineral field and see what particular factors in the situation needed attention for the moment. It was often instrumental in getting action started at needed places at the right time. Where trade conferences were necessary, these were frequently called at the instigation of the committee by proper officials of the War Industries Board and Shipping Board, and the committee took part in the discussion and formulation of conclusions.

It should be apparent from the foregoing that the regulation of overseas trade was not a simple problem. The slightest interference with established movements had far-reaching consequences, many of them quite unexpected. It was not anticipated, for instance, that limitation of salt importations from abroad, in view of our domestic supplies, would bring protest from the dairymen of Wisconsin, from the pork packers of Chicago, and from the Gloucester fishermen, all of whom claimed that the particular varieties of foreign salts were essential for their industry. The Government agencies concerned in the restrictions were so many and variable that the imposition of the simplest restriction was not the routine work of smooth-running organization, but rather a constant battle and compromise with a great variety of interests, official and private.

After a few months, procedure had become sufficiently systematized to allow comparatively speedy action along established lines. This systematic procedure did not lie within the field or any single governmental organization. Authority was much divided. Almost the only place in which the threads of information were brought together was within the Committee on Mineral Imports and Exports. Its position was officially more or less anonymous. Recognizing the difficulties from working within any one organization with set procedure, it remained to a considerable extent an independent unit, preserving freedom of action and getting results through the co-operative action with the many agencies with which it had contact. At no time did any of the war boards or departments have any real understanding of the scope and variety of the committee's activities, and though the official records of these board make various references to the committee, in no place is there any comprehensive account of its work. In peace times it would probably be impossible for any committee of this sort to act so independently in its official and semi-official relations. The urgency of war made it possible. Nevertheless, this experience indicated significant possibilities of co-operative effort through individual initiative, without modification of existing laws or bureau functions, which ought to be of value in peace-time activities, especially those relating to world reconstruction.

The great problem in a co-operative effort of this kind is the physical one of keeping in touch with the variety of interests concerned, even those near at hand in Washington. The first step was to ascertain who were interested official parties related to any mineral field. These differed for different minerals, and often after weeks or months of effort it would be found that some man working by himself in some department or bureau not nominally connected with minerals was almost in a key position with reference to certain aspects of the subject. Having found out where the work was being done and where the authority lodged, it was a matter of everlasting vigilance to keep in touch with the variety of activities and reports emanating from these different sources.

One of the interesting steps taken in this connection, in which the committee took a leading part, was the formation of a Joint Committee of Mineral Information (now the "Economic Liaison Committee"), an informal semi-official body with representatives from twenty-odd Government departments, which met every week to discuss the mineral situation. It was usually the custom at these meetings for some one or for two or three men to take up some such mineral as nitrate or chromite, and indicate the current situation as nearly as possible, and invite suggestions and criticism from all others concerned. In this way representatives present learned what was going on in other departments, supplied their own quota of information, and carried back to their own activities a broader view of the situation. Much duplication was thus unofficially and yet effectively stopped, and many gaps in the field were filled.

This expedient in administrative machinery was inadequate, however, under the stress of war conditions, because it was impossible to meet often enough and long enough to cover the great variety of questions pressing for attention. The Committee on Mineral Imports and Exports attempted to meet the situation by delegating to each of its technical experts the duty of keeping in touch with all of the developments in his particular field, or, where its own assistants were not available, to arrange with some expert in the Geological Survey or Bureau of Mines or War Industries Board. When, therefore, as happened hourly, a request would come in for an immediate decision on some problem from some one of the war boards, the committee would call on these men for a quick summary of the existing situation. It would then if necessary get into personal contact with the men most vitally concerned and would attempt to reach a decision which would take full account of the considerable variety of activities and plans current at the moment. It was the purpose throughout to get agreement in advance from all parties concerned, including the trade, before making a recommendation for official action. This was not always possible; there were many causes of friction and controversy—but on the whole this purpose was accomplished.

NET RESULTS

The net results of the committee activities was the saving during 1918 of upward of one million tons of shipping and the promulgation of official acts, which, had the war continued, would have saved more than two million tons of shipping in 1919. The committee also aided in domestic developments which supplied considerable parts of the deficiency caused by shortage of imports which showed what might be possible in the way of utilization of domestic resources in peace times.

The information on overseas movement of minerals in relation to domestic and foreign supplies, assembled and caused to be assembled by the committee, was of such range and detail as to afford for the first time something in the nature of a general survey of the problem of world distribution and use of mineral resources. A considerable amount of this was brought into the files of the committee, but a greater amount was put together by the Geological Survey, the Bureau of Mines, the State and War Departments, and the several war boards. The committee made strenuous efforts to have this information correlated and recorded so that it should be available at the end of the war, but was only partly successful. A large part of it is being used and developed by the Section on Foreign Minerals of the Mineral Resource Division of the U. S. Geological Survey. On the other hand, important files of information are buried in the files of the Shipping, War Trade, and War Industries boards, to say nothing of the segregated depots of documents and reports in many of the permanent departments.

War experience disclosed our handicaps in the intelligent consideration of the mineral industry from the broadest national and international standpoint. To the people engaged in the work, it seemed to demonstrate beyond question the real necessity for a large-scale study and investigation of this field to meet post-war problems. Considerable efforts are now being made by individuals and departments in Washington along these lines, but, in common with many other valuable experience gained from the war, it is being forgotten or lost sight of, perhaps temporarily, in [illegible]

There is now vital need in high official quarters for the recognition of the existence of a real international [illegible] problem, not confined to national issues alone but covering world distribution and trade, tariff, taxes, and conservation. These phases so closely interlock that intelligent action in any one of them is scarcely possible without a survey of the entire field. At the present moment no individual or organization in Washington or out of Washington is in a position to marshal the information necessary to intelligent advice on the practical questions coming daily both to the administrative and legislative branches of the Government. In particular does it seem desirable to approach mineral tariff problems of the kind now pending with some of the same spirit and method used in the war treatment of mineral imports.

In May and June, 1918, the power exercised by the Committee of Mineral Imports and Exports had grown to such an extent as to require a change in official relations. Its activities cut across the functions of the different war boards to such an extent that it seemed desirable to centralize its authority more largely in one of them. Accordingly, on June 7 the committee on Mineral Imports and Exports of the Shipping Board went out of existence as an official committee of the Shipping Board. Mr. Spurr became War Minerals Executive of the Bureau of Mines, in special charge of the development of domestic resources to meet war requirements; Mr. Pope Yeatman remained as Chairman of the Committee on Non-ferrous Metals of the War Industries Board; Mr. Leith transferred his chief connection from the Shipping Board to the War Industries Board, where he became Mineral Advisor to Mr. Baruch, Chairman of the War Industries Board. The offices and technical assistants of the committee remained as before in the Interior Building, and thereafter the work was continued under Mr. Leith's direction as a function of the War Industries Board. At the same time Mr. Leith retained his connection with the Shipping and War Trade boards. The increasing scope and power of the War Industries Board in regard to mineral commodities made this shift inevitable. Mr. Baruch's approval was a prerequisite to any change in importation of needed commodities, although, as before, the exigencies of the shipping situation made it possible for the Shipping Board at any time to modify the program. The three original members of the committee, though now acting in different official relations, retained close personal connection and consulted frequently in the formulation of program.

The new arrangement continued until after the Armistice, wielding the full power of the previous committee. With more perfected arrangements and more centralized authority, effective results were secured. The method of procedure remained much as before, with the exception that Mr. Baruch and members of his organization played a larger part in the initial formulation of plans before they went forward to the Shipping and War Trade boards for appropriate action. The requirements and production factors had become better understood, and it was possible to follow the developments relating to each of the mineral commodities in much more detail than before. Particular attention was paid to the minerals of the ferro-alloy group in consultation with Mr. Replogle, chief of the Iron and Steel Section; Mr. McLanglin, in charge of pig iron, and Mr. Hugh Sanford, Chief of the Ferro-Alloy Section of the War Industries Board.

Though the United States was well supplied with iron ore of the commonly used kinds, it was unable to meet the requirements for special low-phosphorus ores, some of which were imported from Spain and Cuba, and was unable also to meet its requirements for a variety of alloy minerals necessary in making the great varieties of steel necessary to the war program. Of these minerals, manganese and chromite figured most largely in overseas transport. In 1918 from six to eight hundred thousand tons of manganese ore and upward of one hundred thousand tons of chromite ore were to be imported. It was found possible to develop considerable supplies of both of these minerals in the United States and to cut the necessary importation about half. The story of these restrictions is a long and complicated one. The irregular receipt of imports, together with the irregular development of the domestic industry, created many anxious moments when the supply of one or the other of the commodities seemed to be short.

So vital were the ferro-alloy minerals to the entire steel industry that steel manufacturers on the whole wished to play safe by importing considerable amounts, and in the early stages there was considerable skepticism in these quarters as to whether the domestic industry could supply the deficiencies created by cutting down imports. For this reason it was not possible in the early stages of the program to lessen imports to the extent desired by the Committee of Mineral Imports and its successor. Later, this situation was completely reversed. The domestic production developed so fast and so far beyond expectations that further drastic cuts in imports were possible, but these could not be made fast enough to prevent the accumulation of considerable stocks.

The close of the war found an accumulation of stocks, both from domestic and foreign sources, far beyond the needs of the trade, and the consequent closing of many domestic mines, with geat financial loss. This naturally led to complaints on the part of domestic producers that imports had not been cut so drastically as they should have been. This was undoubtedly true, but the conclusion fails to give recognition to the long and strenuous fight on the part of the mineral advisors of the Government, in the face of the early conviction of the steel trade that domestic sources were not to be relied upon and that the war conditions required a considerable margin of safety in the way of imports. Notwithstanding this early attitude of steel manufacturers, it is to be said that its leaders made every effort to help and encourage the domestic industry, and it was largely to these efforts that it developed so fast. The difficulty lay in the fact that for various official reasons it was not possible to cut down imports as promptly as the domestic situation developed. There was a lag of several weeks. Had the war continued a few months longer this situation would have been taken care of by orders already under way before the Armistice was declared.

One of the minor difficulties encountered in reducing imports of manganese were certain State Department agreements with Brazil and financial arrangements made by the United States Treasury, based on the assumption of a large movement of manganese from Brazil. In the case of chromite from New Caledonia it was frequently possible to move chromite in mixed cargoes in such a way as to take advantage of space otherwise not needed. Despite official orders limiting tonnage of New Caledonian chromite to be loaded, supplies still slipped in on one pretext or another. Situations of this sort often led to strong feeling and bitter discussions, in which the domestic producers charged importers with unfair methods. Sometimes the attention of the entire trade was focused on a single vessel like the "Betsy Ross," the loading of which with 5,000 tons of chromite occasioned many strenuous conferences in which War Trade, War Industries, and Shipping Board officials took prominent part.

For six or eight weeks after the Armistice, the advisory work on mineral exports and imports was closed as rapidly as possible. This was not merely a matter of closing files and offices and dismissing assistants; it necessitated recommendations as to the releasing of embargoes in such a manner as to create as little difficulty as possible in the domestic financial situation. Immediate lifting of all restrictions on mineral imports, in view of the large supplies accumulated in this country and the large development of domestic sources of production, would have meant considerable additional hardship.

The mineral advisory work in Washington here described ended early in 1919. Restrictions had by no means been all released, but the situation had become so chaotic and so lacking in orderly procedure that the kind of systematic information used in building up the restrictions was not being used to any large extent.

CONTINUATION OF MINERAL ADVISORY WORK IN PARIS

On Dec. 28, Mr. Leith went to Paris with Messrs. Baruch and McCormick, chairmen respectively of the War Industries and War Trade boards, to act as Mineral Advisor in the Economic Section of the Peace Conference. He acted when there as the mineral representative of the Central Bureau of Planning and Statistics, which had been designated by the President to collect and forward data from the Washington departments.

Though the mineral work in Paris is part of another story, it nevertheless was concerned in considerable part with problems of the same nature as those previously met in Washington, and should be briefly summarized to complete this account of mineral activities in the international field. Some of the major problems were: (1) The readjustment of the disturbed movements of international mineral trade, in relation to new conditions of shipping, new needs, and especially in relation to the liquidation of the large stocks held by various governments; (2) consultation in regard to damages on mineral properties in the war zone; (3) estimates of value of mineral resources in enemy countries and colonies as a possible basis for reparations; (4) the collection and correlation of mineral resource data in connection with the drawing of new and political boundaries; and (5) consideration of mineral resources in their relations to future international arrangements. This last question has not received much publicity, but as a matter of fact much time was given by officials in Paris to discussion of possible future economic relationships and especially of measures which would embody the spirit of one of President Wilson's fourteen points—freedom of economic opportunity for all nations.

Mr. Baruch was made American member of a drafting committee to formulate a general plan for international economic arrangements. In the formulation of this draft, conferences were held in which mineral resources came up for discussion. In the final outcome of the Peace Conference this plan was not put into effect. All concerned, however, had become convinced of the possibilities of better economic international arrangements, and this applied to the mineral field as well as to others. This attitude was taken more or less in self-defense as a means of meeting the overwhelming number of vital economic questions which were tackled at Paris for settlement. The existing machinery was found inadequate, and even those of the Americans who came to Paris strongly opposed to any extension of international agreements found themselves working toward the formulation of some sort of an international economic organization.

Whatever may be done in this direction in the future, the trend of affairs as disclosed at the Paris Conference and since has in my view shown beyond question that national self-interest requires us to make a comprehensive study of the economic elements of international relations. Mineral resources are not the least important of the problems under this general head. At the present time our Government is not continuing this study in any broad and systematic way, though significant starts have been made in the Geological Survey, State Department, Commerce Department, Tariff Board, and elsewhere.

Just before and following the Armistice, Messrs. Leith, Spurr, and others took part in an interesting series of discussions which disclosed the foresight of the British government in regard to questions like those above indicated. Members of the British Embassy and British War Mission were earnestly engaged in an effort to find out exactly where the Allies and Central Powers stood with reference to essential imports and exports of raw materials. It was found after a series of conferences that the Allies controlled upward of a dozen of essential commodities needed in normal times by the Central Powers. Of these about half were mineral commodities. There were then further discussions as to the ways in which this commanding situation could best be used in formulating the Peace Treaty. One of the suggestions put forward prominently by the British group was that some arrangement be made among the Allies to distribute their exportable surplus of key commodities in a manner to be mutually agreed upon.

This objective consideration of the world use of raw materials was used as a guide by Mr. Leith in preparing his data for the Peace Conference. For each of the important mineral commodities a world balance sheet was made, showing the needed imports and exports of every country and comparing the position of the Allies and that of the Central Powers. These charts practically summarized all of the world data previously assembled by the Committee on Mineral Imports and Exports. During negotiations in Paris this information was repeatedly called for and discussed, but the Allies were not able to agree on anything of the nature of a post-war control of commodities. An effective weapon—by some regarded as almost the only one available for use in enforcing reparation against Germany—was therefore not used. Such information is, however, essential to intelligent consideration of a great variety of international questions now pending. It is of interest to note that high officials of the British government then saw and probably still see the significant relation of raw materials to world peace. There is indication that the British government is using such information to its greater advantage in world affairs.

In closing I would emphasize the fact that this is a brief account of the activities of the group of mineral advisory bodies as organized by the Committee of Mineral Imports and Exports, and that as such it does not bring out in proper perspective the work of many others who played important parts in this field. Both professional and business men in large numbers gave their time freely, and many of these in their official connections took large part in the results accomplished.

Mine Safety Engineers of Note

C. L. Colburn

ON APRIL 1, 1921, in response to a desire on the part of the Mining Section of the National Safety Council that a mining engineer of the Bureau of Mines be detailed for co-operative work at mines in the various districts, C. L. Colburn was appointed. The choice was a particularly excellent one, for in addition to a substantial experience in mine operation, Mr. Colburn possesses the enthusiasm necessary to the successful carrying out of such a co-operative arrangement, and he has already accomplished results that have justified the beliefs of those who were instrumental in bringing about the appointment. Clare Lorimer Colburn was born in Memphis, Tenn., on Oct. 5, 1881, and in 1896 moved with his parents to Denver, Col., where he was educated in the public schools. He then entered the Colorado School of Mines and was graduated in the class of 1907. While an undergraduate he found employment during the vacation periods in the mines at Cripple Creek and Breckinridge. After graduation he held several "jobs" around mines, and for six months was assayer and chemist for the Colorado Assaying & Refining Co.

C. L. COLBURN

In June, 1908, Mr. Colburn formed a partnership with Carl A. Allen in Denver, Col. Soon afterward Mr. Colburn was sent to Luning, Nev., by the Lodi Mines Co., where he remained for several months, surveying the mining property and laying out the mining town and smelter site.

In the spring of 1909 Mr. Colburn surveyed part of the Dives-Pellican mine, at Georgetown, Col. Later in the same year he made a mine examination near Breckinridge, Col., and represented his client as an expert witness in a mining suit which followed. In October, he was sent to Bradshaw Mountain to examine the Crown King mine and several prospects in that vicinity.

The firm of Allen & Colburn subdivided a large tract of land and were the engineers for the construction of an irrigation system at Lisco, Neb. Irrigation systems were also planned during 1910 and 1911 for the Lodge Pole Valley of Nebraska, the Republican Valley of eastern Colorado, and western Nebraska.

In 1911 Mr. Colburn went to Butte, Mont., to accept a position on the engineering staff of the Butte & Superior Mining Co. After several months he was made superintendent of the Stonewall Bryan group of claims, in North Butte, which the Butte & Superior were developing. In 1912 he was made chief engineer for the Butte-Duluth Mining Co. He successively held the positions of superintendent and manager for the same company. The Butte-Duluth company was carrying on underground operations at the Montgomery mine and also mining oxidized copper-bearing ore from an open pit which was treated in a sulphuric-acid leaching mill. This was the first large sulphuric-acid leaching operation in this country. In 1913 Mr. Colburn returned to Denver to resume his engineering practice. In 1914 he took over the management of the Cumbre Mining Co. in that company's operations of a lease on the Junietta and Country Boy mines, in Breckinridge, Col. He represented the New Queen Gold Mining Co. in its suit with the Duncan mine regarding extralateral rights.

In partnership with Mr. Allen, Mr. Colburn did considerable leasing in Breckinridge and Leadville and also examined molybdenum deposits near Climax, Col., and the Fryer Hill district of Leadville for clients. In the fall of 1917 he was made a member of the Speakers' Bureau of the Colorado Council of Defence. After spending several months with this bureau, he secured a position with the U. S. Bureau of Mines, sampling coal for the Navy. In July, 1918, he took the examinations for the Army, was commissioned a captain of engineers, and assigned to Camp Humphreys, Va., for training. He was then assigned to the 140th Engineers at Camp Shelby, Miss., and served with his company until discharged.

Early in 1919 Mr. Colburn returned to the Bureau of Mines as a mining engineer in the Mining Division, later being made assistant chief mining engineer under George S. Rice.

CONSULTATION

No Instruments To Locate Gold and Silver Deposits

"I have been told that you could tell me where I could get an instrument for locating or finding gold or silver hidden in the earth if brought anywhere near it. If so, please let me know if you have any, or where I can get one. I have looked in a few issues of *Engineering and Mining Journal*, but don't find what I want as yet. Please let me know if you can give me any information."

Engineering and Mining Journal frequently receives inquiries from prospectors and others as to the merits of devices reported to have been invented and used for locating ore deposits. We know of no instrument that will successfully locate gold and silver. The magnetic compass is used in the location of iron-ore deposits, and *Engineering and Mining Journal* recently published articles on European attempts to determine subsurface orebodies by means of electrical currents. The divining rod has also been commented upon both editorially and by our subscribers. Many persons are firm believers in the possibility of inventing an ore-finding instrument, but no such device of practical value has so far been developed.

Wilfley Table Twenty-Six Years Old

"In a recent conversation with a party from the West the question came up as to when the Wilfley table patent was obtained. If you are in a position to give me this information it would be greatly apreciated."

The Wilfley table was invented by Arthur R. Wilfley and patented by him in 1895. The first table, we believe, was used in May, 1896, by the maker in his mill at Kokomo, Col. The first table sold was installed in August of the same year, in the Puzzle Mill, at Breckenridge, Col.

Commercial Value of Mica Flakes

"I have a deposit of mica, in which the mica occurs in small flakes, too small to be used for sheets and similar purposes. I believe it also carries some impurities, and would like to know whether there is any practical method of separating the mica from them. Is this grade of mica of any value?"

Mica is of no commercial value as sheet mica if it appears only in very small flakes. Small pieces of mica may be utilized for the manufacture of ground mica used in wall paper, as a lubricant, and in the roofing industry. The material must not contain much impurity in the form of quartz, feldspar and other foreign minerals. We have no information, at the present time, indicating that it is possible to separate mica from such waste material, on a commercial and profitable scale. Practically all of the ground mica now used in the country is manufactured from scrap that results from trimming and cutting of sheet mica. Such cuttings consist of mica only, and, therefore, the grinding companies are not confronted with the problem of separating the mica from impurities. As mica has about the same specific gravity as its impurities, a gravity concentration method such as is employed with the heavy ores cannot be used. The opinion is ventured, therefore, that one would have difficulty in constructing equipment which would successfully separate, on a commercial scale, the mica from the other minerals present.

The Use of Titaniferous Ores

"Can you give me any information relative to the use and users of titaniferous ores, especially rutile? Also, any information you may care to furnish as to concerns most likely to be interested in securing quantities of this high-grade material will be highly appreciated."

Rutile (titanium oxide) and ilmenite (iron-titanium oxide) are the two chief titaniferous ores, and have limited uses. During the war rutile was used for the manufacture of titanium tetrachloride for use in smoke screens, but its chief application normally is in the manufacture of ferrotitanium alloys. Titanium is a common constituent of the earth's crust, but as a metal finds small employment, owing to its infusibility. Titaniferous iron ores present metallurgical difficulties in the recovery of their iron constituent, and are not mined extensively for their iron content.

Only two companies in the United States are engaged in the manufacture of ferrotitanium: the Titanium Alloys Manufacturing Co., which operates a plant at Niagara Falls, N. Y., and uses ilmenite as a raw material, and the Metal and Thermit Corporation, of Jersey City, N. J. Ferrotitanum, being a powerful deoxidizer, is used to cleanse molten steel.

Assessment Work and Abandonment

"In your journal of July 23, 1921, you have an article with regard to assessment work. Will you please inform me how a mining claim in the possession of the owners on July 1, and on which work was being performed, disregarding entirely the question of whether the assessment work for 1920 had been completed, could come within the condition which requires that a mining claim subject to relocation must have been abandoned by its former owner?"

The condition which requires that a mining claim subject to relocation must have been abandoned by its former owner is a statement that does not seem to be in accordance with the mining law. Referring to "Lindley on Mines," it is stated:

"Abandonment is always a question of intent. In forfeiture, the element of intent is not involved. It (the forfeiture) rests entirely upon the statute, and involves only the question whether the terms of the law have been complied with."

A claim holder forfeits all rights to his claim by failing to perform the required amount of assessment work within the stipulated time, even though he had no intention of abandoning the claim.

It seems, therefore, that it is incorrect to say that a mining claim subject to relocation must have been abandoned by its former owner. We find nothing in Lindley's work to this effect.

HANDY KNOWLEDGE

A Small but Profitable Mill

BY S. F. GODFREY

Written for Engineering and Mining Journal

A gold property is being worked on a small scale near Neenach, Cal., by C. B. Cherbbono. The ore is taken from a cut on the hillside in an ordinary car and run to a chute, at the end of the dump, which is made from a discarded boiler stack. This discharges into a two-ton bin or box equipped with a crude but efficient feeder of the drag type, which had been made from the scrap of an hay baler.

The feeder discharges into a 3 ft. x 15-in. ball mill and is operated by an arm attached to the ball-mill scoop. A hose line from a small reservoir furnishes the water, and the run-of-mine ore is scooped up wet.

CHUTE AND GAS ENGINE-DRIVEN BALL MILL ON GOLD PROPERTY, NEENACH, CAL.

The mill is driven by a 5-hp. gas engine and discharges peripherally through a forty-mesh screen on to a baffle plate, from which it is run over amalgamated apron plates and thence by launder to the tailings pond.

The mill is started at 5 a.m. One man is employed on night shift in order to have ore in the bin when the mill starts. The mill is shut down at 9 p.m., thus getting a sixteen-hour run with an average output of eight tons. The plates are cleaned at noon and at night, the amalgam being stowed away in a trusty lard bucket.

The ore is an iron-stained granite carrying free gold and the plate recovery is from $5 to $15 per ton. Instead of depending on assays to determine what is pay ground, a half ton or so of doubtful material is put through the mill. The tailings are carefully panned and show no free gold. The milling expense is estimated at $3.20 per day, or 40c. per ton milled. Several hundred tons of tailings are in the pond. Single jacking is employed in breaking ground.

Dressing Amalgamated Plates With Potassium Amalgam

BY CHARLES FLURY

Written for Engineering and Mining Journal

Upon starting up a stamp mill in Korea that had been shut down for six months, the plates were found to be in very bad condition. Before operation was resumed, they were cleaned with wood-ash extract, sand, and mercury, but the surface of the copper was oxidized and the mercury kept rolling off into the launders and on to the Wilfley tables between each dressing, which was done at six-hour intervals. For the first month only the first apron plates amalgamated properly. The fact that the temperature of the water (approaching the hot season) was rising steadily and that a low-grade ore of about 0.4 oz. gold per metric ton, giving normally only 20 per cent amalgamation, was treated, made it difficult to get the plates into good condition. The amalgamation at the end of the first month was only 5.8 per cent. Resilvering the plates would have meant a delay of months because of the particular situation of the property.

To avoid such a delay I experimented with potassium amalgam with the object of getting a firm deposit of amalgam over the whole plate-area, to precipitate the mercury on the plates. I proceeded as follows:

Two grams of metallic potassium, thoroughly freed by means of filter paper from adhering oil, which serves to preserve it, was added in small portions to 200 grams of dry mercury at 40 deg. C., the mercury being in a porcelain dish. There was an immediate reaction, with the development of heat, the potassium dissolving and the mercury brightening to a clean surface. Specks of potassium carbonate and caustic potash floating on the surface were removed carefully with filter paper. The reaction took ten to fifteen minutes. The potassium amalgam thus formed had a strength of 1 per cent potassium and was poured into the dry atomizing bottle.

After the battery which was to be dressed was stopped and the remaining pulp washed into the trap, the apron plates were broomed and the potassium amalgam was sprinkled over the plates. There was a violent reaction the moment the amalgam came in contact with the plate. Gas was apparently evolved, and the copper film disappeared, being covered immediately with mercury. The mercury thus precipitated spread out like water and was made to cover the plates with sand. This last procedure was rather difficult, as the mercury was solidly attached to the plate and only by repeated treatment could the whole plate be covered uniformly. After applying the potassium amalgam for a week the plates became bright and spotless. Instead of feeding only 1.8 grams of mercury I was able to feed 7 grams per metric ton of ore per day, without having the mercury roll into the launder. The amalgam treatment was then stopped and the usual mercury feed applied.

The lower plate area which receives but little amalgam was washed twice a day with wood-ash extract containing 0.2 per cent of sodium cyanide to keep it clean. Within one month the amalgamation was thus raised to 12.5 per cent.

The efficiency of the potassium amalgam treatment is due, as far as I can see it, to the hydrolysis of this amalgam. The reaction would be as follows:

$$2KHg + 2HOH = 2Hg + 2KOH + H$$

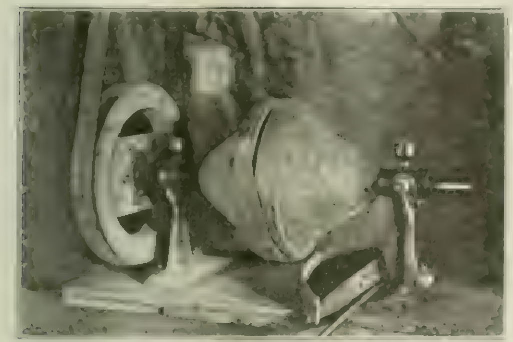
The nascent hydrogen thus produced reduces the oxide film on the copper plate, cleaning the surface.

A Convenient Laboratory Ball Mill

By A. W. FAHRENWALD

Written for Engineering and Mining Journal

Labor-saving devices in the laboratory are as important as in the mine or mill. Many tests are made daily with equipment that is neither convenient nor efficient. A good deal of all laboratory work is routine, and often this routine work is hard and monotonous, which fact reduces the efficiency of an experimenter greatly.



BALL MILL WITH PERIPHERAL ½-IN. SLOT, CLOSED WITH RUBBER BAND WHEN RUNNING.

The preparation of ore samples where much testing is being done should be both simple and easy. It, however, is usually not so and is looked on by the experimenter as a hard and dirty job.

At the ore-testing laboratory of the School of Mines, University of Idaho, where the U. S. Bureau of Mines is co-operating with the Idaho State Bureau of Mines and Geology in studying ore-dressing problems, many samples daily had to be prepared to all degrees of fineness and both dry and in solution. The mills available were of the type that had to be handled both in charging and discharging. Considerable time and patience were required to clean the balls after grinding a charge.

A suitable mill, one that could be easily charged and discharged without handling, and that could be cleaned and conveniently used for grinding either dry or in solution, could not be found listed in the catalogs of any of the firms handling laboratory equipment. I then designed a mill embodying these features, which is shown in the accompanying illustration. It consists of two funnel-shaped castings with their bases bolted firmly together but separated from each other a distance of ½ in. by four lugs. This provides a peripheral slot, as shown in the illustration, where the band is pushed to one side. This slot is closed by a strong rubber band when a charge is being ground. The band is made of a piece of an automobile inner tube. For 2 in. on either side of the slot the mill is turned so as to be perfectly cylindrical, affording a close fit when the rubber band is stretched around the mill and over the slot. The band affords a perfect seal of the slot when grinding, either dry or in solution.

To discharge the mill the rubber band is slipped off and the mill revolved for two or three minutes as in grinding. The ore content is completely discharged in this length of time. The mill shown is 10 x 12 in. inside diameter and reduces 2,000 g. of —8-mesh ore produced from rolls to —65-mesh in forty to fifty minutes. The balls used range in size from a little more than ½ in. in diameter to 1 in. They should not be small enough to slip through the peripheral slot.

This mill has made the preparation of ore samples in flotation and cyanidation testing a pleasure and has reduced the time for the preparation of a single sample from one and one-half to two hours by the older method to about fifty minutes.

The discharging operation and the cleaning of the mill by grinding sand or other suitable material in it can be done while the testing engineer is engaged in other work about the laboratory.

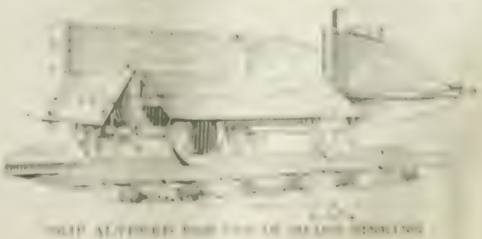
Altering Incline Skip for Use in Shaft Sinking

BY H. H. HUNNER

Written for Engineering and Mining Journal

Two incline skips that had previously been used to hoist ore from a pocket were fitted with new axles for standard-gage track and put into service on a 29-deg. slope, sinking in trap rock. As seen from the sketch, the top edge of the box above rail was 3 ft. 7 in. This being found too high for mucking with ease, the sides and back were cut off by burning 14 in. from the top as shown. The cut-off pieces of the two sides and back were fitted with two strap hinges on the bottom edges. A hook and an eye-bolt, placed so as to fit snugly, hold the back corners together when closed. The forward end of the skip ahead of the upright strap was left intact and a U-clasp was bolted to it on each side to hold the doors in place when closed. This arrangement permitted two-thirds of the load to be shoveled in before the sides were closed, and made it easy to load the large chunks.

In lowering caps, which were 21 ft. long, the rear door was dropped, giving a point of support at the rear about the same height above the rail as the top side of the bale in the forward end. In lagging up the back, a level staging was made by laying short planks in the bottom of the skip, the lower ends resting on the back hinges.



SKIP ALTERED FOR USE IN SHAFT SINKING

THE PETROLEUM INDUSTRY

Deadlock in San Joaquin Valley Strike

SAN FRANCISCO CORRESPONDENCE

The oil workers' strike in the lower San Joaquin Valley oil fields has entered its third week. Newspaper accounts credit the strikers with having built up a military organization which maintains patrols on all the roads, operates a wireless system for communication, and has finally secured an airplane for scout purposes. The strikers have been enabled through some of the county authorities to swear in a number of deputies, and thus have secured a certain legal status in supporting their position. Their organization is headed by a "law and order" committee, whose definite purpose appears to be to picket the properties of the operators and prevent the entrance of any workers who might be brought in to take the place of the strikers.

Until recently all autos were stopped and the occupants were questioned as to their business in the district. This practice has been since discontinued, however, according to reports, but the patrols and picketing continue. The operators have made no move to bring in workers. The strikers are willing to accept the wage cut recently made and waive union recognition and the closed shop, but insist on the operators signing an agreement with the Government representatives that they will make no further wage cuts for the period of one year.

The operators want "less government in business and more business in government" and contend that the agreements which were made during the last four years were the result of war-time expediency. They contend for the right of each company to negotiate future agreements with its own employees and without respect to union rule of Government boards. They say that the "law and order" committee of the strikers is for the purpose of preventing the employers by force from employing other men to take the place of the strikers. They contend that each employer has the right to employ any person he desires to operate his properties. The present status is a deadlock, with the strikers in apparent control of the properties.

New Oil Wells in the Texas Fields

SPECIAL CORRESPONDENCE

A new gusher was recently completed in the Mexia field, Limestone County, making from 15,000 to 25,000 bbl. per day, flush production. This is the No. 1 well of the Kirby Petroleum Co. The flow started from a depth of 3,050 ft., after having been drilled 74 ft. into the sand. The storage facilities, which had been prepared in anticipation of a good production, are not nearly large enough for this enormous flow. The well is 1,500 ft. northwest of the Dusenberg gusher, completed a short time ago. The Kirby Petroleum Co. has acquired a considerable acreage around the well. The well itself is said to be lower on the anticline than the Dusenberg well.

Two deep wells of importance have also been completed in the Texas Gulf Coast fields. At Pierce Junction the Gulf Production Co. brought in its No. 2 Taylor well, making 3,000 bbl. of pipe-line oil from a depth of 3,950 ft. This well was a work-over, having previously been drilled to 3,200 ft., where it produced about 100 bbl. daily. Deeper drilling resulted in the larger production. The other is the No. 9 Schilling well of the Turnbow Production Co., at Goose Creek. This well blew in at 4,336 ft. and is flowing at the rate of 2,000 bbl. of pipe-line oil daily.

Oil Struck Near Lewiston, Mont.

SPECIAL CORRESPONDENCE

Oil has been encountered at a depth of 400 ft. in a well being drilled on the Swallow's Nest structure, at Lewiston, Mont. Although the showing is not a large one, it is regarded as encouraging, as it comes from a small sand from which little was expected. The well is being drilled deeper to encounter larger sands from which production is expected.

The development has created considerable excitement locally, as it has been generally held that this section is unfavorable for oil, on account of overlying basalt.

Oil Shale Reported in Tarapaca, Chile

Discovery of a large area of petroleum-bearing schist or shale has been made at Chucumata, a small local port about twenty-four miles south of Iquique, Chile, according to a recent newspaper article, announces U. S. Consul Homer Brett. Samples weighing about 300 lb. were analyzed by the Nitrate Industrial School in Iquique, and it was found that the petroleum content was large.

Twenty-one mining claims of fifty hectares each have been filed, and a company called the Compañia Nacional Petrolifera Luz de Chile has been organized, of which Don Miguel L. Marquez, of Iquique, is president and general manager.

Dominican Central R. R. to Use Oil as Fuel

A recent report from U. S. Consul W. A. Bickers, at Puerto Plata, states that the Dominican Central R.R. had received during the month a cargo of fuel oil and will hereafter use oil as fuel instead of coal. This road has oil tanks and is converting its engines into oil burners. Formerly it required between 5,000 and 6,000 tons of coal per year. The railway intends to supply fuel oil at cost to the small factories in the republic, which will enable them to purchase oil in larger quantities at lower prices.

Americans Seeking Oil in Panama

In a report dated July 30, 1921, U. S. Consul George Orr, at Panama City, states that concessions have recently been obtained by two American oil companies for carrying on operations in Panama. Considerable exploration work has been done, but no oil deposits have yet been located. Legislative enactments canceling certain privileges originally granted to the concessionaires have resulted in practically suspending active operations.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Tenth Annual Safety Congress of the National Safety Council Held at Boston, Sept. 26-30

Sectional Meetings of the Industrial Groups Include Papers and Discussions Relating to Safety Practices—Mining Section Holds Sessions on Underground Transportation, Fire Fighting and Prevention, Safety Co-operation and Mine Hygiene

STAFF REPORT

FOR THE FIRST TIME in its history, the State House at Boston opened its doors for convention purposes, which indicates the high opinion that the Commonwealth of Massachusetts holds of the work which is being done by the National Safety Council. The Tenth Annual Safety Congress opened on Sept. 26. Headquarters were situated on the third floor of the State House, and most of the section meetings were held in adjoining rooms, others being held at the Massachusetts Institute of Technology and at the Harvard Medical School.

Following a custom established by the National Safety Council at its annual meetings, Boston held a "No Accident Week," and this was also extended to other cities in the state. The attendance was good, about 2,500 members registering. In addition to the regular section meetings, a number of other interesting features were arranged, including motion pictures, safety demonstrations, and trips to various parts of the city.

Monday was largely given over to registration, meetings of officers and committees, and the transaction of the regular business. The section meetings began on Tuesday and included the following branches: Automotive, Chemical, Construction, Drop Forge, Education, Electric Railway, Engineering, Health Service, Metals, Mining, Packers and Tanners, Paper and Pulp, Public Safety, Public Utilities, Rubber, Steam Railroads, Textile, Women in Industry, and Wood Working. A report of the mining section meetings, which were well attended and created great interest among coal- and metal-mining engineers and operators, follows.

The first session of the mining section was held on Tuesday morning, Sept. 27. B. F. Tillson, in making his report as chairman, detailed the past history and the present work of the section and referred to the increasing interest which is being taken in its activities. He called special attention to the co-operative work now being done by C. L. Colburn as safety engineer representing the U. S. Bureau of Mines and the Mining Section of the National Safety Council. Owing to the late arrival of many of the delegates, it was necessary to omit the report of the secretary and the reports of some of the committees.

USE OF STORAGE BATTERIES IN UNDERGROUND TRANSPORTATION

The first paper, "Storage-Battery Locomotives in Metal Mines," by E. V. Daveller and R. E. Renz, was read by Chairman Tillson. In this paper it was stated that the use of the storage-battery locomotive for haulage in the metal mines of the West has been on the increase steadily since 1913 until the recent depression in the mining industry.

Trolley locomotive haulage is well suited to long hauls underground where there is a large tonnage and ample head room in ground that is readily held in place. The storage battery has its particular field in that it can operate in drifts or haulageways with a minimum of head room, it has a wide range in amount that can be hauled, and can easily be moved from one level to another when mining operations demand it. It can fit into any of the particular fields of the three other common methods of underground haulage.

In the Butte & Superior Mining Co. mine at Butte, Mont., underground haulage with storage-battery locomotives has been very successful. The mine is being, or has been, operated down to the 2,300 level, with mining operations being carried on from the 800 to the 2,300 level in the last nine years. The orebodies are wide and the ground is heavy, causing a continual shifting of the grade on the haulage levels and making it unfavorable to maintain economically a constant height of the haulageways. Owing to this condition, all haulageways are narrow and low.

One big advantage of storage-battery locomotives is almost entire freedom from electrical troubles, such as grounds and shorts [illegible] with. Because the voltage is only [illegible], there is little danger from accidental contacts. During the entire operation at the Butte & Superior mine there has been no accident of the locomotives that could be attributed to electrical causes.

The following statistics for the year 1919 at the Butte & Superior are of interest: Number of locomotives operating, 9; cars of ore hauled, 605,372; cars of waste hauled, 172,[illegible]; average haul of car of ore, 800 ft.; average haul of car of waste, 747 ft.; cost of power per car hauled, $0.0041; cost of repairs for locomotive per car hauled, $0.03205; cost of motorman and helper per car hauled, $0.0690; Total, $0.10515.

In Butte both the Elm Orlu Mining Co. and the Anaconda Copper Mining Co. are using storage-battery locomotives with good success. At the Alaska Gastineau mine, at Thane, Alaska, a large type of locomotive has been adapted with great success.

F. W. Whiteside, in his paper, "Advantages of Trolley Locomotives for Underground Haulage, From a Safety Standpoint," found fault with some of the other types of motive power, and by a process of elimination endeavored to prove the superior features of the trolley locomotive. With correct installation, ample weight of tracks, proper bonding of rails, avoidance of sharp angles and rough trolley frogs, and protection of wires, the danger in the use of trolley locomotives can be greatly reduced.

COMPRESSED-AIR HAULAGE AT HOMESTAKE

Guy J. Johnson, safety engineer of the Homestake Mining Co., Lead, S. D., read a short paper on "Compressed Air Haulage," which included an interesting account of the experiences of his company with this type of apparatus. Its adoption was started at the Homestake mine in 1904, and by 1908 had completely supplanted animal haulage. The high-pressure compressor installation consists of an Ingersoll-Sergeant four-stage, cross-compound Corliss, converted from steam to electric drive (Dodge rope drive) with a piston displacement of [illegible] cu.ft. per minute, rated to deliver air under [illegible] lb. pressure at a [illegible] elevation, and one Fraser & Chalmers [illegible] Ingersoll-Rand [illegible], cross-compound Corliss, with a piston displacement of [illegible] cu.ft. per minute, rated to deliver [illegible] under [illegible] lb. pressure at a 5,000-ft. elevation. On the surface, to deliver air to the locomotives, there is the [illegible], with 8 in. x 14 in. cylinders and [illegible] cu.ft. air capacity, and [illegible] and one-half ton locomotives with [illegible] in. cylinders and [illegible] cu.ft. air capacity. These operate on [illegible] tracks, and haul bottom-dump cars of [illegible] cu.ft. capacity.

Underground, they are operating on fifteen [illegible], with thirty locomotives over approximately sixty miles of 18-in. gage track, using both end and side dump cars of 19-cu.ft. capacity. Of these locomotives, seventeen are five ton, with 6-in. x 10-in. cylinders and 40 cu.ft. air capacity; three are five ton with 6-in. x 10-in. cylinders and 28½ cu.ft. air capacity; and ten are three and one-half tons, with 5-in. x 8-in. cylinders and 20½ cu.ft. air capacity. All receive their air charges at approximately 800 lb., and deliver it to their cylinders at 150 lb. Their "cruising radius" is 2,000 ft. with full load, and return. Their charging period is less than a minute, so they can operate continuously without more than the normal stop at the end of each haul. In spite of the evident mechanical losses in compressing air above 800 lb. and using it at 150 lb., the power cost is 2.1c. per ton-mile. Maintenance and repair of compressors, locomotives, pipe lines, charging stations and so forth costs 1.77c. per ton mile, or 0.768c. per ton.

In presenting his paper, "Storage-Battery Locomotives as Applied to Mine Haulage," Charles E. Stuart stated that the first storage-battery locomotives for mine haulage were manufactured in 1897 and were tried out in the Pocahontas coal field. The early types were hardly satisfactory, being insufficiently motored, and other circumstances prevented their adoption at that time. Recent improvements, however, have shown this type to be highly successful, especially in coal mines, and among the advantages that are claimed are the following: They require no trolley wires or bonding of tracks; the personal risk of contact with trolley is eliminated, and there is no dependence on substation or power plant during idle days. The failure of the storage battery at any mine, according to Mr. Stuart, will be accounted for by one of the following reasons: A duty cycle in excess of battery capacity; misapplication, or, in other words, the effort to use the storage-battery locomotive where mule power is cheaper or where man power in conjunction with the strictly haulage type of locomotive would be cheaper; failure to select a locomotive which will stand the abuse of mine practice, and failure to give a reasonable amount of care and attention. Several diagrams showing the performance of storage-battery locomotives under various conditions were shown.

Following the reading of Mr. Stuart's paper there was considerable discussion concerning the query by Mr. Stuart as to the reason for high costs of transportation per ton-mile in metal mines as compared with those in coal mines. This seemed to be due principally, in instances where comparisons could be made, to the variable conditions met in the removal of ore or coal from the working face. There was a difference of opinion as to the advantage of large cars, both from a safety standpoint and with relation to the tonnage handled. Charles W. Goodale, W. H. Patton, J. W. Reed, Carel Robinson, D. B. Wilcox, Guy Johnson, R. L. Kingsland, E. L. Solomon, and Mr. Tillson took part in the discussion.

ANIMAL HAULAGE IN COAL MINES

During the afternoon session the meeting was presided over by D. E. A. Charlton, in the absence of Mr. Tillson. The first paper read was that by E. L. Solomon on "Animal Haulage at Anthracite Coal Mines." In connection with this paper several slides were shown, illustrating various devices that are being used to simplify the work which is required of the mine mule. Under proper conditions, and given the right sort of care, said Mr. Solomon, the mule will respond and render excellent service. Lieutenant Colonel J. A. C. Ritson, in the discussion following this paper, stated that, owing to the thin beds of coal in England, the use of mules in transportation had not found favor there. Shetland ponies have been used to a considerable extent and have proved quite satisfactory.

R. H. Seip read R. M. Magraw's paper, "Animal Haulage in Coal Mines." Mr. Magraw covered somewhat the same ground as did Mr. Solomon in his paper, and also pointed out several features relative to the transportation problems in coal mines.

Following this paper, suggestions as to possible candidates for officers of the mining section for the ensuing year were requested by Charles W. Goodale, chairman of the nominating committee. Mr. Goodale stated that it was the intention of the committee to make selections so as to cover the metal and coal fields as well as to secure geographical representation.

A paper, "Block Signal and Dispatching Systems," by R. T. Murrill, was read by Mr. Charlton. It was unfortunate that it was impossible to show slides of the photographs and diagrams accompanying this paper, for these were well selected and served to illustrate several points mentioned. Descriptions were given of the manual block and the automatic block-signal systems, the latter being particularly interesting, as the author describes the method used on the 600 level of the Inspiration mine at Inspiration, Ariz. This system is an adaptation of the standard equipment used for high-speed surface railway traffic. The level is divided into a number of blocks, and at the ends of each block and at other prominent points on the main line signal lights are placed. The signal lights are operated by means of track circuits; lights are changed automatically by the passing of a train or the throwing of a track switch lever, and different colored lights are used.

SESSION OF FIRE FIGHTING AND PREVENTION

The third session, that on Mine Fire Prevention and Fighting, opened Wednesday morning under the chairmanship of Mr. Tillson. Papers on this subject as applied to anthracite coal mines were read by W. L. Jacobus and by Mr. Tillson, the latter presenting H. H. Otto's paper. Both of these related to the causes, precautions taken, and methods of fighting fires in anthracite mines. The former dealt with conditions at the mines of the Susquehanna Collieries Co., and the latter with those of the Lehigh Coal & Navigation Co. Fires in bituminous coal mines were discussed in the papers of Joseph W. Reed and G. M. Gillette, these relating to the practices at the mines of the Consolidation Coal Co., in West Virginia and Kentucky respectively. Both of these papers were illustrated by lantern slides.

Mr. Tillson read H. M. Wolflin's paper on "Fire Prevention and Fighting in Metal Mines," and this was of considerable interest to metal-mining men, as it brought out several points that have had comparatively little consideration. An interesting account was given of a fire in a California mine at which liquid carbon dioxide was used as a means of stopping the conflagration. In introducing the carbon dioxide into the mine the following method was used: A 2-in. pipe was run from the surface through the bulkhead in the main shaft. This was connected to another section of 2-in. pipe that had a series of twenty connections, to each of which a carbon-dioxide cylinder could be attached, so that a battery of twenty cylinders could be discharged at one time. The cylinders in the battery to be discharged were placed in old 100-lb. carbide drums filled with water. A steam line was arranged so that a ½-in. pipe containing steam at a variable pressure of 10 to 40 lb. per sq.in. gage could be turned into the water in each carbide drum to heat the cylinders as they were being discharged. The carbon dioxide was started into the mine at the rate of approximately forty cylinders (15,000 cubic feet) per hour. The time required to empty a battery of cylinders was from seventeen to twenty-five minutes, averaging twenty minutes, varying with the quantity of steam available. The maximum pressure in the 2-in. pipe carrying the carbon dioxide when twenty cylinders were being discharged was 55 lb. per sq.in. gage.

Following the reading of all of these papers, Messrs. Colburn, Jacobus, Gillette, and Tillson discussed several features relating to the coal papers. Guy J. Johnson, in discussing Mr. Wolflin's paper, stated that the practice of taking frequent air samples during and following the fighting of a metal mine fire was to be strongly recommended. He also said that braticing was ineffective when the ground is caved. Mr. Goodale spoke briefly on conditions relating to fires in the Butte district, and referred to the flooding of the fire area with flotation tailings. He also brought out the fact that a stope filled with caved rock or refuse permits infiltration of air so that it cannot be regarded as being effective in checking a fire.

ELECTION OF OFFICERS OF MINING SECTION

At the completion of these discussions, the election of officers was held and resulted in a unanimous vote for the following: Chairman, B. F. Tillson; secretary, R. H. Seip; first vice-chairman, G. M. Gillette; second vice-chairman, John L. Boardman; and third vice-chairman, William Connibear. Chairman Tillson announced the appointment of J. T. Ryan as chairman of the Committee on Membership and Publicity, and stated that he hoped the present chairman and subchairman of the remaining committees would continue. These are as follows: D. E. A. Charlton, Program and Publications; Prof. R. M. Raymond, Standardization; Orr Woodburn, Mine Rescue, First Aid, and Contests; W. W. Adams, subcommittee on Accident Statistics; Rudolph Kudlich, Ropes and Safety Devices; Prof. H. H. Stoek, Mine Haulage; Dr. R. R. Sayers, Mine Hygiene and Sanitation; Joseph W. Reed, Mine Fire Prevention and Fighting; Major M. J. Shields, Standardization of First Aid Methods, and D. J. Parker, Standardization of Mine Rescue Training. Following the reading of an invitation extended to the section to co-operate with the A. I. M. E. at the February meeting in New York, and an announcement of the tentative program for that meeting, the session was adjourned.

CO-OPERATIVE SAFETY METHODS

Considerable interest, as evidenced by the discussions, was shown at the session held Thursday morning on the subject of maintaining interest in safety. Guy J. Johnson, safety engineer of the Homestake Mining Co., presided. The first paper, read by Mr. Tillson, was by W. H. Moulton and William Connibear, on "Maintaining Safety Interest Among Executives." This paper outlined in a general way the plan adopted by the Cleveland-Cliffs Iron Mining Co., in which a central safety committee, composed of men in executive positions, acts as a legislative body upon safety devices and recommendations. It was stated that a well-defined policy, consistently worked out, would enable an executive to feel the same degree of satisfaction in safety work as in all other features incident to production. Mr. Seip read a paper by Thomas Cowperthwaite on "Maintaining Interest Among Foremen and Bosses." At the mines of the Calumet & Arizona Mining Co., for which Mr. Cowperthwaite is safety engineer, the shift bosses, foremen, and other employees constitute the safety committee, and they are held responsible for such accidents as occur to the men in their charge. Complete accident records are kept, monthly meetings are held, and a competitive system, which is made the basis of a bonus plan, is maintained.

SAFETY BONUS AT FRANKLIN, N. J.

"Getting the Safety Message to the Individual Miner," a paper by N. D. [illegible], was read by Mr. Johnson. This related to the work being done in the bituminous coal regions and brought out the particular need of personal contact between those charged with the safety of the men and the men themselves. Inspections, meetings, the use of bulletins and letters, first aid and mine rescue classes, and the use of moving pictures were among the suggestions offered for the furtherance of the safety idea. John T. Bradley's paper was read by Mr. Tillson, and it made further suggestions in the same directions. Following the reading of these papers, Mr. Seip outlined a bonus system now in use at the mines of the New Jersey Zinc Co. for the prevention of mine accidents. Bonuses are paid monthly, semi-annually, and annually, and are based both on the number of accidents and the time lost. Under this system, which has been particularly successful in keeping down the number and lost time of accidents at their mines, each of the bosses receives $5 monthly provided there are no accidents among his men during that month. A semi-annual bonus of $20 is paid provided he has during the half year not more than ½ an accident per 1,000 shifts worked. Also, annual bonuses on the same terms are allowed. With a standing that shows a loss in time of less than 0.4 per cent of total possible working time, he can further receive an additional $20 semi-annual bonus. The system has the advantage that if a boss loses his bonus for the early part of the year, he can still retrieve in the later part, and the inducement remains for him to hold down accidents. In discussion, several features advantageous and disadvantageous to the bonus system were mentioned.

COLBURN RECOUNTS TRAVELS

F. J. Bailey, assistant to the Director of the U. S. Bureau of Mines, in introducing the next speaker, C. L. Colburn, spoke briefly of the co-operative work of the Bureau and the National Safety Council which has been in operation for six months. Mr. Colburn, in his paper, "Observations of a Safety Engineer in Various Coal and Metal Mining Camps of the United States," outlined several of his experiences at various coal and metal mines and told of the work that is being done along safety lines. Several excellent slides, showing devices, right and wrong practices, and plant installations, were shown.

There was no afternoon session, and several of the visitors availed themselves of the opportunity to view some of the places of historic interest in and about Boston. In the late afternoon a boat trip to Pemberton Beach was made, followed by a shore dinner there, and an entertainment and dancing.

HYGIENE, SANITATION AND SAFETY

The session on mine hygiene, sanitation, and safety was held on Friday morning, with Mr. [illegible] presiding. The first paper read was that of R. H. Seip, on "Traveling Ways and Signs." Mr. Seip outlined the system in use at the mines of the New Jersey Zinc Co. for pointing out means of travel underground, and showed several slides illustrating the signs in use. Reference was made in the paper to the standards and specifications of mine ladders and the need of providing safe means of travel. At the New Jersey Zinc Co. properties at Franklin, N. J., three regular routes are prescribed. Mr. Tillson called attention to the standard danger sign—a solid red circle surrounded by a black square on a background of white—which was approved by a special committee of the National Safety Council and adopted by the council. Richard Maize, one of the Pennsylvania state mine inspectors in the bituminous region, called attention to the fact that it was essential that danger signs be placed only where there was actual danger; otherwise, their value would be discounted. Mr. Colburn suggested the use of "caution" signs in many places where danger signs are now used.

DRINKING WATER AT HOMESTAKE

The next paper was that of B. C. Yates, on "Provisions for Drinking Water at Mines," which was read by Mr. Johnson. The system of supplying drinking water at the property of the Homestake Mining Co., at Lead, S. D., was explained, and sketches illustrating the distribution of the system throughout the mine were shown. Mr. Goodale spoke briefly on the Butte methods of supplying drinking water at the mines. Mr. Reed stated that no attempt to pipe water into the mines of the Consolidation Coal Co. had been made, excepting for such supplies as were needed for the mules.

REFUGE ROOMS ADVOCATED

Considerable discussion followed the reading of Dr. R. R. Sayers' paper, "First-Aid Dressing Stations Underground." Dr. Sayers advocated the installation of special rooms underground where first-aid supplies might be kept and the injured men taken for preliminary treatment. Such rooms, said Dr. Sayers, would also serve as places of refuge where the men could go in case of a mine disaster. This point seemed to impress many of those present as being of more importance than the providing of the rooms for first-aid purposes only. The metal mining men expressed themselves as being in favor of having the first-aid station situated on surface. Another point which Dr. Sayers brought out was the lack of adequate first-aid supplies underground, and he stated that the installation of such stations would insure a dependable place for the storing of such material.

Dr. Sayers also read a paper by Dr. R. C. Williams on "Underground Toilets and Sewage Disposal," in which several systems now in use at metal and coal mines were outlined. The New Jersey Zinc Co. had recently designed a galvanized iron toilet, which embodies many desirable features. This was exhibited at the meeting and attracted favorable comment.

The concluding paper of the meeting was the "Report of the Committee of Standardization of First Aid Methods and Contests," by Major M. J. Shields. In addition to the report a list of questions and answers of first aid contests was included.

Vocational Training of Miners Discussed

Committee's Report Considered by New York Section of Mining and Metallurgical Society—Officers Elected

Several hours were devoted to a consideration of the subject of vocational training for metal miners at the meeting of the New York Section of the Mining and Metallurgical Society of America, which was held at the Columbia University Club on Sept. 30. Immediately following the usual dinner, election of officers for the ensuing year resulted in the choosing of C. M. Weld as chairman, Sidney H. Ball, vice-chairman, and Louis D. Huntoon for another year as secretary-treasurer. An engrossed set of resolutions to be presented to F. F. Sharpless, the retiring secretary of the society, was displayed at the dinner.

The report of the committee on occupational training had already been placed in the hands of the members and was the basis of the evening's discussion. In presenting this report B. F. Tillson read a letter from H. H. Knox, the committee chairman, in which the difficulty of doing such work in small camps was pointed out and suggestions were asked. Mr. Knox also said that private initiative could scarcely do more than blaze the trail for the state to follow, referring casually to practice in Germany and Spain.

The principal speaker was Frank Cushman, representing the Federal Board for Vocational Education, who has made an intensive study of such education as applied to mining. Mr. Cushman sketched the development of the work of the board since the act making possible its creation was passed in 1917. In that year $500,000 of Federal money was available for the work, he said, and by 1925 there would be $7,000,000. To secure such Federal aid the state or community must "match a dollar of its own for every Federal dollar." As a result of the board's work there is today in every state a state board to promote vocational education. Time was required to organize such boards, he said, as they must have qualified staffs.

Mr. Cushman contended that the society's task was to provide adequate vocational training for the men in the ranks in the mining industry, something more easily stated than done. He doubted that any existing schools were going to function to help the society accomplish this result. "Suppose," he said, "the courses are available. Where will you get the men to teach them?" First, men must be obtained who actually know how to do the work, mucking, drilling, or whatever it might be. Such men almost invariably did not know how to impart their knowledge to others. The first task was to make these men conscious of themselves as teachers and to instruct them how to teach others. In every state where worth-while work was being done the most expert workmen were being taught to teach others what they knew

Lectures were no good for this purpose, said Mr. Cushman. The work must be done "right on the job." Foremen could be made into instructors. A man trained in a state agency would not be able to teach miners, but a skilled foreman or shift boss could be taught to do this.

The first device found effective in promoting vocational training was to train the foremen. It must first be assumed that the foreman has a responsible position and that he should train his men, and, next, it must be recognized that usually he does not know how to train them, but must be taught to do so. Furthermore, the idea must be first "sold" to the foremen, for they can kill any program of the sort if opposed to it.

Mr. Cushman dealt with the provisions of the law briefly. The training given must be below that of college grade, otherwise Federal money could not be obtained. Every man in the class must actually be engaged in the occupation considered in the class. The training did not include instruction in English, Americanization, and similar subjects. The board did not conduct schools. Much of the work was being done in evening and part-time classes. A difficulty to be avoided was the tendency to branch off into technical lines, which was not the objective. In response to a question Mr. Cushman said that organized labor seemed heartily in favor of the work.

The states had the money to do this work, said the speaker, but many of them did not seem to know how to go about spending it. On the other hand, some states had spent far more than the Federal Government allowed.

A. Bruce Minear, of the Y. M. C. A., whose headquarters are in Denver, discussed the Americanization work that is being done in various Western camps. The best work was being done not in classes, he said, but, for example, by such things as pageants like those sometimes put on in Butte by the foreigners themselves. At the Sunrise iron mine, in Wyoming, three nations came together on a community basis. The attendance at the Central club house was over 50 per cent of the population. The promotion of thrift, in his opinion, had a direct bearing on vocational work.

Arthur Notman briefly sketched the development of the Phelps Dodge Corporation's educational course, upon the completion of which the miner receives a certificate. This certificate would be of advantage to the men wherever he might go, Mr. Notman said, and without it he was not in line for promotion. This was sufficient incentive to make the men interested in the course and the work involved.

A paper by E. A. Holbrook, assistant director of the U. S. Bureau of Mines, commenting on the committee's report, was read by M. W. von Bernewitz, of the Bureau. An obstacle in the way of vocational training, it was said, was the indifferent attitude of the miners. Mr. von Bernewitz concluded with a few remarks of his own, referring to work that has been done in other communities.

Prof. Robert Peele, following Mr. Notman, said he recalled a time in Arizona when it would have been utterly impossible to conceive of the Phelps Dodge plan. In his opinion the way for vocational training had been paved by the introduction of standardization methods, without which he did not see how vocational training could be carried out. The stimulus to develop such a plan must come from within. Prof. Peele said that he knew it to be difficult to get together instructors capable of dealing with a class of men known to be conservative. He pointed out the essentials heterogeneousness of a body of miners which must be taken into account and that the conservatism of the men in such a group would present problems not found in schools of mines. It would not do, he said, to have a recent technical graduate attempt to teach foremen; men of practical experience were needed.

Mr. Tillson said that the safety movement might be regarded as an entering wedge tending to remove suspicion that such things as vocational training were primarily due to the selfishness of employers. In setting out to instruct a class of shift bosses how to teach others, he advised that the most wide-awake man be selected and taught how to tell his story and be given full credit for it. The other men would follow his examples. Lecturing was to be avoided, he said. The way to do was to "insinuate an idea into the other fellow's head and let him patent it." He also said that there was need of additional incentive, as there were not enough foreman positions.

Columbia Section of A. I. M. E. Holds Joint Meeting at Spokane

A joint meeting of Columbia Section, A. I. M. E., the Associated Engineers, the Northwest Mining Association, Washington Metal Mining Association and the mining committee of the Chamber of Commerce was held at the Davenport Hotel, Spokane, Wash., on Sept. 21. Frank M. Smith, of the Bunker Hill smelter, presided. Guests of the evening were the Hon. Marion E. Rhodes, chairman of the House Committee on Mines and Mining; H. Foster Bain, director; D. J. Parker, Matthew Van Siclen, T. T. Read, Harrison E. Meyer, Daniel Harrington and O. C. Ralston, of the U. S. Bureau of Mines; J. T. Pardee and J. S. Holmes, of the U. S. Geological Survey.

Speakers were Congressman Rhodes, Dr. Bain, Mr. Read, Mr. Parker, Professor Thomson, of the University of Idaho School of Mines, and Professor Jenkins, of Pullman.

This meeting was followed by a meeting of Columbia Section, A. I. M. E., members, who were addressed by Dean Thomson, of Moscow, on the desirability of indorsing a candidate for the presidency of the Institute for the ensuing year. After considerable discussion, Arthur Thacher was unanimously indorsed by the members present, and the secretary was instructed so to notify the members of the nominating committee of the Institute

Tulsa Section of A. I. M. E. Favors Thacher as Next President

A copy of the following letter from the secretary of the Tulsa Section of the American Institute of Mining and Metallurgical Engineers has been sent to each member of the Nominating Committee:

"The Executive Committee of the Tulsa Section of the American Institute of Mining and Metallurgical Engineers, at a regular meeting, thoroughly considered the coming election of officers for the American Institute of Mining and Metallurgical Engineers for the year 1922. The Executive Committee of the Tulsa Section desires that a capable and nationally known man be selected as president of the American Institute of Mining and Metallurgical Engineers for the year 1922. It is the belief of the Executive Committee that the election of Mr. Arthur Thacher would be a very appropriate election, and, further, the Executive Committee of the Tulsa Section therefore urges that you give Mr. Arthur Thacher due consideration for the position of president of the American Institute of Mining and Metallurgical Engineers for the year 1922. The Executive Committee believes that it is expressing the opinion and desire of the Tulsa Section when it asks you to fully consider Mr. Thacher's qualifications. The name of Mr. Arthur Thacher is therefore proposed to you, and I am directed by the Executive Committee of the Tulsa Section to ask that Mr. Thacher's nomination be made and further that Mr. Thacher's name be placed on the ballot for election for the year 1922."

Executive Board of Federated Societies Approves Minerals Relief Procedure

The outstanding feature of the meeting in Washington on Sept. 30 of the executive board of the Federated American Engineering Societies was the willingness with which those in attendance discounted the obstacles that have arisen and their evident determination to make the organization an important factor in national affairs of concern to engineers.

The board recorded a unanimous approval of the policy followed by the original War Minerals Relief Commission composed of former Senator Shafroth, of Colorado, Philip N. Moore and Horace Pomeroy. The board registered its disapproval of the proposed liberalization legislation now before the House of Representatives.

Business Paper Publishers Establish Training Courses for Staffs

The New York Business Publishers Association has completed arrangements to institute on a large scale this fall a Course in Industrial Publishing for the staffs employed on publications issued by its members. The course will last eight or nine months. Classes will be organized early this fall and will be carried on until late in the spring. In addition to classes for members of the New York Business Publishers' Association, arrangements will probably be made for classes for business paper organizations in Chicago, Boston, Philadelphia, Cleveland, St. Louis, and other cities where sufficient interest in such a course may be shown.

Further information and details about the course can be had from the Secretary of the Course in Industrial Publishing, 185 Madison Ave., New York.

MEN YOU SHOULD KNOW ABOUT

Wallace Lee has gone to Siam on an engineering expedition.

Arthur W. Jenks, of Berkeley, Cal., is in New York for a few weeks.

L. G. Mosburg has completed extensive studies in the oil field near El Dorado, Ark.

William F. Ward, who recently spent a month in Colorado, has gone to Philadelphia, Pa.

P. L. Foster recently visited the property of the Tomboy Gold Mines Co., Ltd., at Telluride, Col.

F. J. Nagel is in Michigan on professional business and will return to Mexico in a short time.

R. C. Moore has returned to Lawrence, Kan., after a map-making expedition in southern Utah.

Frederick W. Foote, who has been in Africa during the last year, was a visitor in New York last week.

William J. Loring, president of the American Mining Congress, recently left San Francisco for Chicago.

T. H. Jenks, of Los Angeles, is in the vicinity of Mazatlan, Sinaloa, Mexico, to report on mining properties there.

G. F. Moulton, **M. N. Bramlette**, and **N. F. Bass** are mapping parts of the Glendive anticline in eastern Montana.

H. W. Hoots, of the U. S. Geological Survey, has joined **D. D. Christner** in work on deposits of potash in the Texas fields.

Samuel W. Cohen has returned to Montreal after an examination of the Murray claims, at Elbow Lake, northern Manitoba.

H. C. Carlisle, who has been making examinations in the vicinity of Lordsburg, N. M., has left for Douglas, Ariz., and Los Angeles, Cal.

M. W. Hayward has been appointed head of the geological and exploration department recently created by the Compania Minera de Peñoles.

K. C. Heald, of the U. S. Geological Survey, has completed his supervision of the field work of oil and gas [illegible] and has returned to Washington.

H. L. Brown has been appointed consulting mining engineer of the Compañia Minera de Peñoles, S. A., a subsidiary of the American Metal Co., Ltd.

Colonel Thomas Cantley, chairman of the Board of Nova Scotia Steel & Coal Co., has been elected a director of Oil & Nitrate Products, Ltd., of Nova Scotia.

Harold C. E. Spence, president of Oil & Nitrate Products, Ltd., has spent the summer in Nova Scotia in connection with the development of the torbanites and oil shales of Pictou.

T. F. Field, consulting engineer for the Iron Field Co., has returned to Duluth from a trip of examination to the Isle of Pines, where his company is conducting exploration for gold.

N. C. Grover, chief hydraulic engineer for the U. S. Geological Survey, is en route to Haiti in connection with the reconnaissance survey of the surface water resources of that republic.

Charles W. Goodale attended the meetings last week of the Mining Section of the National Safety Council convention at Boston. On Oct. 3 he addressed the Boston Section of the A. I. M. E.

Mortimer E. Cooley, dean of the Colleges of Engineering and Architecture of the University of Michigan, has been elected president of the American Engineering Council of the Federated American Engineering Societies, to succeed Herbert C. Hoover.

Frank Billings, president, and **J. S. Lutes**, manager of mines, of the Tod-Stambaugh Co., accompanied by **D. P. Thompson**, assistant to the president of the Inland Steel Co., recently visited the properties of the companies on the Mesabi iron range.

G. C. Martin and **S. R. Capps**, members of the staff of the U. S. Geological Survey, who have been in Alaska during the summer, have returned to Washington. **Alfred H. Brooks** was to have reached Seattle on Oct. 4. **J. B. Mertie** is expected to reach the Washington office Oct. [illegible]

M. J. Cavalier, professor of metallurgy in the University of Toulouse, has arrived at Columbia University to take up his work as French exchange professor and will be at Columbia from Oct. 1 to Oct. 30. He comes to America as the result of arrangements for an annual exchange of professors of engineering and applied science between French and American universities, and he will divide his time during the academic year among the universities in this group: Columbia, Harvard, Yale, Cornell, Johns Hopkins, Massachusetts Institute of Technology, and the University of Pennsylvania. The American universities have selected as their representative for the first year Dr. A. E. Kennelly, professor of electrical engineering at Harvard and M. I. T.

Mining and metallurgical engineers visiting New York City last week included J. M. Longyear, Jr., Marquette, Mich.; Walter M. Small, [illegible], Pa.; William F. Ward, Cartagena, Colombia; and Samuel S. Wyer, Columbus, Ohio.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

The stockholders of the Arizona Copper Co., meeting at Edinburgh, have ratified the agreement of the directors to sell the company's holdings to the Phelps Dodge Corporation.

Better custom smelting terms have been offered to ore shippers of British Columbia by the Consolidated Mining & Smelting Co., of Trail. An outline of the proposal is given.

The Engineer mine, in the Atlin district, British Columbia, is involved in interesting litigation, the hearings of which have recently begun at Vancouver.

Henry Ford's operation of the Imperial iron mine, in Michigan, is causing other operators to speculate as to the effect of his high wage scale upon the district.

The mining industry in Alaska will grow but slowly, in the opinion of George S. Rice, of the U. S. Bureau of Mines, who has just returned. Mr. Rice's impressions are recounted at some length by our Washington correspondent. An oil boom is not to be looked for, in his opinion.

Power shortage in the Porcupine district, Ontario, seems less imminent, owing to recent rains.

Another wage reduction has been made by the Mond Nickel Co. in the Sudbury district, Ontario.

Affairs of the Russo-Asiatic Consolidated are said to be in good condition. Leslie Urquhart has recently returned from Russia, according to advices from London.

John D. Ryan and Samuel Lewisohn constitute the metal-mining subcommittee of the Unemployment Conference at Washington.

Ford Visits Imperial Mine

Other Operators Speculate as to Effect of Manufacturer's High Wage Scale on District

Henry Ford, head of the Michigan Iron, Land & Lumber Co., paid a visit to his Imperial mine at Michigamme, Mich., recently. About seventy-five men are now employed there. The steam plant is in operation and the workings are being unwatered. The shaft is being widened to make room for an extra skip road. Five-ton skips will replace the old ones, which were of two tons' capacity. New buildings are being erected to house all of the machinery, and a number of new dwellings are being built. Tractors do all of the hauling on surface, Fordsons, of course, being the machines in use.

Mr. Ford stated that he was well pleased with the progress being made in getting the mine ready for production. He recently purchased 375,000 tons of iron ore in the Menominee district, and his ores from the Imperial will have to be mixed with other grades, those already found not being suited to the manufacture of the best steels. Mr. Ford has other iron lands also.

Some of the mine operators are wondering what effect Ford's high wages for miners and surface workers will have on the industry in Michigan. The wage scale is the same for all workmen, the man on top getting the same rate of pay as the miner.

Tasmanian Tin Mine Closes Down

By Cable from Reuters to Engineering and Mining Journal

Hobart, Oct. 1—The Bischoff mine is closing down, owing to unfavorable conditions in the tin market.

Arizona Copper Co. Stockholders Agree to Sale

Directors' Proposal Ratified at Edinburgh Meeting Oct. 3—Entire Undertaking, With Minor Reservations, Transferred to Phelps Dodge Corporation for Shares

STOCKHOLDERS of the Arizona Copper Co., Ltd., at a meeting held at Edinburgh, Scotland, on Oct. 3 ratified the proposal made by the directors to sell the company's entire holdings to the Phelps Dodge Corporation. The terms of the arrangement are set forth as follows in a circular sent to the shareholders:

"1. The whole undertaking (including the railway) is sold to Phelps Dodge Corporation, excepting the Edinburgh Office, for a sum of about £35,000, and the right (subject to making good if required certain expected federal tax recoveries) to certain British tax recoveries.

"2. The price is (a) Payment of the dividends on the A preference shares and preference stock and retirement of these shares and stock (at the expense of that corporation) within five years. (b) 50,000 fully paid shares of $100 each of the corporation, of which the capital will then be 500,000 shares of $100 each. (c) The purchaser assumes all the liabilities, other than undisclosed contingent liabilities, not incurred in the ordinary course of business. It is believed that all liabilities have been disclosed.

"3. The company is to have the right to nominate a director of the corporation.

"It will thus be seen that, while the "A" preference shares and the preference stock will in the meantime remain, the Phelps Dodge Corporation undertake liability for these shares and stock, and therefore in effect the ordinary shareholders of this company will own one-tenth of the capital stock of Phelps Dodge Corporation, and thus retain a one-tenth interest in the mining properties of this company.

"In order that the shareholders may retain a free market for their shares it is proposed to keep up the present Arizona Copper Co., Ltd., but as it will practically be an investment company only, the expenses of management will be very considerably reduced.

"The arrangement is not one which under normal circumstances the directors would have submitted for approval, because it involves the transfer of the whole of the undertaking for an interest in an American corporation. Under existing circumstances, however, they unanimously recommend that the proposed arrangement be approved, for the following reasons:

"1. If the company is to continue a separate existence money will require to be raised to meet the losses down to May 31 last, as well as the further indefinite losses which will accrue before normal profit-earning conditions return. Even when that comes, provision would have to be made for the repayment of the money so borrowed out of profits, with, in all probability, a heavy loss on exchange as the expenditure has to be met on the other side.

"2. Further, after a few years the future of the company would in great measure depend on the treatment of large bodies of low-grade ore already ascertained to exist, and which it has been demonstrated recently can be profitably treated, but that only after suitable plant has been erected. That plant would involve an expenditure estimated at not less than $10 000 000.

"3. By selling for shares and not for cash the shareholders retain the advantage of participating in the prosperity of the industry when, as is to be expected, the conditions of the trade improve.

"4. The Phelps Dodge Corporation is one of the largest copper operating corporations in the world, of high business repute, and owning large and valuable mines. Its position is such that the resumption of dividends by this company (through dividends declared by that corporation) may be expected at an earlier date than would be practicable if this company continued as at present."

Mond Nickel Rumor Denied

There have been a number of rumors recently to the effect that the Mond Nickel Co., in the Sudbury district, had succeeded in completing a $9,000,000 nickel deal with the Japanese government. No confirmation of this has been obtained, and, as a matter of fact, the rumors are denied by Japanese government officials in New York.

Cornish Tin Situation Stagnant

By Cable from Reuters to Engineering and Mining Journal

London, Oct. 3—The Cornish tin-mining industry is still stagnant. The manager of the Southcroft mine stated that his company would resume operations in the event of the price of tin advancing to £20, provided that the wage scale is so arranged that the company's loss would not exceed £500 monthly.

Belgian Furnace Companies Make Protest

By Cable from Reuters to Engineering and Mining Journal

Brussels, Oct. 1—The Association of Belgian Furnace Companies has lodged a vigorous protest against the ratification of the Belgo-Luxemburg Convention, asserting that its effects upon the Belgian iron industry would be disastrous.

Water Lily Shaft Sunk 801.7 Ft. In Sixty-Two Days

Further information regarding the advance made in sinking the Water Lily shaft of the Chief Consolidated Mining Co. at Eureka, Utah, is to the effect that the shaft was deepened 801.7 ft. in sixty-two consecutive days, beginning July 15, 1921, at 8 a.m. This work is being done by the Walter Fitch, Jr., Co., contractors, who, as already announced, have been credited with breaking the world's shaft-sinking record in sinking 427.5 ft. during the first thirty-one days of the period mentioned.

Gold in Rankin Township, Ont., Draws Prospectors

During the week ended Sept. 24 there was a considerable rush of prospectors into Rankin Township, near Elk Lake, Ontario, where a rich gold find was reported by an Indian. Many claims have been staked, and a number of men are going into the district, but it is understood that assay results of samples brought out have been disappointing.

Suit Over Engineer Mine Begun At Vancouver, B. C.

Plaintiff Questions Title of the Late Captain Alexander—Charges Fraud

Litigation over the ownership of the Engineer mine, in the Atlin district, B. C., began recently in the British Columbia courts at Vancouver. The property consists of a group of six mineral claims situated on the east side of Taku Arm, Lake Tagish, near Atlin, on which considerable development has been done disclosing an extensive body of ore. There also is a small stamp mill and other equipment. Action is being brought by the Engineer Mining Co. and the Attorney General of the province against J. A. Fraser as administrator of the estate of the late Captain James Alexander, who was lost on the "S. S. Sophia," and also against the administrator of the Allan I. Smith estate and the heirs of the Smith estate. The latter are heirs and successors of Captain Alexander, whose title is assailed.

The history of the mine dates from 1899, when the claims were located by two Swedes, Charles A. Anderson and Frank Nelson, representing the Aga Gold Mining Partnership. They were afterward taken over by the Engineer Mining Co., an Alaska company with headquarters at Skagway. Crown grants subsequently were applied for, but were refused by the Gold Commissioner and Mining Recorder, doubtless on the ground that the provisions of the law had not been fully observed. Meanwhile, it is alleged by the plaintiff, Alexander and his partners jumped the claims, restaked, and eventually obtained Crown grants.

The Engineer Mining Co. asserts that it expended $40,000 on the development of the property. It admits that its free miner's license expired on May 31, 1917, but alleges it was not aware of this until 1918. It charges Alexander with making false affidavits when applying for title and alleges that he, to acquire the company's stamp mill and other machinery, arranged that judgment be obtained against the company in the County Court, Atlin. The company's mill, buildings, and machinery were valued at $20,000 and were sold under process of execution to realize judgment of $452. The property was bought in by Alexander, who, it is alleged, prevented competitive bidding at the sale by threat. The plaintiff company asks for a declaration that it is the owner of the mine and that Alexander and his associates fraudulently, deceitfully, and unlawfully obtained the Crown grants.

Iron-Ore Rate Hearing Oct. 10

Oct. 10 has been announced by the Interstate Commerce Commission as the date for resumption of the hearings on the iron-ore carrying rates in the Lake Superior district. The carriers will present their arguments in reply to the petition of the independent [illegible] operators of the district. The meeting will be held in Chicago.

Consolidated Smelter Offering New Terms for Custom Ores

Feels Itself Not Justified in Operating Another Lead Pool Unless Asked To Do So

A circular issued by the Consolidated Mining & Smelting Co. of Canada, Ltd., puts in more definite form the plan for improvement of conditions for shippers of custom ores, particularly silver and lead, in British Columbia. The matter had been discussed at a meeting of several of the more important custom ore shipping representatives held at Nelson early in September.

The proposition is to pay 95 per cent of the fire assay of silver at the average *Engineering and Mining Journal* quotation for foreign silver for the calendar week, including date of arrival, converted into Canadian funds at par. Minimum deduction from silver is to be one-half (0.5 oz.) ounce per dry ton of ore.

The contents of lead will be determined by wet analysis, deducting one and one-half units to determine the dry-lead assay. Ninety per cent of the lead will be accounted for on the dry-lead assay; provided, however, that in no case will the deduction from said dry-lead assay be less than one unit or 20 lb. per dry ton of ore.

The schedule diminishing the quantity of silver and lead to be paid for with zinc over 10 per cent is abolished.

The settlement price for lead to be London Metal Exchange spot quotation at the Bank of Montreal's sale price for sterling exchange, less 1½c. per lb. for refining and marketing.

The zinc penalty is to be decreased by making the charge per unit of zinc 50c. instead of 60c. The schedule diminishing the quantity of silver and lead to be paid for with zinc over 10 per cent is to be abolished. Ninety-five per cent of the gold is to be paid for at $20 per oz. Gold under 0.03 oz. per dry ton will not be paid for.

An improved method of payment is assured by full payment in ninety days after date of arrival of shipment at the smelter. Negotiable drafts will be accepted for all or part of the value of shipment.

The company considers that it does not feel justified in operation of another lead pool unless requested to do so, but if such request is made, the plan would be to start the pool on Oct. 1, 1921, with stocks in the smelter's hands which have not been delivered against sales, to add receipts from all [illegible] and deduct [illegible] against sales from month to month until the stock of Oct. 1 was accounted for, then the receipts in the month of October and so on. Each month's sales deliveries and each month's receipts would be treated as a unit. The net settlement price for each month's sale [illegible] would be that obtained at point of delivery less freight and other charges incurred in effecting such delivery, and also less [illegible] in refining; that is, the actual delivery charges and the refining charge would be substituted for the [illegible] 1½c. deduction.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Ryan Heads Unemployment Committee on Mining

Unemployment Data Discussed at Early Sessions—Subcommittees Formed To Consider Relief Plans

The Committee on Emergency Measures in Mining of the Unemployment Conference held its first session on Sept. 27 immediately following the general conference meeting which made the committee assignments. The committee, as selected, consists of John D. Ryan, Samuel A. Lewisohn, W. K. Field, E. M. Poston, John T. Connery, James B. Neale, John Moore, John L. Lewis, John P. White, and Miss Mary Van Kleeck. Of these Messrs. Neale, Lewis, and White have not been able to come to Washington. The executive secretary of the committee is David L. Wing. On organization of the committee, John D. Ryan was chosen chairman.

After holding sessions Sept. 27 and 28, at which the unemployment data were thoroughly discussed, it was found desirable, in order to expedite matters, to form subcommittees to go carefully over the various plans put forward for relief, and to report back later to the whole committee the result of their work. These subcommittees have not yet reported.

Some idea of the amount of work may be judged from the fact that the subcommittee on bituminous coal mining has been in almost constant session since its formation. In this industry the present emergency is so intimately connected with fundamental conditions in the industry that the problem of practical relief measures presents great difficulties. Mr. Ryan and Mr. Lewisohn constitute the subcommittee on metal-mining unemployment.

Metric System Bill Hearings To Begin Oct. 11

Hearings on Senator Ladd's Metric System Bill will begin Oct. 11 before a subcommittee of the Committee on Manufactures. Senator McNary, of Oregon, is chairman of the subcommittee. Other members of the subcommittee are Senator Weller, of Maryland, and Senator Jones, of New Mexico.

Government's Silver Purchases 73,679,866 Oz.

The purchases of silver by the Bureau of the Mint during the week ended Oct 1 totaled 453,000 fine ounces. This brings the total purchases of silver under the Pittman Act to 73,679,866 fine ounces.

Mining in Alaska To Grow Slowly, Rice Believes

Oil Boom Unlikely—Geology Does Not Indicate Possibility of Many Rich Mines—Coal Drawing Attention

The upbuilding of the mining industry in Alaska necessarily must be slow, says George S. Rice, chief mining engineer of the U. S. Bureau of Mines, on his return from first-hand contact with the mining industry in the territory. Though he does not expect to see mining advance with rapid strides in Alaska, he believes that the gradual character of its growth will contribute to the stability of that industry there. Although it was physically impossible for Mr. Rice to visit all the mining regions of Alaska, he was able to absorb through contact with geologists, business men, and others intimately familiar with conditions, a comprehensive grasp of the present status of mineral development in the territory and to make some deductions as to the industry's economic future.

Mr. Rice discounts the view held by some that the territory is likely to experience the stimulating effect of an oil boom. From the information Mr. Rice was able to gather from geologists and others who have made careful studies of the indications of the occurrence of oil and gas, he concludes that the possibilities of the territory's becoming a large oil producer are not great. Though the formation is such as to make for superficial accumulations of gas, he does not believe the geology is such as to warrant the belief that large accumulations of oil are present. He would not be surprised to see the development of other small oil areas similar to the existing field. He points out, however, that even that would be a material local benefit.

Mr. Rice believes, also, that the metal-mining industry in Alaska cannot expect to have the stimulus of numerous mines of unusual richness. The geology of the territory does not favor the frequent occurrence of the phenomenal mineralization of the Copper River region. Opportunities for secondary enrichment do not exist in Alaska as in some of the other mining countries. Nevertheless he sees in the wide mineralization of the territory abundant opportunity for developing paying mines.

Transportation is the crying need of the metal-mining industry in Alaska, Mr. Rice states. The railroad to Fairbanks will be completed soon. This will be of incalculable benefit to both lode and placer mining. It will not be sufficient, however, to serve the needs of lode mining. Lateral highways connecting railroads with interior points are required if many of the large number of promising prospects in the territory tributary to the railroad are to be given an opportunity to become producers. The railroad, however, is going to give immediate benefit to the placer industry on the Yukon. Difficulties of transportation and the short season have made for long delays before the actual working of gravel could be undertaken. The presence of the railroad will make it possible to save a year's time at least in getting these properties under headway. Mr. Rice found that the railroad was well built and is being well managed.

The conviction now is general, according to Mr. Rice, that the railroad must look almost entirely to the mining industry for its tonnage. There is little prospect for the development of any large amount of agricultural tonnage. Mr. Rice declares that it is from the lode-mining industry that the principal freight must come. In view of the prospective completion of the railroad, a large number of prospectors are at work in the region north and west of the Government line. Though placer activities are not great producers of freight tonnage, their operation requires supplies and they will contribute in an important degree to the general prosperity of the region. The successful application of cold-water thawing and the bettering of the gold situation are factors operating toward the increased exploitation of the placer resources on the Yukon.

Owing to the activities of the Navy Department, coal mining in Alaska is attracting much attention. Though considerable development has been undertaken by the Navy Department, it has not been established, in Mr. Rice's opinion, that Alaska can be made the source of large supplies of coal of navy grade. That being developed at the Chickaloon mine is similar to that of the Pocahontas vein, and unquestionably is of very high grade. The difficulty is that it is badly mixed with wall rock, and there is the danger that the continuity of the beds, of which there are several, may be interrupted by eruptive intrusions. Owing to these conditions, extensive prospecting and development will be necessary to prove the value of these coal deposits. This prospecting is amply justified, Mr. Rice believes. The development of a naval coal supply on the Pacific Coast is of great strategic importance. Pocahontas coal must be transported many thousand miles to Pacific bases.

The Eska mine has been developed to a point where it can furnish the requirements of the railroad and the other demands along the railroad's line

NEWS BY MINING DISTRICTS

London Letter

Doubts As to Shetland Copper Discovery—May Work Welsh Gold Mines—Disposition of Enemy Kaffir Shares Modderfontein B Less Popular——Leslie Urquhart Back From Russia

By W. A. Doman

London, Sept. 20—If rumor can be credited those who are financing the Shetland copper venture are not in a happy frame of mind. Early reports stated that about 500,000 tons of copper ore had been proved. Some one cast doubts upon the accuracy both of the quantity and of the metallic content. The people putting up the money, among whom is said to be a banker, became nervous and called to their aid the well-known firm of Bainbridge Seymour & Co. Colonel Yuill was consequently dispatched to the property, and although he has not reported, and nothing definite is known, I have seen people shake their heads when Shetland copper is mentioned. The intention was, of course, to float a public company, but if Colonel Yuill is not satisfied it is said to be likely that the venture will be abandoned.

There is talk of reopening some of the Welsh gold mines to give employment to local out-of-works. Gold exists in several places in the neighborhood of Dolgelley, and spasmodic mining has been carried on for many years. The veins are narrow, and the metal recovered is not sufficient to pay the costs of working and leave a surplus to remunerate capital. We are not likely to see a recrudescence of the old Pritchard Morgan days when the gold was brought to London to stimulate the interest of investors. A good deal was apparently made out of manganese mining in Wales during the war.

The Public Trustee in London and the Custodian of Enemy Shares in South Africa have at last reached an agreement as to the best method of disposing of the Kaffir gold mining shares which were taken over by the respective governments during the war. Ordinary business men could have settled the problem in a few hours, but it has required two visits to London on the part of the Union government official. Harmony prevailing, it is possible that in the near future the Kaffir "bosses" will put their heads and their resources together, and form a syndicate to purchase and hold the shares for better times. Both officials recognize that market conditions are so unfavorable that to offer stock for sale now would meet with little measure of success.

Modderfontein B has lost some of its popularity of late. The reason it is not easy to state, apart from rumors that developments are not as satisfactory as could be desired. The latest figures are those for the June quarter. They show that of a total of 3,035 ft. sampled on reef, only 1,110 ft., or less than 37 per cent, was payable, the assay value being 43 dwt. over 17 in., or 731 inch-dwt. Though the value is good the percentage of payability is distinctly low. The report does not specify the part of the mine where the work was done. This is naturally an important matter, because the eastern is the known poor section. At the annual meeting of shareholders, held on May 26, it was stated that the results from January to April inclusive exhibited a consistent all-around improvement. One of the mine's troubles seems to be the high cost of working; the average for last year was no less than 26 1 per ton.

Leslie Urquhart, who has been visiting Moscow on behalf of the Russo-Asiatic Consolidated and other companies, has returned to London. Though he cannot be regarded as optimistic, he is certainly not depressed about Russian conditions. He seems to have been negotiating in connection with the affairs of British investors in general, and he is expected to make a statement on the subject soon. It is interesting to note that the officials of the mining and other companies constituting the Russo-Asiatic Consolidated met Mr. Urquhart in Moscow and reported what amounts to "all well" at the mines. This presumably means that no great damage has been done.

BURMA

Rain Hinders Burma Corporation's Smelter Operations

Namtu—The Burma Corporation's lead production for August was 4,261 tons gross; refined lead production 2,598 tons; refined silver production approximately 260,900 oz. Smelter operations were seriously interfered with during August by heavy rains, which interrupted traffic on the railway.

AUSTRALIA

South Australia

Medical Examination Insisted on at Port Pirie

Port Pirie—Until recently it appeared probable that Port Pirie would remain closed, but as the result of intervention by a member of the federal cabinet the strike has been settled and 1,000 men have been re-engaged. The federal government offered the services of Dr. A. J. Lanza, who has arrived from the United States in connection with the new health department to be created, as the medical arbiter, and it is hoped that a mutually satisfactory agreement in regard to the proposed medical examination prior to employment will be reached. The company's insistence on such an examination is due to the liability for claims that may arise in the future under the Workmen's Compensation Act.

New South Wales

Broken Hill Proprietary's Steel Works Operations Expanded Last Year

Broken Hill—The resumption at Port Pirie will naturally facilitate the reopening of the mines at Broken Hill, but how soon this will take place is not now definite, as the Port Pirie Smelting Works has a fair tonnage of concentrates on hand, and naturally at present low prices the company is not anxious to resume operations on a normal scale.

Newcastle—Since the establishment of the iron and steel works by the Broken Hill Proprietary, Ltd., in 1915, strikes had caused a cessation of operations during about 30 per cent of the total period, thus severely handicapping the industry. These strikes were for the most part brought about by outside factors over which the company had no control. During the twelve months ended May 31, the output showed an expansion as compared with the preceding year, the figures being: pig iron, 227,533 tons; steel ingots, 209,458 tons; coke, 240,905 tons; sulphate of ammonia, 3,385 tons, and tar, 2,456,960 gallons. A plant for recovering motor spirit and naphtha is being built.

The manufacture of galvanized corrugated sheets and wire netting by associated companies is making good headway, and another company is expected to erect a plant for the manufacture of wire ropes. The company's net profit for the twelve months was £351,331. The surplus of liquid assets over liabilities amounts to £1,[illegible], not including an investment of [illegible] £1 shares held in the Associated Smelters.

Tasmania

Mount Lyell's Operations Normal Once More

Mt. Lyell—Matters at Mount Lyell have settled down again and operations are proceeding along normal lines. Production at the North Mount Lyell mine is being maintained at the rate of [illegible] tons monthly, and at the Mount Lyell mine about [illegible] tons of pyrites is being mined.

Queensland

Mount Morgan Employees Wish To Vote Again as To Resuming Work

Brisbane, Aug. [illegible]—A petition signed by [illegible] of the late employees of the Mount Morgan company is being presented to the Arbitration Court, asking that another ballot be ordered to be taken on the proposals made by the company some time ago for resuming operations. Since these proposals were made copper has fallen in price and the-

£3 or £4 per ton, and if the company were to resume now it could only be at a greater loss than it was prepared to meet if it had restarted soon after the works closed down last Easter. Nevertheless, a report comes from labor circles that there is a good prospect of operations being resumed next month.

The cobalt mine, in the Cloncurry district, continues to develop very well at depths of 50 ft. and 112 ft. At both of these levels two good shoots of concentrating ore have been proved. Up to date 124 tons of ore has been sent to England, but nothing is yet known of the results of the two or three shipments dispatched. It is said that the rich patches of ore such as can be profitably sent away for treatment overseas do not extend below 50 ft.; that being mined lower down is a concentrating proposition, and must await the erection of the concentrating plant that has been begun.

It has been previously stated (in the Brisbane news letter of July 30) that the system adopted by the electrical "diviners" who have tried, and so far failed, to locate silver-lead ore at Indooroopilly, near Brisbane, consists of "improved apparatus and methods based on the Williams and Daft system." A reference to the *Engineering and Mining Journal* of May 7, 1921, p. 782, will show that the Daft and Williams, or telephonic, method is there described in an article on "Study of Underground Electrical Prospecting," by C. Schlumberger, who states that "lack of precision and the need for great experience on the part of the experimenter caused the method to be abandoned."

CANADA

British Columbia

Nickel Found in Gabbro Copper Mines on Vancouver Island

Victoria—George E. Winkler, president and manager of the Gabbro Copper Mines, Ltd., on the west coast of Vancouver Island, reports the discovery of nickel in the ores of that property. In a zone recently uncovered, having a maximum width of over 30 ft., there was shown considerable copper and a great deal of pyrrhotite. Unlike occurrences in the Sunloch Mine, nearby, where what is known as the Cave zone is in the basalt several hundred feet from the gabbro contact, the newly found zone of the Gabbro Mine is entirely in the gabbro. A pyrrhotite sample assayed at the provincial Bureau of Mines showed 5 per cent nickel. Check assays gave similar results. Specimens have been sent to the Canadian Geological Survey Branch, Ottawa, where they have created much interest.

The report of a gold discovery in the Lillooet district has, as usual, created excitement. There seems to be some confusion as to the exact location of the latest find. Statements have been made that it is on Gunn Creek, in the Bridge River section. That there is gold in the latter country is known, but it is not this that has created the recent interest. The center of attraction now is the Taseko (Whitewater) River region and the recoveries being made from claims staked on Iron Creek, a tributary of the Taseko River. It is in this vicinity that the limonite deposits recently investigated by the provincial government are located, and it is reported that members of the exploratory party which spent the 1920 season on the Taseko were informed of the occurrence of gold in Iron Creek. H. Taylor, an old-time prospector, is credited with being the original staker. He and his associates are said to have been making considerable recoveries of gold, coarse and rough.

Stewart—Pat Daly is now planning the further development of the "Big Missouri" group of claims in the Salmon River zone, Portland Canal. The diamond drilling and exploratory work carried out under Sir Donald Mann does not convince Mr. Daly that this property is without a future. Mr. Daly explains that two companies have been formed, one a holding company incorporated in the United States and known as the Portland Canal Mines and another incorporated in British Columbia and known as the Daly Mines Co., Ltd. It is stated that necessary funds will be available for development.

Trail—Ore received at the Consolidated smelter during the week ended Sept. 21 totaled 4,575 tons, from the following sources:

Mine	Location	Wet Tons
Company Mines,		4,471
Champion,	Salmo,	20
Knob Hill,	Republic,	84

Ontario

Chances of Power Shortage Less at Porcupine—Mond Nickel Cuts Wages—Competition in Powder

Porcupine — During the last few weeks the possibilities were strong that there would be another severe power shortage in the Porcupine district this winter. Fortunately, very heavy rains have occurred recently and it is understood that, if the normal October rainfall is obtained, the power company should be able to continue its service. A few days ago the storage was 14 in. below normal, but in two days over 4 in. of rain fell. The power company is building a dam on Kenogamisee, which is planned to raise the main storage area by 10 ft., and thus assure a sufficient water supply during the winter, but the mining companies are doubtful if this work can be completed in time to help out the present season. In addition to the water shortage, the companies are using about 25 per cent more power than they were known to be consuming a year ago.

In view of the fact that the Hollinger is proposing to bring its capacity up to 5,000 tons per day, and the McIntyre has started a new 500-ton mill addition it is doubtful if the power company will be able to develop sufficient power from its present sources to supply the camp. The total capacity of the company is taken by the Dome, Hollinger, and McIntyre, and, as a matter of fact, there is not sufficient power for them, so that the prospects for any other companies which desire power are not particularly rosy. There are, however, several other water-power sources within a reasonable distance, and to provide for present requirements and future extensions at least one of these powers should be developed.

The Dome has declared the regular dividend of 25c. a share, payable Oct. 20. Development on the new orebody in the east end of the property is satisfactory, and the ore is showing high values. No visible gold is to be seen, but the ore carries heavy sulphides.

It is understood that negotiations are under way for the control of the Schumacher mine, but even if these negotiations were successful it is doubtful if the power company could supply power this winter.

The McIntyre is delaying work on the new 500-ton mill addition in view of the possible power shortage mentioned.

Kirkland Lake—A special meeting of the shareholders of the Teck Hughes company will be called soon to ratify a proposed reorganization of the company. The company has a half million bond issue outstanding, on which the interest has been defaulted. The bond holders could have taken over the property, but did not want to do anything which would work against the interest of the shareholders. It is now stated, however, that the bond holders have formulated a plan which is satisfactory to the majority shareholders of the Teck Hughes company, and it is felt that the shareholders, as a whole, will find the plan acceptable and will ratify it. Conditions at the mine continue to be favorable, the average recovery being slightly over $10 per ton, and the cost approximately $6.

Cobalt—For the first time in several years northern Ontario is enjoying the benefit of a competition in powder. Several new brands of powder have recently reached the market, and competition is resulting in cheaper prices for the consumer. The Dome Mines has been making a test of "thompsonite," and on account of the absence of injurious fumes, has decided to use it in certain of the workings, and has bought a carload. "Burrowite" has been tried out in Kirkland Lake, and it is stated that the results have been satisfactory. Another powder company which was promoted by interests identified with the old Curtis & Harvey company will also soon have its product on the market. As a number of the mining companies are shareholders in this company, the concern should enjoy a satisfactory market for its product.

The ten-year old liquidation in connection with the Bailey Cobalt Mines recently came to an end, when at a special shareholders' meeting in Toronto the directors were authorized to make application for the termination of the winding-up proceedings. The directors were also given the necessary authority to receive from the liquidator 425,000 shares of the capital stock of the Bailey Silver Mines, Ltd., and to hold this stock for the benefit of the Bailey Cobalt shareholders.

Nipissing costs are now down to about 35c. per oz., and there is some talk of the directors paying a bonus. The company has started its third diamond drill hole on the Rochester property, which adjoins the Hollinger, in the Porcupine district. No information regarding results is available.

Crown reserve is understood to be meeting with good success with its diamond drilling in Larder Lake. Three holes have been put down, of which two have cut the vein, which shows a width of 18 ft. and 35 ft., respectively, and it is expected that the third hole will cut the vein at a much greater depth, in a short time.

The Right-of-Way company is in liquidation, but it is expected that the property will be repurchased by the old directors.

Sudbury—Beginning Oct. 1 the management of the Mond Nickel Co. announced another cut in wages of 5c. an hour. This will bring the pay for drill runners to $4.20 a day, with other classifications in proportion.

Ottawa—The government announces that during the coming winter the T. & N. O. Ry. will begin the construction of a seventy mile right-of-way from Cochrane to Tin Can Portage, on the Abitibi River. The estimated cost of the extension is $3,500,000. In deciding upon the proposed extension, the government took into consideration the unemployment situation, as well as the country which the extension will serve. The line will tap large pulp reserves and will also open up some good farming land, and will lead to the development of the extensive kaolin and fire-clay deposits which have been found in that country. It will also put the railroad within reach of a large water power, which would immediately become available if the Government decided to electrify the line.

Yukon Territory

Season's Gold Yield Estimated at $4,000,000 — Frosts Stop Hydraulic Work

Dawson — The gold yield of the Yukon Valley, including Canadian and American territory, for the season of 1021 aggregates approximately $4,000,000. It is estimated that the production of the interior of Alaska for the season will run to about $2,675,000. The output of the Canadian Yukon will amount to about $1,250,000 for the season. A million of this was produced within a radius of fifty miles of Dawson, and the bulk was shipped from that point. This makes a total for the two territories of $3,925,000, to which may be added an estimated $75,000 for the Atlin camp in northern British Columbia.

Following is the total season's yield, as estimated, by camps: Dawson, $1,250,000; Fairbanks, $800,000; Kuskokwim, $550,000; Iditarod, $500,000; Tolovana, $250,000; Ruby, $125,000; Bettles, $85,000; Ophir, $80,000; Marshall, $50,000; Circle, $50,000; Chandelar, $40,000; Hot Springs, $35,000; Rampart, $25,000; Eagle, $35,000; Forty Mile, $40,000; Atlin, $75,000.

Hydraulic operations around Dawson are shutting down, the first frosts forcing the clean-up. Several dredges around Dawson will run two or three months longer. These include two new dredges on Dominion Creek, one on Gold Run, and two on Klondyke Valley. A dredge on Highest Creek, tributary to Dawson, is also having an exceptionally successful season. The Old Glacier Creek district west of Dawson, which was discovered before the Klondyke, is producing over $100,000 this year by the old steam-thaw and hoisting processes alone.

MEXICO

Durango

Guanacevi Affected by Poor Railroad Service

Guanacevi—A number of the principal mines of this camp are closing down owing to the lack of explosives and other mining supplies. The fault is said to lie with the railroads, which are unable to deliver freight or handle the ores from the camp.

The Esperanza mine, in Chihuahua, north of this camp, has closed down for the same reasons and will not attempt to resume operations until an improvement is made for handling the mine output.

Hidalgo

Resumption of Work Likely Following Rise in Silver

Pachuca—Preparations are being made to begin work at Pachuca and adjacent camps. It is said the Real del Monte, El Oro, and Tlalpujahua mines will resume operations after having been idle for several months.

Aguascalientes

Asientos—More mines in the Asientos region suspended during the week ended Sept. 24, throwing a number of miners out of employment. Some development work is being carried on, and a new mill is being projected for the camp, which will treat the ores from the near-by mines.

TEXAS

Back Taxes Claimed on Shipments of Union Sulphur Co.

Jefferson County, Tex., is trying to collect taxes for a period of fourteen years on sulphur shipped by the Union Sulphur Co., of Calcasieu Parish, La., to the port of Sabine, and thence by boat to other ports. A [illegible] question of interest is involved in this claim for taxes, as the sulphur is mined in Louisiana. The commissioners of Jefferson County, however, contend that the sulphur at the docks on Jan. 1 each year is taxable. About [illegible] in taxes, if allowed, will be collected.

ARIZONA

C. & A. Acquires Claims on Bitter Creek—Coronado Property To Be Sold To Satisfy Arizona Copper Co.'s Judgment

Duncan—It has been announced by some of the owners that the deal for the Belali group and Norman King group of ten claims, situated on Bitter Creek near the old Clear Lake mill, thirty miles from the railroad at Duncan, has been finally closed, the property going to the Calumet & Arizona Mining Co., which has had it under option for sixty days. This is a siliceous silver-lead property that has produced some high-grade ore.

Clifton—Notices were recently issued that the mining property of the Coronado Mining Co., situated in the Copper Mountain district near Clifton, would be sold by the sheriff at public auction to be held at the court house in Clifton, to satisfy a judgment obtained against the company in the Superior Court on August 31, by the Arizona Copper Co.

Big Bug—At the organization meeting of the board of directors of the Big Ledge Copper Co. held in New York recently, John Borg was elected president, Nelson Gray, vice-president and treasurer, and William C. Sherwood, secretary.

The board considered the recent report on the properties prepared by W. W. Lytzen, which indicates that present developed ore reserves represent only 5 per cent of the development possibilities of the Henrietta vein, and authorized the new president to prepare a plan for future development operations to be submitted to the full board at its next meeting. The advisability of constructing another 100-ton unit to add to present milling facilities will also be discussed then.

CALIFORNIA

San Francisco Mint Breaks Record in Coining Dollars

San Francisco — Twelve cars of freight, aggregating 450 tons, have been forwarded to [illegible], Mexico, and most of the shipment has been unloaded at its destination. The machinery and freight are for the construction of a gold dredge purchased by the [illegible] Gold Placers, Inc., in San Francisco.

A drilling party in charge of Ralph L. Van [illegible] will leave San Francisco early in October to explore certain concessions on the Sinaloa, Yaqui, Mayo and Fuerte rivers, in Sinaloa.

More records have been broken by the San Francisco mint, which is coining silver dollars at the rate of [illegible] per day. [illegible]

Grass Valley—The North Star mine has [illegible] men on its payroll and is now operating at full capacity. The Empire has 450 men and is operating its eighty stamps to capacity. Other local mines are active.

Shawmut — The destruction of the boarding house at the Belmont-Shawmut by fire has delayed the resumption of operations.

Oroville—Search is being made for platinum in the Magalia Ridge district. Platinum has recently been found in the sluice boxes of the Steiffer placers operated by the Evening Star Co., and as a result greater attention is being paid to its probable occurrence in other properties.

Engelmine—The August output of the Engels Copper Mining Co. approximated 1,040,000 lb. copper, 15,300 oz. silver, and 130 oz. gold from 27,000 tons of ore. Milling is proceding at rate of 1,000 tons per day, with an average extraction of 86 per cent. The extraction of the sulphide copper is close to 90 per cent. New ore of better grade and quantity is being opened on the 7th level of the Engels mine. The deep adit has reached a length of 250 ft., and progress is at the rate of 300 to 350 ft. per month. Two years will be required to complete the 7,600-ft. adit. The adit will concentrate operations, eliminate pumping and hoisting at the upper mine, supply all water under gravity flow for the mill and open up ore reserves to a depth of 500 ft. below the present workings in the upper or Engels mine. One-third of the present production comes from the lower or Superior mine.

NEVADA

Much Activity in Comstock District—Tonopah Divide Creating Reserve Fund To Build Mill

Virginia City—There is considerable activity all along the Comstock Lode and adjacent territory. Many claim transfers are being made, and those familiar with the district and conditions predict a boom for the spring of 1922.

Sampling of the Middle Mines is being continued, and it is generally believed that the options held by Albert Burch and associates will be exercised, and that samples will show that a considerable portion of the vein can be mined by glory-hole method.

Divide—According to a recent statement by H. C. Brougher, president of the Tonopah Divide Mining Co., the company is clearing from $5,000 to $10,000 a month at present, and is building up a reserve fund to be used in the construction of a mill near the mine. Fifty tons of ore is being shipped daily to the Belmont mill at Tonopah, the hauling cost being $1.75 per ton. No recent estimates of ore reserves have been given out, but Mr. Brougher states that in the past year more ore has been developed than mined. The main shaft is being sunk at the rate of 100 ft. monthly, and sinking will be continued until water level is reached.

The Divide Extension shipped 600 tons of ore to the MacNamara mill at Tonopah during the first twenty days of September. The ore is said to average $50 per ton. Crosscutting to pick up the faulted segment of the vein on the 200 level is being continued.

Tonopah—Reported bullion shipments from this district, representing clean-up of operations for the first fifteen days of September, are as follows. Tonopah Belmont, $97,000; Tonopah Extension, $38,000; West End, $55,000; and Tonopah Mining, $65,000. The Belmont is shipping 450 tons of ore daily and doing extensive development work on all levels from the 700 to the 1,200.

The Extension reports 244 ft. of development during the week ended Sept. 24, with development from the 1,200, 1,540, 1,600, 1,680, 1,760, and 1,880 levels. The West End reports tonnage mined as 225 tons per day, with development work on all levels from the 500 to the 1,100.

The Tonopah Mining Co. is producing 200 tons of ore daily and doing development work from the Mizpah, Silver Top, and Sandgrass shafts. The Midway reports cutting quartz stringers in the crosscut on the 1,600 level, some of the quartz showing mineralization.

Ely — Development work is being pushed with a small force by the Nevada Consolidated on the high-grade copper orebody found some time ago in the Ruth mine. About 500 cars averaging over fifty tons per car have been sent to the smelter at McGill, where the ore is stockpiled pending resumption of smelting in the Ely district. This ore averages about 8.5 per cent and carries a small gold content. No definite announcement has as yet been made as to when operations will be resumed, and the town is quiet.

Shipment of the surplus copper stored at the McGill smelter to the refinery at Baltimore, Md., has been started. About 20,000,000 lb. is on hand at present at the smelter, and it is expected that shipments will be made at the rate of about forty cars per week. The shipments will be routed via Shafter and the Western Pacific to San Francisco and thence by water through the Panama Canal to Baltimore. A saving of $5.50 per ton is reported to be made by this routing over the charges on the all-rail route east.

The Taylor mill will soon be treating ores from the Taylor district again. The plant has been completely overhauled.

UTAH

Utah Steel Corporation Gets Stock-Selling Permit

Midvale—The Utah Steel Corporation, which is planning important expansion and the utilization of iron deposits in the southerrn part of Utah, has been granted permission by the State Securities Commission to dispose of $1,000,000 worth of preferred stock, this to bear interest at 8 per cent. The Utah Steel Corporation beginning in 1915 with a plant representing a cost of $175,000, has added to its equipment until it now has an investment of $2,000,000. It has been producing iron and steel from scrap iron, and finding a market in the Western and Pacific Coast states. The company has made a contract with the Milner corporation for iron ore from the southern part of Utah, and it is understood that, as soon as it is ready to start work on the proposed new blast furnace, provision will be made by the railroad for the construction of a twenty-one mile branch line from Lund, on the Salt Lake Route, to the iron fields. The coal fields which are to supply fuel for the new industry are already tapped by railroad.

Park City—The shipments for the week ended Sept. 24 amounted to 1,436 tons. Shippers were: Judge allied properties, 593 tons; Silver King Coalition, 560 tons; and Ontario, 283. Considerable prospecting is going on in the eastern section of the camp, following the recent find at the Park-Utah, one of the Judge allied properties.

Construction of the new mill of the Coalition is progressing. Steel work has been started, and some of the machinery is on the ground. Excavation for the cement foundation for the large crusher has been started. This work is in solid rock.

Eureka—Ore shipments from the Tintic district for the week ended Sept. 24 amounted to 144 cars, as compared with 161 the week preceding. Shippers were: Tintic Standard, 38 cars; Chief Consolidated, 36; Victoria, 13; Eagle & Blue Bell, 11; Dragon, 8; Iron King, 8; Iron Blossom, 7; Swansea, 3; Gemini, 3; Mammoth, 2; Eureka Hill, 2; Colorado, 2; Silver Park, 1; Silver Park lease, 1; Sunbeam, 1.

The Mammoth mine, at Mammoth, has closed down, owing to the low price of copper and high costs. Lessees are continuing at the Grand Central. The South Standard has resumed shaft sinking. Drifting is being done on the 1,050 level of the Eureka Bullion.

COLORADO

Two Radium Companies To Resume—Rich Ore at Bull King Causes Rush—Gem Mining Co.'s Property Transferred

Montrose — Announcement has been made that the Radium Company of Colorado and the Radium Luminous Materials Corporation would both renew operations after a long period of inactivity. These companies are owners of large radium properties in the west end of Montrose County, the former company shipping its ore to Denver for reduction and the Radium Luminous company treating its output at a plant in the East.

The Standard Chemical Co., the largest radium-mining company in the country, is operating its plant at full capacity, and indications are that operations will soon reach pre-war activity, throughout the carnotite districts.

Denver—A big rush has started to a new district on the Utah and Colorado line, centering around a new camp known as Bull King. Exceptionally rich ore is reported, and many new locations are being made.

Idaho Springs—New York business men have organized the Commonwealth Silver Mines Co., and have taken over the property of the Gem Mining Co. in this district. The new company will operate the Freighters' Friend, Silver Age and Franklin groups, through the Newhouse or Argo tunnel.

Cripple Creek—A 500 ft. shaft will be sunk on the Elkhorn property, and equipped with electrically operated hoist and air compressor.

MONTANA

Anaconda Denies That It Intends To Resume Mining—Tuolumne Co Cuts New Milling Ore

Butte—Gossip is continuing of negotiations pending between the Davis-Daly Copper Co. and the East Butte Mining Co., but nothing is obtainable from an official source which might lend color to the rumors that some sort of consolidation is in the air. East Butte has resumed raising its shaft from the 1,800 level to the surface, and the work is now within 350 ft. of completion. The shaft will materially cut down the crosscutting distance to the ore zone of the Pittsmont properties.

The Tuolumne Copper Mining Co. has opened a fair-sized body of milling ore on the 1,606 level of the Main Range mine, which it is drifting upon westerly in the hope of uncovering ore which will grade into the commercial class, the present range of assays showing more than 6 oz. of silver and from 1 to 1½ per cent copper.

Butte & Superior is drifting upon its copper-ore showing on the 2,200 level of the Black Rock mine, with the grade holding and apparently giving indications of widening. The situation, according to the observation of those working in this drift, is improving.

The Davis-Daly drift to the northwest on the 2,700 level of the Colorado mine is showing about 3 ft. of high-grade ore. Crosscutting is being pushed on the 750 level of the Hibernia, and within a month's time, or possibly a week or two longer, the orebody should be reached.

The Anaconda Copper Mining Co., in a somewhat remarkable statement published in the last week in one of the local newspapers, said to be controlled by that corporation, stated that copper metal was practically unsalable. The statement published was in refutation that the company proposed any early resumption of copper mining, and painted the situation as not warranting the raising of any false hopes on the part of the people of Butte, or of unduly encouraging local merchants into the belief that better times were near. A full crew is now working on half time at the Anaconda's timber-framing plant at Rocker, Mont. An interesting item referred to the starting up of the timber-pickling plant at Rocker, but for how long a time is not known. This resumption has been in the nature of an experiment.

MICHIGAN

The Copper Country

The Problem of Recovering Copper From Amygdaloid Sands—Quincy in Good Condition—Mohawk Running at Capacity

Houghton, Mich.—Some of the mines, notably Copper Range, Mohawk, and Quincy, are working out their own problem in the further recovery of copper from waste amygdaloid sands. Copper Range "rock" is a free-milling amygdaloid, susceptible to fine grinding. The loss per ton is about 5 lb., but this can be reduced another pound by regrinding. Copper Range is convinced that the solution of its problem is finer grinding rather than leaching or flotation. Even if flotation could be successfully applied it is believed it would be too expensive, because of the relatively small metal content of the sands and the large outlay that would be required for equipment and handling.

Approximately 15 per cent of the Mohawk tailings are reground, and it is its policy to install additional regrinding processes whenever other equipment can be discarded to provide the necessary space. The conclusion has been practically reached that an addition to the mill, which would be required to house more tables and regrinding mills, would not be justified, owing to the comparatively low copper content in the tailings. As in the case of Copper Range, the loss is about 5 lb. to the ton.

All but one of the stamp head units in the Quincy mill have been completely equipped for regrinding. As a result, Quincy last year recovered nearly 2,500,000 lb. of copper that otherwise would have been lost.

Although copper losses in amygdaloid tailings average about 5 lb. to the ton, the percentage is much higher in conglomerate sands. In the older deposits of Calumet & Hecla tailings, the copper content will run from 12 to 20 lb., and in the newer sands the loss is 8 to 10 lb. Calumet is now recovering the greater part of this metal by flotation.

Although failing to "break even" at the present price of copper, Quincy is holding an organization together, and will continue to operate on approximately a 50 per cent basis throughout the winter. It has effected every possible economy, and production is down to the minimum. The mine is working a total of nine shifts a week, or four and a half days in the Nos. 2, 6, and 8 shafts. Metal sales have not kept pace with refined-copper production, and a larger surplus than usual is on hand. Just what this surplus is, however, has not been divulged.

Considerable [illegible] copper continues to come from Nos. 2 and 6 shafts. The new No. 2 hoist, the [illegible] powerful drum hoist in the world, is working smoothly and has contributed materially to a lowering of costs in that shaft.

Quincy should be one of the first of the Lake mines to "come back" strong when normal conditions in the metal market return. Not only is the grade of ore holding up at depth in all shafts, there being no diminution in the yield of mass copper, but improvements in all departments of operation have effected notable economies.

Mohawk continues to work to the capacity of its stamp mill. A full program of mining and development is under way throughout the mine, with little or no change from day to day in output of "rock," or yield of copper per ton. Daily "rock" shipments average about 2,600 tons, the yield being approximately 23 lb. of refined copper to the ton. Mohawk is now sinking, drifting, and stoping in No. 1 shaft, and some particularly good ground is being opened north of the shaft.

Work will continue in the two south drifts from the 1,700 level of Mayflower as long as mineralization continues. Both drifts are again in copper, with a fair grade of "rock" coming from the main drift, the copper appearing in both mass and barrel form. The improvement in the parallel or No. 2 drift is encouraging, the drift having passed through a "trappy" section encountered after it had gone through a long stretch in which the mineral values were quite satisfactory.

Seneca's drifts north from the 3rd, 5th and 6th levels toward the Gratiot continue in good ground. The mineralization also persists to the south, in the direction of Ahmeek. There will be no reduction of development work in Seneca this winter.

Marquette Range

Cleveland-Cliffs Shipping Stock Ore—Oliver Shipping From Section 16

Negaunee—The Cleveland-Cliffs Iron Co. has had steam shovels at work in the large stockpiles at the Maas and Negaunee mines. The same company is now shipping more ore from the Gwinn district, but little is going forward from the mines west of Negaunee in Marquette County. The Oliver Iron Mining Co. is making regular shipments from its Section 16 property, the only mine being operated by this company on the range. Some of the mines will have difficulty arranging stocking room for the coming winter.

MINNESOTA

Mesabi Range

Hill-Trumbull Mine Lays Off 125 Men

Nashwauk—All machinery at the [illegible] mine, a property of [illegible] Quinn & Co., is being removed from the underground workings by a small crew. The property has not been operated for two years, but it is [illegible] that the company plans to [illegible] and that [illegible] will be started next spring.

Marble—The Hill-Trumbull mine, [illegible] by the Mesabi Cliffs Iron Mining Co., has completed its shipment of [illegible] tons of ore for this season and all work has been stopped, except that of [illegible]. In all 125 men are affected.

THE MARKET REPORT

Daily Prices of Metals

Sept.	Copper, N. Y., net refinery* Electrolytic	Tin 99 Per Cent	Tin Straits	Lead N. Y.	Lead St. L.	Zinc St. L.
29	12.25	26.25	26.50	4.70@4.75	4.45@4.50	4.45@4.50
30	12.25	26.375	26.625	4.70	4.45@4.50	4.50
Oct. 1	12.25	26.375–26.50	26.75	4.70	4.45@4.50	4.50
3	12.25@12.375	26.50	26.75	4.70	4.45@4.50	4.50@4.55
4	12.375@12.50	26.375	26.75	4.70	4.45@4.50	4.55@4.60
5	12.50 @12.75	26.50–26.75	26.75–27.00	4.70	4.45@4.50	4.60

*These prices correspond to the following quotations for copper delivered: Sept. 29, 12.50c.; 30th, 12.50c.; Oct. 1, 12.50c.; 3d, 12.50@12.625c.; 4th, 12.625@12.75c.; 5th, 12.75@13c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Sept.	Copper Standard Spot	Copper Standard 3 M	Copper Electrolytic	Tin Spot	Tin 3 M	Lead Spot	Lead 3 M	Zinc Spot	Zinc 3 M
29	68¼	69¼	72½	156½	158½	23⅛	23	26¾	26¾
30	68¾	69¾	72½	156½	158¾	23⅛	22⅞	26⅜	26¾
Oct. 1									
3	68¾	69¾	72½	157¼	159½	23¼	23⅛	26¾	26⅞
4	68⅝	69½	73	156½	158½	23¼	23⅛	26½	27
5	69¾	70¼	73½	155¾	157¾	23¼	23⅛	26¾	27¼

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Sept.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London	Oct.	Sterling Exchange "Checks"	Silver New York Domestic Origin	Silver New York Foreign Origin	Silver London
29	371¼	99¼	71⅜	43⅛	3	372½	99¼	70	42⅜
30	372	99¼	70½	42⅜	4	373¼	99¼	70⅜	42½
Oct. 1	372¼	99¼	70⅜	42⅜	5	375½	99¼	70⅜	42⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, Oct. 5, 1921

Copper and zinc were the most active metals during the week, the trading in each having an influence on prices. Although the lead market was not inactive, buying was not so heavy as last week, and prices show no change since the first of the month. The better feeling among producers which has been noted for the last few weeks exhibits no let-up, the rise in all the metals has been steady and regular, and there is little likelihood of any runaway market carrying prices to a level which cannot be held. It should not be forgotten that even at present levels prices are below pre-war averages.

Copper

The heavy buying of copper which was started by the brass companies has gradually gathered momentum, and other consumers have come into the market, particularly wire manufacturers and users. Public-utility companies have also noted the rising tendency and have been in the market for future requirements; in fact, the general inquiry for future copper which runs well into the first three months of next year has been one of the features of the market. Although trading was on a 12.50c. delivered basis last week, an increased activity in demand gave prices an upward boost. Yesterday some copper in fair-sized quantity was sold for 13c. delivered, October and November delivery, but copper is still available at 12.75c. Future copper has been sold for about one-eighth cent premium per month. All producers and dealers report the market as strong, and many are of the opinion that the market will advance further. Export business has been lighter than last week, the price quoted yesterday being from 12.65 to 12.75 c.i.f. Interest has momentarily shifted from foreign trade to domestic business. It is noticeable that the London market has also shown an improvement.

Lead

The American Smelting & Refining Co. continues its official contract price, at 4.70c., at which level most of the other New York business has been done. The New York market has been much more active than that at St. Louis, the demand seemingly centering in New England manufacturing establishments. The quietness of the market is not worrying producers, as lead still continues to be in excellent statistical position, and it is realized that a steady market is more to be desired than a widely fluctuating one. One producer feels that it would be unwise to see too much of a rise in lead, with a possible influx of foreign lead and other unwonted results.

Zinc

Zinc has continued its advance, and was sold today for 4.60c. East St. Louis. Buying is in good volume, and metal is steadily moving into actual consuming hands, chiefly galvanizers.

Shipments are making an inroad on the surplus which has been accumulated during the last few months, and the

September Monthly Average Prices

Copper:

New York Electrolytic	11.948
London Standard	67.977
London Electrolytic	72.295

Lead:

New York	4.600
St Louis	4.392
London	23.148

Silver:

New York, foreign	66.160
New York, domestic	99.250
London	40.082
Sterling Exchange	371.725

Zinc:

St. Louis	4.235
London	25.256

Tin:

99 per cent	26.280
Straits	26.680
London	156.750
Antimony	4.564
Quicksilver	42.660
Platinum	75.960

healthy rise and strength of the market have made producers a lot more cheerful than for many days. As is usually the case, many consumers who had intended to remain out of the market have been drawn in by the advance in price. High-grade zinc is still selling for 6c., with freight allowance.

Tin

A better demand is reported but prices do not show any pronounced changes. Although the London market is down today, the improvement in sterling exchange more than makes up for the decline. The tin-plate trade is improved, and a fair business has been done with this class of consumers. Forward deliveries of tin are quoted about ½c. higher than spot.

Arrivals of tin in long tons: Total September, 2,600; Oct. 3d, London, 50; Straits, 925.

Gold

Gold in London: Sept. 29th, 111s. 4d.; Sept. 30th, 111s; Oct. 3d, ——; Oct. 4th, 110s. 6d.; Oct. 5th, 109s. 8d.

Foreign Exchange

Foreign exchange rates have been moving irregularly, but the tendency is slightly upward. On Tuesday, Oct. 4, francs were 7.135c.; lire, 3.975c.; and marks, 0.805c. New York funds in Montreal, 10.995 per cent premium. Sterling cables continue to be quoted ½c. higher than the figure given on page 594.

Silver

Since our last report there has been selling by both China and the Indian bazaars, with a consequent fall in the price of silver. The rupee rate and China rates are off from last week, and unless an improvement occurs in these exchanges any material advance in silver seems unlikely. The market closes quiet and uncertain.

Mexican Dollars—Sept. 29th, 55; 30th, 54½; Oct. 1st, 54½; 3d, 53½; 4th, 54½; 5th, 54.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 18@20c. per lb.; 18½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 5c.; market dull. W.C.C. brand, 5¼@5½c. per lb. Cookson's "C" grade, spot, 9c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb.

Cadmium—Range $1@$1.10 per lb. in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb.; black oxide, $2.55 per lb. in bbls.

Iridium—Nominal, $150@$170 per oz.

Molybdenum Metal — In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominal, $55@$60 per oz.

Platinum—$78 per oz.

Quicksilver—Market weaker at $39@$41 per 75-lb. flask. San Francisco wires $43.75. Dull.

Rhodium—$150 per troy oz.

[1]**Selenium** — Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

Thallium Metal—Ingot, 99 per cent pure, $20 per lb.

Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $24@$26; ground, $28; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—20@22c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 50c. per lb. of contained sulphide, New York. Quotation purely nominal.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

Titanium Ores—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

Zircon—Zircon sand, washed, f.o.b. Pablo, Fla., 4½@6c. per lb., according to grade.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Oct. 1—Zinc blende, per ton, high, $23.95; basis 60 per cent zinc, premium, $23.50; Prime Western, $22.50; fines and slimes $20@$18; average settling price, all grades of blende, $22.09.

Lead, high, $64.65; basis 80 per cent lead, $60; average settling price, all grades of lead, $58.27 per ton.

Shipments for the week: Blende, 5,477; lead, 1,256 tons; value, all ores the week, $195,190.

Keen competition developed early in the week, with offerings $1 above last week's closing. Another half dollar was added today for Prime Western, while premium was advanced to $23.50, a gain of $2.50 per ton. About 2,000 tons sold on the premium basis, the demand being for blende with little or no lead content.

Although settling prices for lead indicate over $60 basis, all buyers deny that a higher basis is offered, and no seller was found who would admit having received over $60 basis. The mines being restarted for lead production, it is shown by careful survey, have no more than offset in output others that have closed down temporarily.

Platteville, Wis., Oct. 1. — Lead ore advanced to $60 per ton. Shipments for the week: Lead, 112 tons. Shipments for the year: Blende, 8,461; lead, 1,283 tons. Shipped during the week to separating plants, 697 tons blende.

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,500@$2,000; No. 2, $850@$1,250; spinning fibers, $350@$800; magnesia and compressed sheet fibers, [illegible]; shingle stock, [illegible]; paper stock, [illegible] $70; cement stock, $16@$27.50; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada.

Barytes—Crude, 88 to 94 per cent barium sulphate, $10@$12 per net ton; ground [illegible] in bags, carload lots; [illegible] in bags, carload lots; all f.o.b. South Carolina points. [illegible] material, [illegible] per net ton, f.o.b. Atlantic seaports. [illegible] grades are $24.50. Crude [illegible] per long ton, f.o.b. Cartersville, Ga.

Bauxite—[illegible] bauxite, $8@$10 per [illegible] ton, f.o.b. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. [illegible] [illegible] per gross ton, [illegible] [illegible] per gross ton, f.o.b. shipping point.

Borax—Granulated, crystals or powdered, in bags, carloads, [illegible] per lb.; in bbls., [illegible].

Chalk—English, extra light, [illegible]. Domestic, [illegible] heavy, 4c. per lb., all f.o.b. New York.

---

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

China Clay (Kaolin)—Crude, \$6.50@\$8.50; washed, \$9@\$10; powdered, \$12@\$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, \$13@\$20, f.o.b. Virginia points. Imported lump, \$12@\$20, f.o.b. American ports; powdered, \$25@\$40, f.o.b., quoted at New York.

Emery—Turkish emery, 6c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b., from New England points.

Feldspar—No. 1 soap grade, \$7@\$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, \$6@\$6.50; No. 2, \$5@\$5.50. Market dull. Large stocks are available and quotations are nominal. Producers report cancellations of orders. No. 1, Canadian, ground, \$23 f.o.b. Ohio points.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, \$20@\$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, \$40@\$55; gravel, \$15; lump, \$12.50, f.o.b. Lordsburg, N. M. Ground, acid grade, 97 per cent CaF_2, \$30, New Mexico.

Fuller's Earth—16 to 30 mesh, \$21; 30 to 60 mesh, \$23; 60 to 100 mesh, \$19; 100 plus mesh, \$15, f.o.b. plants, Pennsylvania. California grades, \$15@\$25, f.o.b. mines. Imported, English, \$24@\$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, ¾@2⅛c.

Gypsum—Plaster of paris in carload lots sells for \$4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, \$3.50@\$4.50; calcined stucco, \$9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, \$1.40@\$1.75 per net ton; 1½ in., \$1.35@\$1.70. Prices for other sizes practically the same. Agricultural limestone, \$2.50@\$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, \$12@\$15 per ton. High-grade caustic calcined, lump form, \$30@\$40 per ton. Plastic calcined, \$45@\$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, \$60.

Dead-Burned — \$33 per net ton, Chewelah, Wash.; \$58@\$64, Chester, Pa. Austrian grade, \$53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica — India block mica, slightly stained, per lb.; No. 6, 35c.; No. 5, \$1.20; No. 4, \$2.50@\$3; No. 3, \$3.50@\$4; No. 2, \$4.50@\$6; No. 1, \$5.50@\$6.50. Clear block: No. 6, 50c.; No. 5, \$1.75; No. 4, \$3.25; No. 3, \$5; No. 2, \$6.50; No. 1, \$8; A1, \$6.50@\$8.50; extra large, \$25; ground, wallpaper grade, \$90@\$160 per ton (depending upon quantity); ground roofing mica, \$25@\$70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, \$30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, \$11.65; 75 per cent, \$10.65; 75@74 per cent, \$10.15; 70 per cent, \$6.25; 68 per cent, \$5.75; 68@66 per cent, \$5.50.

Pumice Stone — Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 13c.; Spanish lump, 13@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica — Glass sand, \$2.25 per ton; sand-blast material, \$2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, \$16@\$30 per ton. Ganister, crude, \$2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, \$2.25@\$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—\$16@\$18 per ton for domestic, f.o.b. Texas and Louisiana mines; \$18@\$20 for export, f.a.s. New York.

Talc—Paper making, \$11@\$20 per ton; roofing grades, \$8.50@\$13; rubber grades, \$11@\$18; all f.o.b. Vermont. California talc, \$16@\$35, talcum powder grade. Southern talc, powdered, carload lots, \$7.50@\$11 per ton; less than carload, \$25, f.o.b. cars. Imported, \$30@\$40; Canadian, \$18@\$40 per ton.

Mineral Products

Arsenic—5¾@6. per lb.

Sodium Nitrate—\$2.25@\$2.30 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, \$12.50 per ton, f.o.b. in bulk, Western mines, spot and six months' contract; \$20@\$22 per ton, New York.

Potassium Sulphate—Powder, domestic, \$1.20 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, \$200@\$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., \$12@\$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 11c. per lb. of chromium contained; 4 to 6 per cent carbon, 11@12c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, \$60@\$63, f.o.b. furnace; resale, \$90, delivered; English and German, \$60@\$63, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, \$25@\$27 per gross ton, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, \$2.25 per lb. of contained metal, f.o.b. works. Imported material, \$1.70@\$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, \$38@\$40; 50 per cent, \$60@\$65; 75 per cent, \$130@\$135.

Ferrotungsten—Domestic, 70 to 80 per cent W, 40@45c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, \$6 per lb. of U contained, f.o.b. works.

Ferrovanadium—\$4.25@\$4.50 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 20.50c. per lb.; wire, 14@14.50c.

Lead Sheets—Full lead sheets, 7¾c.; cut lead sheets, 8c. in quantity, mill lots.

Nickel Silver—29.50c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets, 16.25c.; sheathing, 15.25c.; rods, ⅜ to 3 in., 13.25c.

Zinc Sheets—\$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, \$50 per ton; 76 per cent, \$90@\$95 f.o.b. works.

Chrome Cement — 40@45 per cent Cr_2O_3, \$30@\$32 per net ton, and \$31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—\$52@\$55 per net ton.

Fire Brick—First quality, 9-in. shapes, \$35@\$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, \$30@\$35.

Magnesite Brick—9-in. straights, \$65@\$70 per net ton; 9-in. arches, wedges and keys, \$77; soaps and splits, \$98, f.o.b. works.

Silica Brick—9-in., per 1,000; \$35@\$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Oct. 4, 1921

In point of mill activity, the sheet branch of the steel trade is easily the leader, for the Steel Corporation last week operated its sheet mills at 84 per cent and has scheduled 89 per cent for the present week.

Bars, shapes, and plates are generally quotable at 1.60c., with higher prices on small lots and occasionally lower prices on particularly desirable orders. A number of producers have been making a special effort to gather in business.

Pig Iron—The Standard Sanitary Manufacturing Co.'s purchases of 5,000 tons of foundry iron each for the Allegheny and New Brighton plants, at \$21, Valley, remain the latest important transactions, 5,000 tons of southern iron at \$19, Birmingham, having also been bought, for the Louisville plant. It appears now that all the sales of basic iron lately have been at \$19.25, Valley, and neither at the former price of \$19 nor at the \$20 which has been the reported asking price of furnaces for more than a month. We quote: Bessemer, \$20; basic, \$19.25@\$20; foundry, \$21, Valley, freight to Pittsburgh being \$1.96.

Coke

Connellsville—Furnace, \$3.25@\$3.50; foundry, \$4.25@\$4.50.

---

[1] Foote Mineral Co., Philadelphia, Pa.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York 1920	New York 1921	London 1920	London 1921	Sterling Exchange 1920	Sterling Exchange 1921
January	132 827	65 950	79 84[illegible]	[illegible]	[illegible]	372 [illegible]
February	131 [illegible]	59 233	85 005	34 745	337 466	385 932
March	125 551	56 023	74 [illegible]	32 479	370 870	38 806
April	119 779	59 337	68 848	[illegible]	392 438	391 784
May	102 585	59 810	60 010	[illegible]	[illegible]	[illegible]
June	90 957	58 510	51 [illegible]	[illegible]	[illegible]	[illegible]
July	91 971	60 260	53 736	[illegible]	385 538	362 565
August	96 168	61 [illegible]	59 875	[illegible]	360 404	364 505
September	93 [illegible]75	66 160	59 476	[illegible]	[illegible]	371 725
October	83 480		54 197		[illegible]	
November	77 734		50 952		342 133	
December	64 774		41 845		[illegible]	
Year	100 [illegible]		61 590		[illegible]	

New York quotations cents per ounce troy, 999 fine. London, pence per ounce sterling silver, 925 fine.

Copper

	New York Electrolytic 1920	New York Electrolytic 1921	London Standard 1920	London Standard 1921	London Electrolytic 1920	London Electrolytic 1921
January	18 [illegible]	12 597	118 095	70 964	123 238	7[illegible] 119
February	18 [illegible]	12 556	120 188	7[illegible]	126 950	75 925
March	18 331	11 976	10[illegible] 533	67 565	118 348	71 [illegible]
April	18 [illegible]	12 438	103 025	[illegible]	111 500	71 786
May	18 484	12 742	96 750	73 196	109 200	74 298
June	18 065	12 697	87 864	71 852	101 909	75 682
July	18 576	12 [illegible]70	90 148	71 [illegible]	106 455	75 286
August	18 346	11 634	93 935	[illegible]	111 143	72 705
September	18 144	11 948	96 381	67 977	111 905	72 295
October	15 934		93 327		104 905	
November	14 257		84 807		94 614	
December	13 188		75 702		85 905	
Year	17 456		97 480		10[illegible] 839	

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York 1920	New York 1921	St. Louis 1920	St. Louis 1921	London 1920	London 1921
January	8 561	4 821	8 300	4 747	47 [illegible]	23 387
February	8 814	4 373	8 601	4 228	50 [illegible]	20 650
March	9 145	4 [illegible]84	8 894	4 [illegible]	4[illegible] [illegible]54	18 911
April	8 902	4 356	8 618	4 272	3[illegible] 225	20 [illegible]
May	8 576	4 952	8 352	4 [illegible]	39 458	[illegible]
June	8 323	4 485	8 169	4 [illegible]	34 [illegible]	[illegible]
July	8 338	4 410	8 283	4 [illegible]	34 [illegible]	[illegible]
August	8 [illegible]87	4 382	8 725	4 [illegible]	3[illegible] 304	2[illegible] [illegible]
September	8 177	4 600	8 160	4 3[illegible]	35 432	23 148
October	7 070		7 018		35 238	
November	6.159		6 127		32 489	
December	4 727		4 717		24 [illegible]	
Year	7 957		7 830		37 832	

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York 99% 1920	New York 99% 1921	New York Straits 1920	New York Straits 1921	London 1920	London 1921
January	61 596	36 000		36 [illegible]	376 512	1[illegible]0 464
February	58 466	28 534	59 932	32 14[illegible]	395 750	166 250
March	61 037	27 296	61 926	28 [illegible]	3[illegible] 48[illegible]	156 024
April	61 120	28 990	62 115	[illegible] 494	345 450	163 905
May	53 230	31 431	55 100	[illegible]	294 813	177 411
June	4[illegible] 125	28 514	48 327	[illegible]	250 614	167 506
July	4[illegible] 798	26 755	49 154	[illegible]	[illegible]	164 530
August	43 856	[illegible]	47 620	[illegible]	274 048	[illegible]
September	41 940	26 280	44 465	[illegible]	270 120	156 750
October	39 310	......	40 555		[illegible]	
November	[illegible]		3[illegible] 854		241 [illegible]	
December	3[illegible] 135		34 058		2[illegible] 449	
Year	48 27[illegible]		49 101		2[illegible] 866	

New York quotations cents per lb. London, pounds sterling per long ton.

Zinc

	St. Louis 1920	St. Louis 1921	London 1920	London 1921
January	[illegible]	[illegible]	[illegible]	25 262
February	8 [illegible]	4 [illegible]	61 [illegible]	24 [illegible]
March	8 [illegible]	4 737	53 467	25 077
April	8 [illegible]	4 [illegible]	4[illegible] [illegible]	[illegible]
May	7 [illegible]	4 [illegible]	4[illegible] [illegible]	[illegible]
June	7 [illegible]	4 [illegible]	41 [illegible]	[illegible]
July	7 720	4 [illegible]	41 [illegible]	[illegible]
August	7 835	4 [illegible]	41 [illegible]	[illegible]
September	7 [illegible]	4 [illegible]	[illegible]	[illegible]
October	7 [illegible]		[illegible]	
November	6 247		[illegible]	
December	5 824		27 [illegible]	
Year	7 [illegible]71		44 372	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York 1920	Antimony (a) New York 1921	Quicksilver (b) New York 1920	Quicksilver (b) New York 1921	Platinum (c) New York 1920	Platinum (c) New York 1921
January	10 577	5 258	90 192	4[illegible] [illegible]	154 23	73 400
February	11 588	5 250	[illegible]	[illegible]	[illegible]	7[illegible] 227
March	11 056	5 282	[illegible]	[illegible]	138 56	72 463
April	10 500	5 137	102 192	[illegible]	127 04	73 404
May	9 655	5 [illegible]	[illegible]	4[illegible]	97 50	73 740
June	8 289	5 087	[illegible]	46 846	85 19	74 942
July	7 500	4 735	90 333	44 950	83 94	70 440
August	7 177	4 597	83 806	45 028	111 44	73 222
September	7 113	4 564	75 000	4[illegible]	[illegible]	[illegible]
October	6 723		67 200		[illegible]	
November	6 109		58 417		[illegible]	
December	5 534		49 577		[illegible]	
Year	8 485		81 123		11[illegible]	

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer 1920	Bessemer 1921	Basic 1920	Basic 1921	No. 2 Foundry 1920	No. 2 Foundry 1921
January	$40 47	33 96	$39 [illegible]	31 96	$[illegible]	33 88
February	42 95	28 96	42 61	26 96	43 40	30 25
March	43 40	28 16	42 90	26 46	4[illegible]	27 85
April	43 72	26 96	44 22	24 46	43 90	26 77
May	44 00	2[illegible] 21	44 88	[illegible]	45 36	25 56
June	44 8[illegible]	24 96	45 41	22 66	4[illegible]	24 38
July	47 21	22 84	47 42	20 76	46 56	22 36
August	48 90	21 96	49 88	20 29	49 35	21 53
September	50 46	21 [illegible]	50 46	21 21	51 96	[illegible] 82
October	49 21		44 38		48 58	
November	41 26		39 20		42 61	
December	36 96		34 90		37 73	
Year	44.45	...	43 85		44 93	

In dollars per long ton.

Monthly Crude Copper Production

	1921 May	1921 June	1921 July	1921 August
Alaska shipments	4.216.920	3.234.693	3,019.812	4,407.434
Arizona Copper	2 000 000	[illegible]	[illegible]	[illegible]
Calumet & Arizona	[illegible]	[illegible]	[illegible]	[illegible]
Con. Ariz. Smelting	[illegible]	[illegible]	[illegible]	[illegible]
Inspiration	[illegible]	[illegible]	[illegible]	[illegible]
Magma	[illegible]	[illegible]	[illegible]	[illegible]
Miami	4.625 000	3.939 000	4.112.000	4.281.000
New Cornelia	1.327.415	1,300.000	1.502.927	1,511.964
Old Dominion	[illegible]	[illegible]	[illegible]	[illegible]
Phelps Dodge	[illegible]	[illegible]	[illegible]	[illegible]
Shattuck Arizona	[illegible]	[illegible]	[illegible]	[illegible]
Ray	[illegible]	[illegible]	[illegible]	[illegible]
United Verde	[illegible]	[illegible]	[illegible]	[illegible]
United Verde Extension	[illegible]	[illegible]	[illegible]	[illegible]
Calumet & Hecla	[illegible]	[illegible]	[illegible]	[illegible]
Other Lake Superior	4.500.000	4.500.000	4.250 000	4.250 000
Anaconda	[illegible]	[illegible]	[illegible]	[illegible]
East Butte	1 641 1[illegible]	[illegible]	[illegible]	[illegible]
Nevada Cons.	[illegible]	[illegible]	[illegible]	[illegible]
Chino	[illegible]	[illegible]	[illegible]	[illegible]
Utah Copper	[illegible]	[illegible]	[illegible]	[illegible]
Others, estimated	[illegible]	[illegible]	[illegible]	[illegible]
Total United States	[illegible]	[illegible]	[illegible]	[illegible]
Imports, ore and concentrates, etc.	[illegible]	[illegible]	[illegible]	[illegible]
Imports of blister, unrefined	[illegible]	[illegible]	[illegible]	[illegible]
Imports of refined, etc.	[illegible]	[illegible]	[illegible]	[illegible]
Grand total	41 072 014	45 600 744	54 304 516	47,374 449
Granby Cons.	2 539 000	2.254 639	2 255 425	2,483 704
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Phelps Dodge Mexican properties	[illegible]	[illegible]	[illegible]	[illegible]
Cerro de Pasco	[illegible]	[illegible]	[illegible]	[illegible]
Chile	[illegible]	[illegible]	[illegible]	
Katanga	6 275 430	6 012 880	7 011 745	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	

(a) [illegible]

Comparative Annual Copper Production

	[illegible]	[illegible]	[illegible]
January	[illegible]	[illegible]	[illegible]
February	[illegible]	[illegible]	[illegible]
March	[illegible]	[illegible]	[illegible]
April	[illegible]	[illegible]	[illegible]
May	[illegible]	[illegible]	[illegible]
June	[illegible]	[illegible]	[illegible]
July	[illegible]	[illegible]	[illegible]
August	[illegible]	[illegible]	[illegible]
September	[illegible]	[illegible]	
October	[illegible]	[illegible]	
November	[illegible]	[illegible]	
December	[illegible]	[illegible]	

MINING STOCKS

Week Ended October 1, 1921

COPPER

Stock	Exch.	High	Low	Last	Last Div.	
Ahmeek	Boston	54	48	52	Sept '20, Q	$0 50
Alaska-Br. Col.	N. Y. Curb	*45	36	*43		
Allouez	Boston	†20	†18	19	Mar. '19	1 00
Anaconda	New York	41¾	37¼	41½	Nov. '20, Q	1 00
Arcadian Consol.	Boston	1¼	1¼	1¼		
Ariz. Com'l	Boston	8¾	8½	8½	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*30	*25	*29		
Bingham Mines	Boston	13½	12	13	Sept. '19, Q	.25
Calumet & Arizona	Boston			45½	Sept. '21, Q	.50
Calumet & Hecla	Boston	239	230	235	June '20, Q	5.00
Canada Copper	N. Y. Curb	*30	*25	29		
Centennial	Boston	8¼	8¼	8¼	Dec. '18, SA	1.00
Cerro de Pasco	New York	30½	26½	30½	Mar. '21, Q	.50
Chile Copper	New York	12⅞	10¾	12⅞		
Chino	New York	40	39¼	39½	Sept. '20, Q	37½
Columbus Rexall	Salt Lake	*19	*19	19		
Con. Arizona	N. Y. Curb			*1	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1¼	1	1¼		
Copper Range	Boston	36	33¼	35½	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*23	*21	23		
Davis-Daly	Boston	7	6½	6¾	Mar. '20, Q	.25
East Butte	Boston	9½	9	9½	Dec. '19, A	.50
First National	Boston Curb	*98	*75	*95	Feb. '19, SA	.15
Franklin	Boston	2	1¾	1¾		
Gadsden Copper	Boston Curb			*45		
Granby Consol.	New York	20⅛	17	20⅛	May '19, Q	1.25
Greene-Cananea	New York	24¾	21	24	Nov. '20, Q	.50
Hancock	Boston	3	3	3		
Howe Sound	N. Y. Curb	2¼	2⅛	2¼	Jan. '21, Q	05
Inspiration Consol.	New York	36½	33¼	36	Oct. '20, Q	1.00
Iron Cap	Boston Curb	7	5	7	Sept. '20, K	.25
Isle Royale	Boston	20	18½	20	Sept. '19, SA	.50
Kennecott	New York	22¼	20	22¼	Dec. '20, Q	50
Keweenaw	Boston	†1	†*96	*98		
Lake Copper	Boston	2½	2¼	2½		
La Salle	Boston	1½	1½	1½		
Magma Chief	N. Y. Curb			*3		
Magma Copper	N. Y. Curb	*22	*21	*22	Jan. '19, Q	.50
Majestic	Boston Curb	*7	*7	*7		
Mason Valley	Boston	1 9/16	1 9/16	1 9/16		
Mass Consolidated	Boston	2	1¾	1¾	Nov. '17, Q	1 00
Miami Copper	New York	22	21	22	Aug. '21, Q	.50
Michigan	Boston	2½	2	2		
Mohawk	Boston	50½	49	50	Nov. '20, Q	1 00
Mother Lode Coa.	N. Y. Curb	4½	3⅞	4		
Nevada Consol.	New York	12¾	11	12¾	Sept. '2[illegible], Q	.25
New Baltic	Boston Curb			3		
New Cornelia	Boston	14¼	13½	13¾	Aug. '20, K	.25
North Butte	Boston	11	9¾	10½	Oct. '18, Q	.25
North Lake	Boston	*25	*25	*25		
Ohio Copper	N. Y. Curb			*6		
Old Dominion	Boston	23	21¾	23	Dec. '18, Q	1 00
Osceola	Boston	27	27	27	June '20, Q	.50
Phelps Dodge	Open Mar.	†160	†145	..	July '21, Q	1 00
Quincy	Boston	38	36½	38	Mar. '20, Q	1.00
Ray Consolidated	New York	14	12¾	14	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*20	*17	*17		
St. Mary's Min. Ld.	Boston	38	38	38	June '20, K	2.00
Seneca Copper	Boston			13¾		
Shannon	Boston	1½	*90	*95	Nov. '17, Q	.25
Shattuck Arizona	New York	7⅛	6½	7⅛	Jan '20, Q	.25
South Lake	Boston	†1	†*50	1		
Superior & Boston	Boston	2¼	1¾	1¾		
Tenn. C. & C. cfs.	New York	8¾	7¾	8⅞	May '18, I	1 00
Tuolumne	Boston	*43	*40	*40	May '13,	10
United Verde Ex.	Boston Curb	26½	24½	25½	May '21, Q	25
Utah Consol	Boston	3¾	3⅞	3⅞	Sept. '18,	.25
Utah Copper	New York	52½	49¼	52½	June '21 Q	50
Utah Metal & T.	Boston	1⅛	1⅛	1⅛	Dec. '17,	30
Victoria	Boston	1⅛	1⅛	1⅛		
Winona	Boston	*50	*45	*45		
Wolverine	Boston	12	11	12		

NICKEL-COPPER

Stock	Exch.	High	Low	Last	Last Div.	
Internat. Nickel	New York	14½	13¾	14¼	Mar '19,	50
Internat. Nickel, pf	New York	[illegible]	80	80	Aug '21, Q	1 50

LEAD

Stock	Exch.	High	Low	Last	Last Div.	
National Lead	New York	75¼	75	75¼	Sept '21, Q	1 50
National Lead, pfd.	New York	102	102	102	Sept. '21, Q	1 75
St Joseph Lead	New York	12¼	12	12	Sept. '21, Q	25

QUICKSILVER

Stock	Exch.	High	Low	Last	Last Div.	
New Idria	Boston	†*50		*50		

ZINC

Stock	Exch.	High	Low	Last	Last Div.	
Am. Z. L. & S.	New York	10½	8¼	10½	May '20,	1 00
Am. Z. L. & S. pfd	New York	31	26½	31	Nov. '20, Q	1 50
Butte C. & Z.	New York	4½	4	4¼	June '18	50
Butte & Superior	New York	15	14	15	Sept. '20,	1 25
Callahan Zn-Ld.	New York	4½	4	4	[illegible] '20, Q	50
New Jersey Zn.	N. Y. Curb	125	116	117	[illegible] '21, Q	2 00
[illegible]	N. Y. Curb			2	[illegible] '16	03
Yellow Pine	Los Angeles	†*50	†*20	[illegible]	Sept. '20, Q	03

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills & Co.; Spokane, Pohlman Investment Co.; Salt Lake Stock and Mining Exchange; Los Angeles, Chamber of Commerce and [illegible], Colorado Springs; The Financial Press, N. Y.

GOLD

Stock	Exch.	High	Low	Last	Last Div.	
Alaska Gold	New York	⅜	⅜	⅜		
Alaska Juneau	New York	1	⅞	⅞		
Carson Hill	Boston	15¼	14½	14½		
Cresson Consol. G.	N. Y. Curb	1½	1½	1⅝	June '20, Q	$0.10
Dome Extension	Toronto	*70	..	*75		
Dome Mines	New York	19¼	18½	19	July '21, Q	.25
Florence Goldfield	N.Y. Curb	*50	*38	*48		
Golden Cycle	Colo. Springs	..	...	*67½	June '21, Q	.02
Goldfield Consol.	N. Y. Curb			*6	Dec. '19,	.05
Hollinger Consol.	Toronto	7 48	7 45	7 47	Sept. '21, 4 wks.	.05
Homestake Mining	New York	58	57¼	57½	Sept. '21, M	.25
Kirkland Lake	Toronto	*38	*35	37		
Lake Shore	Toronto	1 40	1 33	1 36	Aug '21, K	.02
McIntyre-Porcupine	Toronto	1.98	1 92	1.94	Sept. '21, K	05
Porcupine Crown	Toronto	*17	*14	*14	July '17,	.03
Porcupine V. N. T.	Toronto	*20	*18½	*19½		
Portland	Colo. Springs	*36	*36½	*36½	Oct. '20, Q	01
Reorgan. Booth	N. Y. Curb		....	*4	May '19,	.05
Schumacher	Toronto	*27	*25	*26		
Silver Pick	N. Y. Curb			*9		
Teck Hughes	Toronto	*16½	*15¼	*15½		
Tom Reed	Los Angeles	*70	*68	*70	Dec. '19,	.02
United Eastern	N. Y. Curb	2¼	2 3/16	2¼	July '21, Q	.15
Vindicator Consol.	Colo. Springs	*22	*22	*22	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*5	*3	*4		
Yukon Gold	N. Y. Curb	1¼	*80	1⅛	June '18,	02½

SILVER

Stock	Exch.	High	Low	Last	Last Div.	
Arizona Silver	Boston Curb	*18	*17	*18	Apr. '20, M	.03
Batopilas Mining	New York	⅜	½	½	Dec '07, I	.12½
Beaver Consol.	Toronto	*28	*26	*27	May '20, K	.03
Coniagas	Toronto	1 65	1.50	1 65	May '21, Q	.12½
Crown Reserve	Toronto	*14	*11½	*14	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3½	3½	3½	July '21, Q	.12½
La Rose	Toronto	*34	*31	*32	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*23	*18	*22	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.20	1 00	1 10	Sept '20, Q	.12½
Nipissing	N. Y. Curb	5½	5	5⅛	July '21, Q	.15
Ontario Silver	New York	5¼	4½	4⅝	Jan '19, Q	.50
Ophir Silver	N. Y. Curb		..	*11	Jan. '12,	.10
Temiskaming	Toronto	*25	....	....	Jan. '20, K	.04
Trethewey	Toronto	*14	*12	*14	Jan. '19,	.05

GOLD AND SILVER

Stock	Exch.	High	Low	Last	Last Div.	
Barnes-King	Butte	....	....	*60	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	1¼	*85	1⅛		
Cash Boy	N. Y. Curb	..	.	*5		
Consol. Virginia	San Francisco	*35	*26	*26		
Dolores Esperanza	N. Y. Curb	1⅜	1¼	1¼		
El Salvador	N. Y. Curb	*22	*15	*20		
Jim Butler	N. Y. Curb	*7	*7	*7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*3	*3	*3	June '16,	.05
Louisiana Con.	N. Y. Curb			¼		
MacNamara M.& M.	N. Y. Curb	*16	*14	*15	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.			4	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1⅜	1 5/16	1⅜	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*70	*62	*68		
Tonopah-Extension	N. Y. Curb	1 7/16	1⅜	1 7/16	July '21, Q	.05
Tonopah Mining	N. Y. Curb	1⅜	1¼	1½	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	*87	*85	*87	Dec. '19, SA	.05

SILVER-LEAD

Stock	Exch.	High	Low	Last	Last Div.	
Caledonia	N. Y. Curb	*6	*6	*6	Jan. '21, M	01
Cardiff M. & M.	Salt Lake	†1.15	†1.10	1 07½	Dec. '21,	15
Chief Consol.	Boston Curb	2¼	2¼	2¼	Aug. '21, Q	05
Consol. M. & S.	Montreal	15	14½	15	Oct. '20, Q	62½
Daly Mining	Salt Lake	†2 50	†1.00	...	July '20, Q	.10
Daly-West	Boston	2¼	2¼	2¼	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb			2	Apr. '21, K	.05
Electric Point	Spokane	*6½	*6	*6	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*49	*33	*49		
Federal M. & S.	New York			7	Jan. '09,	1.50
Federal M. & S., pfd	New York	22¼	21½	22¼	Sept. '21, Q	1.00
Florence Silver	Spokane			*10	Apr. '19,	.01½
Grand Central	Salt Lake	†*50	†*15	...	June '20, K	.03
Hecla Mining	N. Y. Curb	4 1/16	4	4	Sept. '21, Q	.10
Iron Blossom Con.	N. Y. Curb	*17	*17	*17	Apr '20, Q	.02½
Judge M. & S.	Salt Lake	†2.50	†1 50	..	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*3	*3	*3	June '21, I	.02
Prince Consol.	Salt Lake	7 75	7	7 75	Nov '17,	02½
Rambler-Cariboo	Spokane	*2	*11	*2	Feb. '19,	.01
Rex Consol	N. Y. Curb	*9	*8	*9		
South Hecla	Salt Lake	†*35			Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb			*8	Oct. '17,	.05
Stewart Mining	N. Y. Curb	*4	*4	*4	Dec. '15	.05
Tamarack-Custer	Spokane	1 75	1.75	1 75	Jan. '21 K	.04
Tintic Standard	Salt Lake	1 97½	1 80	1 82½	July '21, Q	.05
Utah Apex	Boston	2	2	2½	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb			*2	Nov. '17,	.01

VANADIUM

Stock	Exch.	High	Low	Last	Last Div.	
Vanadium Corp.	New York	32¼	30¼	31½	Jan. '21, Q	1.00

ASBESTOS

Stock	Exch.	High	Low	Last	Last Div.	
Asbestos Corp.	Montreal	47¼	42	47¼	July '21, Q	1 50
Asbestos Corp., pfd.	Montreal			[illegible]	July '21, Q	1 75

MINING, SMELTING AND REFINING

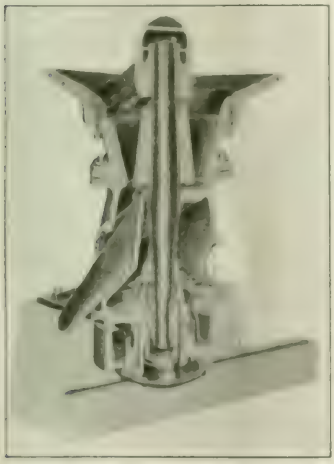
Stock	Exch.	High	Low	Last	Last Div.	
Amer. Sm. & Ref.	New York	39½	36⅛	39	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	73	73	73	Sept '21, Q	1.75
Am. Sm. pf. A	New York			66	July '21, Q	1.50
U. S. Sm. R. & M.	New York	34	32	34	Jan '21, Q	50
U. S. Sm. R. & M. pf.	New York	42	42	42	July. '21, Q	87

NEW MACHINERY AND INVENTIONS

A Gearless Standard Crusher With Ball and Socket Bearings

Industries that make use of rock crushing machinery as an essential part of their operating systems are always interested in any development that promises either better results or lower costs. When a forward step is taken that insures both, there can be no doubt about the value of the improvement, nor any limit to the interest awakened.

The Kennedy gearless crusher is a highly developed secondary recrushing unit, designed to produce finely crushed rock at a rapid rate and at low cost. The gears, heretofore an essential part of all gyratory crushers, were eliminated, and the driving power was applied directly to the eccentric. This permitted higher crushing speeds without adding mechanical complications to the machine; on the contrary, a greater degree of simplicity was attained.



GEARLESS STANDARD CRUSHER

The Kennedy crusher, shown in the accompanying illustration, contains the Kennedy ball [illegible] eccentric, which has been widely known as the most important single advance in gyratory-crusher design since the inception of the type, because it maintains perfect alignment of the main shaft and its bearing in the eccentric, eliminating of the possibility of cramping or binding, and consequently preventing heating, high power consumption, rapid wear and loss of eccentricity. The machine has [illegible] highly refined spider, permitting the passage of any stone that will enter the machine; the same arrangement of spider ring [illegible] of the top of the eccentric, preventing breakage through expansion of the [illegible], the same dust collars; the same general design and construction found in the Kennedy gyratory crusher.

In addition to these important features, the direct drive, with its manifest advantages, is now embodied. The bottom plate sleeve acts as a support for the packed lower dust collar, and as this sleeve does not revolve, the wear on the collar is reduced to a minimum. This bottom plate sleeve acts also as a support in which the eccentric sleeve and ball are contained and for supporting the driving dogs. It also forms a journal for the driving pulley, which is equipped with ball bearings, reducing the friction to the lowest factor known. The bottom plate sleeve is shouldered on the inside to prevent the eccentric sleeve from moving upward. At the bottom it has a groove and shoulder for receiving the bayonet lock that supports the ball race and pulley.

The eccentric sleeve is made in two parts and is joined by bolts passing through at top and bottom. It has a pocket on the thick side for receiving the locking pin that connects the ball-and-socket bearing to the eccentric sleeve. This pin is flattened on the sides for providing ample bearing in the pocket, preventing wear. At the bottom, where the eccentric is joined together, it forms a male driving dog for fitting into the female seat.

The driving power is applied through a universal device that eliminates all friction and side strain due to the driving of the eccentric and relieves that grinding and side thrust common to all gyratory crushers. The thrust due to pressure against the eccentric is delivered to the eccentric sleeve at the middle of the ball, and thus the eccentric sleeve floats without pressure from top to bottom.

The pulley is supported by the bayonet lock method, and is keyed in position. The eccentric is driven by a double male and female connection cast integral with the bottom plate. The bottom plate is bolted to the pulley and the joint is packed to prevent oil leakage. When the pulley turns, both the bottom plate and driving dog move, turning the eccentric directly, eliminating all pull and side thrust on the eccentric.

The oiling system is unique. Oil from the eccentric chamber can flow freely between the balls, over the top of the pulley hub into the oil well inside the pulley. From this reservoir it is [illegible] up by centrifugal force and delivered to the top of the eccentric and ball and sleeve.

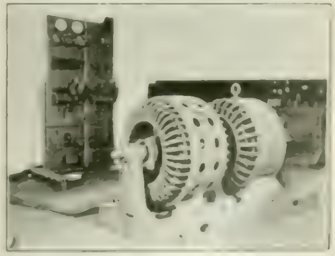
An important improvement is made in the design of the bottom shell. The base is made square so that it may be [illegible] in any direction. This enables the operator to set the machine in any position without having to predetermine whether it shall be right hand, left hand, or [illegible], as has formerly been necessary. Thus the crusher may be driven from a line shaft by belt or rope drive, [illegible] sheaves or pulley for belt drives being supplied for leading belt or ropes from pulley or motor to the crusher. The drive pulley can be on the same horizontal plane or above or below the crusher, as desired. These features enable the crusher to be installed in any kind of position without difficulty.

The machine is made by the Kennedy-Van Saun Manufacturing & Engineering Corporation, [illegible] Broadway, New York.

A Demonstration of Automatic Switching for Mine Substations

A demonstration of special interest to the mining industry was recently conducted at the works of the Westinghouse Electric & Manufacturing Co. at East Pittsburgh, in the presence of a number of prominent engineers and mine operators from the Pittsburgh, West Virginia, Kentucky, Illinois, and the anthracite districts. The purpose of the demonstration was to show the applicability and operation of automatic substation equipment as particularly adapted to coal mines, this being the first attempt to apply the fundamental principles of automatic switching to mining conditions.

A 150-k.w. mining type synchronous motor-generator set, 275 v., with control panels, involving the latest use of the principles of automatic switching, was used in the demonstration. The functions performed by the apparatus were as follows: Automatic starting and stopping by closing and opening the alternating current source of supply; automatic starting and stopping by pilot wire control; short circuit on direct current side [illegible]; overload [illegible] action of [illegible] attempt to start [illegible] to start [illegible] stopping and lo[illegible] [illegible] current [illegible].



MINING TYPE SYNCHRONOUS MOTOR-GENERATOR AND CONTROL PANELS

A [illegible] brought out the fact that [illegible] near the work to be done, thus avoiding transmission losses and the costly results of low voltage on locomotives, and without regard to other conditions which must necessarily be considered if an attendant is necessary.

Although the demonstration involved only the operation of a mine motor-generator set, the same principles have been applied to rotary converters used in mine service, with equally successful results.

New Type of Belt-Driven Air Compressors

A new type of belt-driven air compressor known as the "Imperial" type "XCB" has been announced by Ingersoll Rand Co. and has incorporated in it several noteworthy features of construction, including Ingersoll-Rand plate valves, for both the air intake and discharge, and the five step clearance control for regulating the compressor's output. The plate valves used include the features which have been proved necessary to the successful functioning of this type of valve, the most important of these being that the valve is supported throughout its entire operation in perfect alignment without any form of wearing guide—a very essential feature in the life of the valve.

The clearance control has been used with great success on the larger direct-connected electric motor driven compressors and has been found most efficient where conditions call for more than 600 cubic feet of free air per minute and where direct-connected electric motor drive is used. Under average working conditions it is well known that the demand for air is seldom steady throughout the working day, and for this reason the performance of the compressor at underload is of primary importance. By means of the clearance control, the compressor is automatically loaded or unloaded in five successive steps, these steps being obtained by the reduction or addition of clearance space to the air cylinders. The compressor will operate at full, ¾, ½, ¼ and no loads, and the design of the clearance control is such as to secure efficient operation at any one step, the reduction in input power required being practically in proportion to the reduction in output capacity.

An extremely valuable feature of the clearance control is the fact that the clearance pockets are made integral parts of the compressor cylinder and the entire regulation is obtained by the control of the volume of air taken in and compressed. With this method of control there is no loss of power due to wastage of air and leakage. The clearance pockets in the cylinder are automatically thrown in communication with the ends of each cylinder in proper succession, the process being controlled by a predetermined variation in receiver pressure.

Another added feature of the control is the maximum demand stop which will prevent the compressor being operated at any higher maximum load than is desired. This can be adjusted so that the compressor will operate on a maximum of ¼, ½, ¾ or full load and, under conditions where the load factor is comparatively low, it is of value in reducing the maximum demand, permitting a saving in the purchase of electric power—a feature found in no other type of control.

The Dallemagne Table

The American manufacturers of concentrating tables employ a much slower shaking motion than that used by Messrs. F. & E. Dallemagne, of Irun, Spain, in a table which has proved popular abroad. No riffles are used, and instead of 250 to 300 strokes per minute, the vibrations amount to at least 750 and may go as high as 1,000. Preliminary classification and careful screening are necessary for best results.

INDUSTRIAL NOTES

The Texas Gulf Sulphur Co. announces the removal of its New York office to 41 East 42d St. Telephone 6473 Vanderbilt.

The Universal Portland Cement Co. has announced a reduction in its selling prices for Universal portland cement, effective Sept. 15, of 20c. per bbl. at its Chicago plant and 15c. per bbl. at its Pittsburgh and Duluth plants. This is the second price reduction made by this company this year.

The American Sheet & Tin Plate Co., of Pittsburgh, Pa., has issued a new and revised set of weight cards covering black sheets, galvanized sheets, and formed products. These cards are 14 in. x 20 in. in size, and are clearly printed. They are of particular value to all engineers and contractors and will be sent on request.

Gus F. Ziv, formerly manager of the Chicago branch of A. Milne & Co. is now president and treasurer of the Ziv Steel & Wire Co. 4423 West Kinzie St., Chicago, Ill., which will engage in the handling of high-grade tool and solid drill steel and also high-grade hollow drill steel, made in Sweden. Norman J. Hyslip has been appointed general sales manager.

T. A. Jones has been elected president of the W. A. Jones Foundry & Machine Co., Chicago, to take the place of William A. Jones, deceased. Mr. Jones has been for many years associated with the company as secretary and treasurer. Other officers elected are, W. T. Jones, vice-president and treasurer; J. A. Sizer, secretary; G. W. Page, assistant secretary. The general policy of the company is in no way altered by these changes, and W. T. Jones continues as general manager in addition to his new position as vice-president and treasurer. This company also announces the appointment of Robert B. Moir as manager of its New York branch. He will assume his new duties immediately, making headquarters at the present sales office and transmission warehouse of this company, at 20 Murray St.

The Denver Engineering Works Co., the Stearns-Roger Mfg. Co., the Colorado Iron Works Co. and the Queen City Foundry Co., all of Denver, and all for years intimately identified as leading manufacturers of equipment for mines, announce that they have consolidated their manufacturing facilities. This consolidation affects only the production of the equipment made by the four companies. Each of the four companies maintains its individual identity, with individual selling, engineering, and service staffs handling the products of the individual company. The new producing organization is known as the General Iron Works Co., and is a distinct step toward co operative production with a view to greater efficiency, a lower price, and better service to the ultimate consumer. A large new plant, thoroughly up to date, including iron and steel foundry, plate, pattern, forge, machine, and structural steel shop, will be erected in Denver.

TRADE CATALOGS

Drills—The Sanderson-Cyclone Drill Co., Orrville, Ohio, has issued its catalog B-45, "Big Blast Hole Drills." The publication is well illustrated, and shows the application of "Cyclone" equipment to quarry, open-pit mining and heavy rock excavation. Much operating and cost data are given, and many of the features of big-hole drilling are pointed out.

Wood Stave Pipe—Pacific Tank & Pipe Co., San Francisco, Cal., has issued catalog No. 14, "Pacific Wood Stave Pipe." The catalog contains, in addition to specifications and general information concerning "Pacific" wood stave pipe, illustrations showing installations, practical tables on the subject of the flow of water through pipes, and a description of several "Pacific" products closely allied to the manufacture of wood stave pipe.

Magnesite Brick — The Harbison-Walker Refractories Co., of Pittsburgh, has issued a small folder descriptive of Metalkase Magnesite Brick. These consist of soft steel containers of round or rectangular section, open at the ends, filled solidly with fine-ground, dead-burned magnesite. They are highly suitable for electric furnace linings, since they have the high melting point and slag-resisting qualities of magnesite, and in addition have superior resistance to spalling and are better able to withstand rapid temperature changes. They are made in the following stock sizes: 9-in. Keys, 9 x 2½ x (3 x 2); 9-in. Straights, 9x2½x2½; 13½-in. Keys, 13½x(3x2); 13½-in. Straights, 13½x2½x2½; together with 9-in., 13½-in., and 18-in. Rounds, all 3 in. in diameter

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, October 15, 1921 Number 16

The Opportunity for Copper Producers Is Still Open

THE CHIEF HANDICAP in popularizing the use of copper is the high price charged by jobbers and retailers. We have spoken about this before, and expect to do so again, for it is of importance. Heretofore, the copper-mining interests have not been concerned about their product after the raw material is sold. It is to their credit that they have retained the right of selling it instead of allowing the market to pass into the hands of traders and speculators, as is the case with tin; but something further must be done. The Anaconda company pointed the way by establishing a rod and wire mill at Great Falls, and we understand that the venture has been successful. There is also a community of interest between the Phelps Dodge Corporation and the American Brass Co. The more producers and manufacturers get together, the better. All, however, have neglected the smaller business, feeling, no doubt, that it is too unimportant to be worth the effort. But here lies the big opportunity for expansion. Think of the increased demand for copper if even 10 per cent of the population of this country felt that it was advisable to have copper screens on their windows, copper roofs and gutters on their houses, copper tanks in their kitchens, and brass pipes for their plumbing, to say nothing of the innumerable other less evident purposes for which this metal is suited on artistic and economic grounds.

We would like to see the Anaconda company or the American Brass Co. or any other copper fabricator establish stores in, say, New York, Chicago, San Francisco, and New Orleans, or in New York alone as a starter, in which copper and brass products would be sold in large or small quantities at reasonable prices. A store where, if you or I wanted to buy a sheet of copper, we could get it for 25 or 30c. a pound instead of 75c. or a dollar; a store where copper would be the principal if not the only thing sold, and not a side line carrying undue overhead costs. Prices could be made very low at first. Possibly sufficient only to pay expenses, until the demand was cultivated. If such a project were properly handled and advertised we believe the results would be startling.

The increased building which must come in the next year or two to provide homes for everybody offers a particular opportunity for the establishment of such a store at this time. A builder who uses copper equipment in his house will find that it is half sold, for there will be little competition from older houses. Who of us has not seen copper leaders on a house, or copper screens, and thought to himself "that house must be well built; it has the earmarks of quality." With reasonable prices the builder will not find his extra investment prohibitive.

We are going to give a lot of free advertising to the first copper or brass company to start a retail store with common-sense prices.

Grouping of Washington Scientific Bureaus

REORGANIZATION of the Government bureaus and departments in Washington is a problem for which many solutions are offered. Classification is not so much a matter of science as of good judgment and practicability. A mass of heterogeneous materials, such as we have in Washington, can be classified almost any way—horizontally, vertically, or diagonally—or as the knights move on the chessboard; and in actual practice, or in the propositions submitted, we find examples of all these systems. A crowd may be classified according to color, or height, or sex, or dress, or education, or according to whether or not those composing it wear earrings; and it is easy to classify the Government organization and remodel it in many different ways. We recall the recent movement for a Department of Public Works, and the proposal to include under this all Government work into which engineering entered, in any walk of life, and a lot where it was rather difficult to see the connection with engineering. As engineering is essentially the application or setting to work of technical or scientific knowledge, practically all fields of intelligent endeavor could have been brought together under this plan, for now we have all kinds of engineers—not only mining, electrical, and the like, but the sanitary engineer, the efficiency engineer, and even the economic engineer.

Very similar is a recent proposition by a scientist, a criminologist of standing, to group all the scientific bureaus of the Government under one organization, that organization to be the Smithsonian Institution. In this group he proposes to place the Geological Survey, the Reclamation Service, the Bureau of Mines, the Patent Office, the twelve "scientific" bureaus of the Department of Agriculture, the Bureau of Standards, the Bureau of Fisheries, the Hygienic Laboratory, the Bureau of Public Health Service, the Army Medical Museum, the Government Hospital for the Insane, the Coast and Geodetic Survey, the Library of Congress, and part of the Census.

It will readily be seen that the suggestion implies a grievous misconception of conditions and how much worse such a grouping would be than what we have at present. Indeed, it is not a classification, but a mixing up, a shaking together in a bag, of many offices with many fields of activity, and the real job would be to try to classify and organize such a heterogeneous aggregation after the mixing process. At the moment we do not think of any department of the Government which might not come under the general designation of Science, for the State Department deals with political science, the War Department with military science, the Department of Labor with the science of sociology, and so on, so that the Secretary of the Smithsonian Institution, under this plan, might well be appointed to the cabinet, assistant to the President.

Training the Miner to Mine

THE SUBJECT of vocational training for miners is one which has engaged the attention of at least one large mining company; it is a subject which we recommend especially to the attention of all employers. As a nation, we are strong for education. We teach the boys algebra and Latin, and send them out to a business career. Oh, a business career, certainly—what boy that has attended high school, as every boy of ambitious parents does, at the very least, would descend thereafter to learn a trade, and work with his hands? Better no job, and a white collar, than overalls and a solid livelihood.

Now here is a national movement, strongly supported by Washington and supplied with Federal funds, which proposes, for example, to teach the miner—what? Algebra? No. Geology and mineralogy? No. It proposes to teach him to be a first-class miner. It intends to teach the shift boss how to be an intelligent and efficient shift boss. Glory be! Shall we, indeed, have skilled workmen of our own, highly educated as to manual dexerity and common sense, and not be dependent on the half-trained and ignorant and therefore restless, vagrant, and discontented type of mine workman which must be tolerated in many mining camps?

The plan to educate the miner to be a first-class miner and give him a certificate as to his grade in his honorable calling appeals to us as one of fundamental and far-reaching worth. Increased efficiency, lowered cost, and, therefore, higher wages should result from this; more permanent mining camps, fewer strikes. The Federal Board for Vocational Education has considerable funds which it allocates to each state, to be matched dollar for dollar by the state, municipality, or other state source (evidently a mining company might be an eligible partner), and then to be used under the broad rules laid down by the board, and approved by the Cabinet members who constitute that board in part. These Federal funds are by no means working to full capacity; and if you desire to avail yourself of them in your local problem you probably will find that they are available.

The Bureau of Mines is interested in this problem, and its Division of Education and Publicity has given considerable attention to the matter. The Committee on Occupational Training of the Mining and Metallurgical Society of America, of which Charles A. Mitke, of Arizona, is chairman, has prepared a course for the instruction of miners along these lines, just issued as Bulletin 149 of the society. Write to any of these sources, or to us, if you are interested in this movement, which should be pushed as assiduously as the safety work in mines has been, and which has a broader scope.

Mine Hygiene in Australia

ADVICES FROM AUSTRALIA recite a curious situation as to the prosecution of Government work regarding the public health. An agreement was made between the Rockefeller Institute and the Australian government, whereby the former agreed to provide three experts if the government would create a Department of Health to co-operate. Accordingly, Dr. Lanza, well known from his studies of industrial (including mining) hygiene, and especially known to us from his papers published by the Bureau of Mines, in *Engineering and Mining Journal* and elsewhere, arrived in Australia in August. He found that the government has created, as agreed, a Department of Public Health, but that the slight formality of allotting to the new department funds from the treasury, and providing it with a personnel, had been overlooked. Now Dr. Lanza is perplexed as to how to deal with this entirely impersonal and personally unrepresented department. Evidently, in Australia they do not take the question of new departments in the government as seriously and heavily as we do in the United States. If it were so with us, doubtless our need and desire for a Department of Mines could be accommodated over night.

The Competition of Japanese Mining

STUDENTS OF COMMERCIAL CONDITIONS in Japan report that there has been little or no deflation from the war conditions in that country, and that consequently prices and living conditions are very high, without the attendant prosperity which during the war made high prices relatively of little moment, by and large, in Japan as well as the United States. The key to the situation is the price of rice, the national food, and the cost of this has been kept up by the agrarians, which group is dominant in the national parliament: and this by itself effectually blocks the process of general deflation.

Copper, of which Japan is an important producer, is accordingly in the position that the cost of production is as great or greater than the price of the metal; in which respect the Japanese conditions correspond with those in this country. It is evident that times have changed in more countries than our own, and that for the time being at least to talk of the danger of competition by cheap Japanese labor is an anachronism. Indeed, Japan some months ago found it cheaper to buy a quantity of copper from the United States than to produce it; although later, in the financial crisis through which she passed, she flung much of it back on the American market, liquidating it for ready cash.

In general, it would seem that the race for markets and consequent business prosperity is a race of deflation, which means a competition in lowering costs of production; for prices of raw materials and manufactured commodities are determined in the world market and by the world demand. In other words, costs are regional and national; prices are international. In this connection the process of deflation, of course, is a comparative thing, for the cost of producing depends upon the double factor of cost of supplies and efficiency in production. The greater the efficiency the higher the corresponding wage; so that deflation in this country to a point allowing competition with other nations does not mean leveling our wage scale to that of Japan or of Germany: in fact, to raise wages for increased efficiency is the best and normal way to secure low costs. But—no efficiency, no wage. Our producers—both labor and management—should learn and digest this just arrangement.

So the cry of cheap Japanese labor producing copper, of cheap Chinese labor producing antimony, of cheap Bolivian labor producing tungsten, is not well founded, as an argument, on fact and experience. As a matter of fact, Chinese labor is notoriously not cheap, but high; for though the laborer—miner or otherwise—may receive only a small stipend, he is inefficient. The same is true, almost as a law, of labor in other countries. A great international contractor once observed that he found labor cost him the same in all countries, regardless of the wage. We ourselves have made some observations along this line, in mine sampling. In the course of many large mine examinations, in each of which some thousands of samples of uniform length, breadth, and thickness were cut, careful costs were kept, reduced to the individual sample as a unit, in order to be able to estimate the costs of other examinations more accurately. In the examinations in question the cost of the labor employed varied, at that time, from fifty cents a day in southern Mexico to four dollars a day in Colorado and Montana. The result of the investigation showed, with an abundance of data, that it cost almost exactly the same to cut a sample under all these varied conditions.

The Roodepoort Plan

THE NEWS ITEM from South Africa, discussed in our recent London letter, covering a proposed scheme for continuing work on the Roodepoort United, a Rand mine, on a copartnership basis between capital and labor, is of more than passing interest—indeed, it is a milestone in the development of capital-labor relations. The costs have become so high and the grade of the gold ore so low that the management finds it impossible longer to work the mine at a profit, or even to make it pay expenses and fixed charges. Shutting down of the property, cessation of payment of interests on the company's debt, and the throwing out of work of the miners is the normal conclusion. But the novel proposition has been made that the men are to work at one-half union wages; then out of the first earnings the interest on the company's debt is to be paid; next the full scale of wages is to be made up; and finally, anything left over is to be divided between the miners and the stockholders.

It will be interesting to see if the miners will take a gamble on this proposition and what the outcome will be. Certainly with every man working for himself, as he would be under this plan, he will not only do his best himself, both as to quality and quantity of work, but will see that his associates get into the collar and pull along with him. If the experiment succeeds, the men will have a sound argument for some such plan, or a modification of it, in more prosperous mining enterprises. They will be able to point out that if the arrangement can turn a hopeless operation into a self-sustaining one, it might be able to make a going operation more healthful and prosperous.

No rule will work out in all cases; and in many operations such a plan perhaps might never be practicable. In a high-grade mine the temptation might be to rob the mine of its richer ore, and endanger the future; but such a danger is always present at the hands of some manager ambitious for a showing, and especially of directors impatient for returns, and with the proper management and directors there would probably in most cases be little trouble from the miners on that score.

In any event, the endeavor to build up schemes of operation so that every man down to the mucker has some little stake and some little gamble in the operation, besides his daily wage, will be found to be one of the soundest principles of mine management. There are many ways of doing this, from the bonus system up to the extreme Roodepoort plan concerning which we write.

Human engineers—the managers of industry—would do well, in the interest of capital and of humanity, to make an intensive study of these principles, which will be essentially studies in leadership, in sound business, and in fraternal responsibility.

Anaconda Accident Rates

TABLOID FOOD is usually inefficient. Its potential food value may be high, but is unavailable unless diluted by other foods of lower food value. Statistics without the background of imagination are equally unassimilable, and without the visualization of general and sociological conditions cannot be accurately interpreted.

D. Harrington, of the U. S. Bureau of Mines, has presented in the Bureau's *Reports of Investigations* a summary of the accident record of thirty-two mines of the Anaconda Copper Mining Co. in Montana. The tabulation presents the serious plus the fatal accidents for each 10,000 shifts worked in each mine over a period of six years, 1915 to 1920, inclusive.

Butte is a compact community of which the principal industry is mining. It has been long established, and a considerable proportion of miners have been residents of long standing. What proportion of the miners are transient is not known, but undoubtedly Butte, like other Western mining centers, has a large proportion of "drifters." What the labor turnover for the Anaconda mines is we do not know. It would be an important factor in understanding the variations in the accident rate from year to year. A large labor turnover increases the accident rate. On the other hand, a considerable degree of stabilization of the mining community would reduce it.

A well-organized operating division is in charge of all of the mines, and the mining operations have been developed under excellent supervision through a period of years. Supplementing operation is a Bureau of Safety under the leadership of Charles W. Goodale. This bureau has persistently attacked the problem of reducing the mining hazard to a minimum by structural improvements, protection of machinery and working places, elimination of unsafe methods, and inculcating the safety first idea among the workmen. Neither brains nor expense has been spared. To the combined efforts of the operating division and the Bureau of Safety, together with the co-operation of the workers, must be given credit for the splendid record made in reducing to a minimum the drain upon man power caused by accidents in these mines.

Look for This Article

THOSE INTERESTED IN DREDGING and in the difficult problem of determining the value of placer properties through drilling cannot afford to miss the article on "Drilling Results and Dredging Returns," by Charles W. Gardner, which will appear in our Oct. 22 number. This is a subject on which there is altogether too little literature, too much divergence of theory and practice, and a lamentable proportion of failures due to incorrect, careless, and stupid methods of drilling, sampling, and calculation.

Mr. Gardner has been actively engaged in gold dredging for many years, and is manager for the Yuba Consolidated of California. He is the dean of dredging men in California.

WHAT OTHERS THINK

The Tacna-Arica Problem

I do not know whether or not you relish criticism of articles printed in your magazine, but I am going to take a chance that you will accept the following criticism in a friendly spirit:

On page 481 of the Sept. 24 issue of *Engineering and Mining Journal* there is an article entitled "The Tacna-Arica Problem." This article states that mineral nitrates are found in the provinces of Tacna and Arica. I personally spent several years in Chile looking up and investigating various nitrate problems, but never once heard of any indications of nitrate occurring in these two provinces. The nitrate district in Chile runs approximately from the port of Taltal at the southern end to Pisagua at the northern end, and by glancing at a map of Chile you will note that Pisagua is a considerable distance south of Arica.

It is quite true that both Bolivia and Peru are unwilling to have Chile retain these two provinces, but my understanding is that the reason Bolivia desires the provinces is to obtain a seaport of her own instead of being forced to transport all of her imports and exports through either a Chilean or Peruvian port.

Wilmington, Del. G. B. STREET.

Encourage Copper Roofing

It is now drawing close to a year since most of the large copper producers were compelled to cease mining ore and producing copper; still, the outlook for the future of that metal is as yet far from bright. Several suggestions have been made of ways to increase consumption and find new uses for the metal, all of which deserve credit; but the fact remains that copper is not moving as it should be, and until such time as it does, we cannot look for a revival of the mining industry, which would mean a like revival in other lines and spell prosperity.

The President and Congress are wrestling with the problem of caring for the unemployed, which has all the earmarks of being a gigantic one. The various industries are asking for Government aid at this time, in the form of protective tariff on their products and raw materials; and it would seem that the copper industry is entitled to some Government aid, in view of the fact that this metal was produced at record speed even after the Armistice was signed, by order of the Government. This aid could have been rendered very nicely by the Government keeping the scrap copper, left from the war, off of the market, and by so doing protect the mining industry, but primarily protecting the Nation.

Another great war is not by any means improbable, and should it occur the United States will once more be clamoring for copper, together with other needed metals; and these will necessarily have to be produced under the pressure of rush and the resulting low efficiency of labor, which will mean peak prices will be paid for it, just as in the recent case. Had the Government kept the scrap copper, rolled it into plates and used it to cover the roofs of all Federal buildings in our land, it would have provided the best possible roof covering, would have to a large measure prevented the slump in mining, and set an example; for if the Federal buildings had copper roofs, all first-class building done in the future would have followed suit, and, above all, in the event of war and need of an immediate supply of copper, the Government would own it, and it would be only a matter of days to convert it into munitions of war, compared with the months necessary to produce it from the ground and to put it through the various metallurgical processes before it would be ready for use.

But is it yet too late to do this? The price of copper is low, and the Government would be looking to the future by buying copper and using it for this purpose; and it might even mean the guarantee of the liberty of America. J. F. INGLIS.

Baker, Idaho.

Why the Mining Engineer?

During 1914 I was in Butte. We had an old Cornish miner then whom everybody called Alec. I do not know his last name; that, however, does not matter. He was considered one of the best of the miners and the best timberman. He had been underground twenty-three years. One day at lunch time I volunteered the information that he must be pretty sick of it by that time and hoped that he would soon get a job in the carpenter's shop up on the surface as a reward of his undoubted merit. He just gave me a look, more surprised than unkind. His more experienced and wiser head discovered my innocent ignorance of the real values of the things in the world and assured me with a solemnity rarely associated with his buoyant face that he would surely die if he had to live to see the day when he could no more work underground. I felt sure he meant it. To a large majority of this metropolis, working in a dark hole is inconceivable even when bringing a large remuneration. Such are the ways of human beings.

Recently some of us were surprised to see sensible looking individuals filling the corridors of the Spanish Consulate volunteering to assume the uncertain responsibilities of being a member of the Foreign Legion of Spain to fight under the scorching sun of African deserts at 75c. per day. I dare say most of them would have gone even without that small remuneration. Something of this spirit every mining man has.

And again the sailor. Have you ever been seasick? I have. No money seems enough to go through the experience I had once off the coast of Ireland eleven years ago. Yet the men of the sea are reputed to be homesick for the ocean after an extended sojourn on the land. Those of your readers acquainted with Joseph Conrad's works will remember Captain MacWhirr. Did he grunt at roughing it?

Though it is to be conceded that the Anglo-Saxons excel in this supreme test of civilization, it must be mentioned to the credit of other nations that each has its representatives in the game of adventure and undertaking that cannot be easily translated into terms of mundane advantages. Long live their memory! It is these men that we honor; even the most utilitarian among us bows his head before the altar of self-sacrifice.

So the mining engineers need not fall into despondency because a man in another trade and with no apparent superior qualifications is enjoying a better salary in the midst of home comforts. Consider the President of this big United States. The list of men and women who pay income taxes larger than the President's salary takes longer than one breath to read. There is a great deal of fun in doing things. DJEVAD EYOUB.

Brooklyn, N. Y.

Pressure Smelting of Zinc Ores Not a Success

Regarding the smelting of zinc ores in a blast furnace under pressure, as outlined by Mr. Evans W. Buskett in *Engineering and Mining Journal* of Sept. 10, I would refer metallurgists to the following literature on this subject:

A. Lencauchez, "Memoires de la Société des Ingenieurs Civil," 1877, pp. 568-580, abstract *Eng. and Min. Journ.*, Vol. 26, (1878), p. 111.

U. S. Patent 538,785, Emil E. Lungwitz, May 7, 1895.

Robert C. Schupphaus, *Journal Soc. Chem. Ind.*, Nov. 30, 1899 p. 987.

"Partial Pressure, Partial Volume, and the Lungwitz Zinc Process," *Electrochem. & Met. Ind.*, Vol. 3, pp. 408-409, November, 1905.

Fred W. Gordon, "The Langwitz Process of Zinc Smelting," *Eng. and Min. Journ.*, Vol. 81, pp. 795-797; Vol. 82, pp. 71-73; April 28, July 14, 1906.

U. S. Patent 974,257, Frederick W. Gordon, Nov. 1, 1910.

U. S. Patent 1,080,102, Elisha B. Cutten, Dec. 2, 1913.

W. McA. Johnson, "Tests on the Lungwitz Zinc Smelting Process," Min. & Met. Soc. Amer. *Bull.* 90, pp. 247-256, November, 1915.

A. Rzehulka, "Die Kontinuierliche Gewinnung von metallischens fluessigen Zink im Schachtofen," *Chem. Zeit.*, Vol. 38, pp. 895-897, 937-939; July 14, July 23, 1914.

The process, therefore, is not new. The Lungwitz method was thoroughly tested in 1905, and failed to produce spelter. The idea seems plausible, as 50 to 100 lb. pressure would prevent ebullition of zinc at melting temperatures; but owing to the large quantity of inert gas present, the total pressure required to give the necessary partial pressure of zinc vapor would be impossible of practical attainment.

Rolla, Mo. B. MARVEL O'HARRA,
Assistant metallurgist, U. S. Bureau of Mines,
Mississippi Valley Experiment Station.

Gives Credit to the Pine God

It is with some disappointment that I occasionally scan certain letters printed in your "What Others Think" department. Reference is to the publication of letters by Harbren, Groheigher, and others.

Either you are being victimized by fakes, pure and simple, or the letters are the genuine products of earnest but simple-minded citizens. If the latter is the case, it would seem beneath the dignity of the *Journal* to ridicule in this manner sincere but uneducated and visionary men. If these letters are fakes, that, of course, is your own business.

In this connection, however, I wish to narrate my own actual experience with alchemy. I have actually transmuted iron into gold through the discovery of an ancient manuscript, written by one Dios de Pino.

I am an old man now, but during youth and early manhood followed the sea. It was through a shipwreck on the coast of Corsica many years ago, when I was cast, the only survivor, to the beach, that I made the discovery. I found the manuscript lying beside me on the beach when I recovered consciousness.

A subsequent examination proved the writing to be in medieval Italian, and a cautiously obtained translation indicated that one of the old alchemists had actually been able to make gold.

Sir, I retired from the sea to manufacture gold. After a number of experiments, I was so successful that I made my pile and retired. I then destroyed the formula, and decided not to allow my discovery to be perpetuated. I did this not from selfishness, but because, were the secret to become known, gold would be worthless. The consequent wholesale manufacture of gold would, in my opinion, lead only to an economic cataclysm and, possibly, revolution terrible in its scope.

Bloomfield, N. J. BENJAMIN DOUBLEDAY.

A Correction

In *Engineering and Mining Journal* of Sept. 17 I am quoted as having said in my evidence submitted to the Finance Committee of the Senate on Aug. 26 as follows:

"If the proper protection were granted, he states that the Cuyuna Range could produce 75 per cent of the manganese that is consumed in the steel-making trade for many years."

What I did say was:

"I believe that if this industry was protected so that there would be a sale for the ore, that this country is capable of producing 75 per cent of the manganese that is consumed in the steel-making trade of this country and would be able to do so for a great many years."

I assume that *Engineering and Mining Journal* wishes to be fair in this matter and that it does not intentionally misquote.

I refer you to "H. R. 7456, Schedule 3, Metals and Manufacturers of." Hearing before the Committee on Finance, United States Senate, Sixty-seventh Congress, First Session, page 1,910, sixth paragraph, which gives my exact words.

I would appreciate it very much if you would correct the statement that appeared in yours of the 17th, and give my statement in connection with this matter fair publicity. GEORGE H. CROSBY.

Duluth, Minn.

There Was No "By The Way" Page in That Issue, and We Feared the Letter Would Not Keep!

I should like to draw your attention to what I hope may prove to have been an error on your part. In the *Engineering and Mining Journal* of Aug. 27 you printed a letter from Mr. L. Maitland Leo under the heading "What Others Think." Surely you must have intended to locate this gem with others of its class in the "By The Way" column. Otherwise its publication by a reputable journal unaffiliated with Mr. W. R. Hearst is extremely hard to understand. Someone who does not personally know the author of this diatribe might possibly take it seriously. W. H. HANNAY.

Trail, B. C.

VIEW OF SULPHUR-MINING PLANT, SHOWING RESEMBLANCE TO OIL WELLS

The Gulf Coast Sulphur Industry

A Sketch of the Development of Louisiana Sulphur Deposits, Which Have Displaced Sicily as the Leading Producing Area—Manufacture of Sulphuric Acid Consumes Greatest Amounts of Sulphur and Is Vital to the Industry

By ALBERT G. WOLF

Written for Engineering and Mining Journal

SULPHUR, one of the most widely used elements found free in nature, a part of a vast number of common manufactured articles or a necessary reagent in their production, essential to almost every industry in the complex organization of our modern civilization, is a substance about which the average person has only meager and hazy knowledge. Ask ten persons where sulphur comes from, and at least nine of them will reply, "from volcanoes," or "from Italy," and ask the same ten what are the chief uses of sulphur, and more than likely all will say, "matches, medicine, and fumigating."

FIRST AMERICAN SULPHUR COMPANIES ENCOUNTERED MANY DIFFICULTIES

The first discovery of a large deposit of sulphur in the United States was made at Sulphur, Calcasieu Parish, La., in 1869, by the Louisiana Petroleum & Coal Oil Co., in boring for oil. From that time until 1892 many attempts were made by shaft sinking to reach the sulphur, which lay 500 to 600 ft. below the surface and was overlaid by thick beds of quicksand. Some of the companies which engaged in this work were the Calcasieu Sulphur & Mining Co., the Louisiana Sulphur & Mining Co., and the American Sulphur Co. All attempts were failures, because of the insurmountable difficulties presented by the quicksand and poisonous gases, the latter taking a toll of five lives in the last effort to extract the mineral by direct means.

About the time that it appeared impossible to mine the sulphur from this wonderfully rich deposit, Herman Frasch, a chemist for the Standard Oil Co., took up the study of the problem, conceived the idea of melting the sulphur in place by means of superheated water, and obtained his first patent in 1891. Frasch organized the Union Sulphur Co., and after overcoming many obstacles, including a misunderstanding of the very nature of the sulphur deposit he intended to work,[1] and the drilling of several wells in barren territory, the first well was tested in January, 1895, and a little sulphur was brought to the surface. During 1896 a production of two or three thousand tons was made, and the total output up to 1898 was only 4,500 tons.

USE OF FUEL OIL MADE FRASCH PROCESS PRACTICABLE

Although the process was technically a success, the high cost of fuel (coal from Alabama) used in heating the water threatened commercial failure. Opportunely, in 1901 Captain A. F. Lucas discovered a great source of cheap fuel in the crude oil of the Spindle Top field, near Beaumont, Tex., and once more the Union Sulphur Co. began operations. The first production of note was made in 1903, when 23,715 tons was extracted.

---

[1] For a complete description of the several salt domes in which sulphur occurs, see the following references: "Oil Prospecting in the Gulf Coast Country," by W. G. Matteson, *Bulletin* of the American Institute of Mining Engineers, February, 1918; "Origin of the Gulf Coast Salt Domes," by G. Sherburne Rogers, *Economic Geology*, September, 1918; "Gulf Coast Salt Domes," by Albert G. Wolf, *Colorado School of Mines Magazine*, September, 1920.

The production of the Union Sulphur Co. since then is shown in the following table:

	Tons		Tons
1903	23,715	1911	204,220
1904	79,187	1912	786,605
1905	218,950	1913	478,565
1906	287,590	1914	804,470
1907	185,882	1915	379,885
1908	367,896	1916	383,465
1909	270,725	1917	575,130
1910	246,510	1918	478,700

Previous to the large-scale production from our coastal deposits, Sicily was the largest producer in the world, followed by Japan. A few figures show clearly what happened to the Sicilian sulphur trade. The total exports from Sicily to the whole world fell off from 450,917 metric tons in 1912 to 136,991 metric tons in 1919, and to the United States from about 200,000 long tons in 1903 to practically nothing in 1919.

SICILIAN COMPETITION ELIMINATED

For about ten years prior to 1906 nearly all the sulphur mined in Sicily was handled by the Anglo-Sicilian Sulphur Co., a British corporation which at one time controlled the sulphur market of the world. When, in 1916, this agreement was about to expire, the Italian government sent a commission to the United States to investigate this American sulphur industry, which was making such invasions upon its cherished monopoly. Baldacci, an engineer, reported that Louisiana sulphur could be produced for 18 lire and sold anywhere in the United States for 40 lire, whereas the Sicilian mineral sold for 80 lire at the place of storage and 125 lire in the United States.

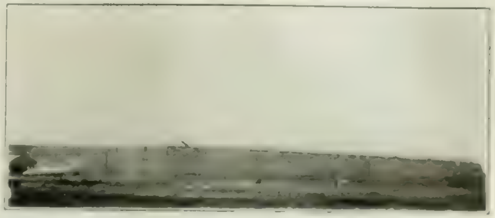
In a final and frantic effort to withstand American competition, the Italian government passed a law Aug. 1, 1906, forming all producers of sulphur in Sicily into a "Consorzio" for a period of twelve years, to sell sulphur for the common account of its members. An ultimatum was sent to the Union Sulphur Co. to keep the product out of European markets and upon refusal the Sicilian trust attempted to "dump" sulphur upon the American market. This move was met by the Louisiana company in a reduction of price from $22 to $19 per ton, which the foreign organization could not meet, and practically no more Sicilian sulphur was shipped to America.

LOADING BOX CARS WITH SULPHUR AT [illegible] LOCOMOTIVE CRANE AND [illegible] SULPHUR VAT TO RIGHT

Captain Lucas not only was the first to discover oil in the coastal salt-dome formations, but was the first to drill at Bryan Mound, Brazoria County, Tex., where he discovered a large deposit of sulphur in a formation similar to that at Sulphur, La. This work was done for the J. M. Guffey Petroleum Co. No oil, at least none in commercial quantity, was found, and no attempt was made at that time to mine the sulphur. Later, E. F. Simms, of Houston, Tex., obtained an option to purchase the ground.

FRASCH PATENTS EXPIRED IN 1908

In 1908 the Frasch patents, under which the Union Sulphur Co. operated, expired, and the practical monopoly of the sulphur business in this country enjoyed by that company legally expired with them. It was not until 1911, however, that steps were taken to form a company to work the Bryan Mound deposit. A little later, July, 1912, the Freeport Sulphur Co. was organized, and on Sept. 30, 1913, the Freeport Texas Co., the holding company of the Freeport Sulphur Co. and allied interests, was chartered.



VAT CONTAINING SEVERAL HUNDRED THOUSAND TONS OF SULPHUR

The first plant of the Freeport Sulphur Co. pumped sulphur on April 18, 1912, but no substantial amounts were extracted until 1916. In 1917 the maximum production was made, more than half a million tons. In 1921 the steaming plants were all shut down on account of the general business depression.

Big Hill, Matagorda County, was one of the domes drilled immediately after the discovery of oil at Spindle Top, and oil and gas were found. This stimulated drilling, and between 1901 and 1904 oil was produced, variously estimated between 200,000 and 500,000 bbl. Though the oil field was soon exhausted, sufficient evidences of sulphur were found to cause the organization in later years of a sulphur company to explore this deposit. The first company, known at the Gulf Sulphur Co., was formed in December, 1909, after test drilling had proved to the promoters that a sufficiently large sulphur deposit existed to insure the success of the enterprise. For the next few years this company was practically dormant except for the purchase of land. In 1916 a new drilling campaign was started, and in less than two years from the beginning of this operation a sulphur deposit containing over 10,000,000 tons had been developed.

TEXAS GULF THE WORLD'S LARGEST PRODUCER

In July, 1918, the Texas Gulf Sulphur Co., the present operating company, was organized. Construction was started in August, 1918, and with the aid of priority rights from the Government on account of the demand for sulphur for war purposes, the plant was completed and the first sulphur produced in March, 1919. The steam boiler plant of [illegible] hp. was planned of sufficient capacity to produce [illegible] tons of sulphur daily, but more than this was produced during 1919, and a total of over [illegible] long tons in 1920. The present production is over [illegible] tons daily, making this the largest sulphur-mining company in the world.

The following table, adapted from "Mineral Industry of 1919," shows the tonnage of sulphur produced in the United States and throughout the entire world. The tonnages here are expressed in long tons of 2,240 lb., the standard unit of weight in the sulphur business in this country, instead of metric tons as in "Mineral Industry." The sudden increase of production in 1916 is due to the entrance of the Freeport Sulphur Co. as a producer. The figures for 1919 and 1920 are not yet completely available, but those for 1919 will probably not exceed the figures for 1918, because the Union Sulphur Co. was shut down during the greater part of that year and the next, whereas the figures for 1920 may do so, because the Texas Gulf Sulphur Co. took the leading place that year as a producer.

It should be added here that the three coastal fields produced more than 99 per cent of all the sulphur mined in the United States:

TABLE I. PRODUCTION OF SULPHUR

In Long Tons, 2,240 Lb

Year	World Production	U. S Production	U. S. Exports	Value	U. S. Imports	Value
1902	544,259	7,445	.. . .	(About)	......	...
1903	621,065	35,097	. .	.	200,000	..
1904	755,126	193,482	. .	.. .	......	.. . ..
1905	817,485	214,989	..	..	.....	....
1906	832,590	293,984		..	. ..	... .
1907	789,241	307,790	.		..	.
1908	816,332	307,760		.. .	....	... .
1909	804,690	298,213	..	. .	.....	..
1910	775,286	255,596	..	.. . .	.	... .
1911	764,358	242,408			..	....
1912	773,436	303,655		..	. . .	....
1913	793,645	311,778	.	. .	.....	....
1914	863,143	342,001	98,163	$1,807,334	25,336	$448,490
1915	846,412	294,407	37,271	724,679	26,367	472,458
1916	1,184,561	766,870	128,755	2,505,857	22,456	404,784
1917	1,528,691	1,120,429	152,736	3,500,819	1,010	29,340
1918	.. ..	1,266,767	131,092	3,626,638	82	95,242
1919	....	....	224,712	6,325,552	103	8,633

TABLE II. BASIC INDUSTRIES AND CHIEF USES

	In per Cent
Agriculture	8.8
Fertilizers	
Fungicides	
Insecticides	
Carbon disulphide	3.1
Fire extinguishers	
Insecticide	
Poison (for pests)	
Solvents	
Direct use	2.8
Cements	
Fumigating	
Medicine	
Sulphuring	
Rubber industry	8.3
Belting	
Ebonite	
Elastic	
Sheet rubber	
Miscellaneous rubber goods	
Sulphur dioxide	25
Bleaching	
Explosives	
Fumigants	
Paper manufacturing	
Photography	
Sulphuric acid	52
Chemicals	
Explosives	
Fertilizers	
Galvanising	
Petroleum industry	
Steel industry (pickling)	
Sugar industry	

TABLE III. COMMERCIAL APPLICATIONS OF SULPHUR

Acids, organic and inorganic
Alcohol
Alum manufacture
Aniline
Antichlor
Artificial silk
Belting
Binding medium
Bleaching
Celluloid
Cements
Chemicals (miscellaneous)
Chlorine manufacture
Dyes
Dying
Ebonite
Elastics
Explosives
Fabrics
Fertilizers
  Per se
  In composts
  Artificial
Films, moving picture
Fire extinguishers
Fumigating
Fungicide
Galvanizing
Glass
Glue
Glycerine
[illegible]
Insecticide
Lithopone
Medicine
Metallurgical work
Paints
Paper
  News
  Parchment
  Cheap print
Petroleum industry
  Motor fuel
  Lubricating oil
  Liquid fuel
  Illuminating oil
  Solvents
  Special products
Photography
Plastics (wood pulp)
Poison (rat and other)
Preparation of organic substances
Preservative (food)
Reagent, laboratory
Refrigerating
Rubber industry
Sheet rubber
Shoe polish
Soap
Sodium carbonate
Sodium thiosulphate
Solvent
Steel pickling
Storage batteries
Sulphuring
Tanning
Textiles
Tires
Water purification

The uses of sulphur are so varied that a complete description cannot be given herewith but in Table II are shown the percentages of sulphur used in the United States in different basic industries, with some of the principal subdivisions under each, and in Table III a list, alphabetically arranged, of the various uses to which sulphur is put, or the different articles in the manufacture of which sulphur is essential. There is a little repetition in this table, but it serves to point out more clearly the very important part sulphur plays in our every-day life. Tables II and III have been remodeled from a chart in "Recent Advances in the American Sulphur Industry," by Raymond F. Bacon and Harold S. Davis, American Institute of Chemical Engineers, December, 1920.

Dangers and Inefficiency of the "Ragtown" Community

Unsanitary conditions in the average mushroom oil camp or boom oil town, often referred to as a "ragtown," invite the visitation of a costly fire or epidemic declares C. P. Bowie, petroleum engineer, in Technical Paper 261, "Oil-Camp Sanitation," published by the U. S. Bureau of Mines. Such communities usually have no water supply, or a wholly inadequate one. Garbage and decaying vegetable matter, tin cans, old rags and scrap paper are laid generally in small heaps about temporary structures or strewn promiscuously over vacant lots. Flies swarm in legions, and the atmosphere reeks with offensive odors.

Many oil men employ the contract system of drilling, which almost eliminates the tendency of companies to build camps or small towns over which they may exercise personal supervision as to housing and sanitation. The system relieves the company of all responsibility except its financial obligations to the contractor.

Though it is admitted that the sanitation conditions in such communities are deplorable, it has been argued that they are the results of extraneous circumstances and will be remedied as soon as conditions become normal, but experience has shown that so-called "normal" conditions are never attained until such a community has been visited by costly fires and epidemics. In fact, "normal" conditions are not established until the field has been proved a success or failure, which often takes months or even years.

The responsibility for the betterment of such conditions plainly belongs to the state governments; broadly speaking, all the states have legislation adequate to cope with these exigencies. The enforcement of the laws, however, too often is left to the community itself, and rests in the hands of a few men, who either think that they cannot afford to run the risk of antagonizing their neighbors by the enforcement of ordinances, or are so engrossed in business that they are indifferent to the responsibilities intrusted to them. Therefore, the neglect of those in authority to meet these responsibilities brings hardship and unnecessary misery to a class of migratory workers who may be especially susceptible to the influences of social unrest.

The employer is also a sufferer. He meets a material loss through the "soldiering" of discontented workers, petty strikes, and an enormous turnover in his force of laborers.

Remedial measures recommended for the amelioration of faulty sanitation conditions in oil camps are given in the paper above mentioned.

Mine Blacksmith Shops

A Description of the Way in Which a Small Shop Can Be Enlarged By Successive Stages To Keep Pace With an Increasing Scale of Operations—Future Requirements Should Be Considered at Outset

BY R. J. DAY

Written for Engineering and Mining Journal

WHILE ON A BUSINESS TRIP to some mines in Arizona, I received instructions to visit as many blacksmith shops as possible and to make sketches showing the location of the various machines, particularly rock-drill sharpeners, and study the sequence of operations required for sharpening drill steel. The object in view was the arrangement of a series of drawings, whereby expansion of the blacksmith shop could be made with the minimum amount of rearrangement of the machines already in place; if possible, making it unnecessary to stop work at any time during the period of expansion to change the location of the equipment already installed.

In accordance with these instructions, blacksmith shops of mines under development, and shops of contractors, where only one sharpener unit was required to keep the drill steel in proper condition, were visited; also blacksmith shops of mines, such as the United Verde Copper Co., at Jerome, Ariz., where six or more sharpeners are in operation. I was therefore enabled to obtain information pertaining to the work in both large and small shops.

As the essential duty of the mine blacksmith shop is to keep drill steel in proper condition, the equipment of particular interest is that required to perform this work. The equipment generally used in modern shops for this purpose is: An oil furnace for heating the drill steel to proper forging temperature; a pinning device for opening the hole in the hollow drill steel when it becomes closed during the sharpening operation or from other causes; a drill-sharpening machine with the necessary dies, dollies, forming blocks, and other accessories; and a cooling tank, for use when tempering the drill bits and shank ends of the drill steel.

The oil furnace may be of any standard make of suitable size to meet the requirements. The furnace suggested for use with the proposed arrangements shown in Figs. 4, 5, 6, 7 and 8 is of the double-opening type; that is, steel may be inserted in the heating chamber from either side of the furnace. If such a furnace is installed, one furnace can be used for two sharpening units, as shown in the proposed arrangements. The furnace used, however, should have an opening of sufficient length, so that twelve to fifteen or more steels may be inserted in the heating chamber at one time. This will allow for a continuous supply of heated steels for the sharpening machine and eliminate any loss of time that may otherwise occur through necessity of waiting for the drill steels to reach the proper temperature for forging.

The pinning device is a comparatively new machine on the market, but its merits are readily recognized and, owing to the fact that the work is speeded up considerably by its use, it has many earnest advocates wherever it has been installed. This machine is a device in which the heated, hollow drill steel is held securely in a vise, a pin being then forced into the hole in the steel the required distance and withdrawn, the operation being completed so quickly that the damage done to the pin on account of its coming in contact with the hot steel is negligable. The means of forcing the pin into the hole in the steel and withdrawing it varies according to the make. Some machines accomplish the result by applying pressure alternately to opposite sides of a piston, to which is attached a piston rod provided with a chuck for holding the pin. Another popular means involves an air-hammer action, which drives the pin into the hole in the hollow steel, an arrangement being provided so that when the pin has been driven into the steel the required distance, the hammer action can be reversed and the pin withdrawn.

DRILL-SHARPENING UNIT, BLACKSMITH SHOP OF UNITED VERDE EXTENSION MINING CO. JEROME, ARIZ.

The drill-sharpening machines, although differing somewhat as to appearance, have in general the same characteristic features of operation. The heated steel is held firmly in a die (of the form and size required by the sectional shape and size of steel used) by means of an air-operated vise. The die is provided with a cone-shaped cavity wherein the hot steel is upset by means of a dolly, which is driven against the heated end of the steel by an air-actuated hammer. This operation causes the end of the steel to take the shape of the frustum of a cone. The wings of the bit are then formed in a set of forming blocks furnished for the purpose. The operations of upsetting the steel and forming the wings of the bit are repeated until the bit is brought to the proper size and shape. When forming new bits it may be necessary to repeat the upsetting and forming operations several times.

When resharpening bits, the operations are the same as when forming new ones, with the exception that it is only necessary to upset the steel sufficiently to bring the bit up to size and resharpen the cutting edge. The cutting edge is formed during the upsetting operation by means of a V-shaped groove cut in the face of the die.

The above description covers only the making and resharpening of the drill bit, but equipment has been developed for forming all of the various types of shanks which are in general use. The forming operations are more or less similar, consisting of upsetting the steel in a die of the proper construction and forming the lugs, collars and other parts, until the shank of the desired shape is obtained.

The cooling tank is used for quenching the steel during tempering. The tank generally consists of a watertight box, provided with necessary inlet and overflow pipes. A grating, with provisions for holding the same the proper distance below the surface of the water, is generally provided. This insures that the bit and shank ends will be quenched to the desired distance back from the end of the steel.

In the description of the proposed arrangement of the drill-sharpening shop of the United Verde Copper Co. shown in Fig. 2, and also of the proposed arrangements shown in Figs. 4, 5, 6 and 7, mention is made of a revolving rack for dull steels. This rack should be so constructed that the steel will be held in a vertical position. This will permit of the storage of the maximum amount of steel in the minimum space. The object of having the rack revolve is that the steel may be brought as near as possible to the helper whose duty it is to heat the steel in the oil furnace, thus eliminating the necessity of his walking around the rack to secure the desired steel.

A description of the miscellaneous equipment such as forges, steam hammers, and drill presses is considered unnecessary. These machines are in such universal use that nearly every one is familiar with their design and operation. They should be selected only after careful consideration of the requirements, and should be such that they will satisfactorily meet all demands that may be made upon them.

PRESENT AND PROPOSED INSTALLATION DESCRIBED

To understand the requirements of the mine blacksmith shop better, it may be advisable to consider some of the installations already in operation, and others that were contemplated by some of the copper mining companies. With this in view, the arrangement of the equipment in the blacksmith shops of the United Verde Extension Mining Co., at Jerome, Ariz., and the Copper Queen Consolidated Mining Co., at Bisbee, Ariz., is shown; also the arrangement of the equipment of the proposed drill-sharpening shop of the United Verde Copper Co., at Jerome, Ariz., which was being considered when I visited that plant.

In Fig. 1 is shown the arrangement of equipment in the blacksmith shop of the United Verde Extension Mining Co. at the time of my visit. The machines and other equipment consisted of the following (the italic letters refer to Fig. 1):

A-A1-A2, oil furnaces
B-B1, pinning devices
C-C1-C2, drill sharpeners
D, emery wheel
E, work bench
F, foreman's desk
G, anvil
H, open forge
I, 600 lb steam hammer
J, drill press
K, threading machine
L, cooling tank
M, rack for dull steel
N, face plate
O, rack for sharpened drill steel

Also such tools and stands for supporting the long drill steel as are necessary.

The sharpening unit which was in active use is shown at *A1-B1-C1*. The unit shown at *A-B-C* is held in reserve. The sharpener shown at *C2* is a Sullivan machine, and was not in active use, with the exception that the vertical hammer (used for forming the wings on the drill bits) was being used for light forging work.

The dull drill steel was brought into the shop in mine cars running on the track shown at *X*, and was sorted according to size of bit, and stored in the rack for dull steel shown at *M*. The dull drill steel was thus within easy reach of the man whose duties were to heat it in the oil furnace, shown at *A1;* pin the bits of the hollow drill steel with the pinning device shown at *B1*, and then pass the heated steel to the sharpener operator, who resharpened the dull bit or formed a new bit on the steel.

After the sharpening operation was completed, the drill steel was deposited on the floor, near the oil furnace shown at *A2*, where it was within easy reach of the man in charge of the tempering. The steel was then reheated in the oil furnace shown at *A2* to the proper temperature for tempering and quenched in the cooling tank shown at *L*. The drill steel now ready for use again was stored in the rack for sharpened steels shown at *O*, where it was kept until wanted.

Although this description deals with the forming or resharpening of the bit ends of the drill steel, it is understood that when it is necessary to form shanks on new steel, the work is done along the lines previously outlined in the description of the drill-sharpening machine.

The rest of the equipment listed was sufficient to handle all of the miscellaneous work which shops of this kind are expected to do.

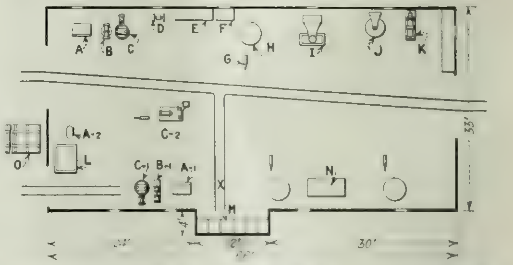


FIG. 1. ARRANGEMENT OF EQUIPMENT IN BLACKSMITH SHOP OF UNITED VERDE EXTENSION MINING CO.

It is probable that some changes have been made in the arrangement of this shop. The foremen in charge of such shops are generally trying to increase the efficiency of their departments and make such improvements from time to time as may be suggested.

PROPOSED SHOP OF UNITED VERDE COPPER CO.

As stated before, one of the essential duties of the mine blacksmith shop is the keeping of the drill steel in proper condition. This fact was realized by those in direction of the management of the United Verde Copper Co., with the result that they had plans under way at the time of my visit for a shop in which drill sharpening would be the only consideration. The arrangement that they were considering at that time is shown in Fig. 2. It will be noted that it was the intention to install six sharpening units. As all of these units were to be identical, a description of any one of them will serve for all. Each unit was to consist of the following: A revolving rack for dull steel shown at *A*; an oil furnace for heating the steel, shown at *B;*

a pinning device for opening the hole in the hollow steel, shown at *C;* and a drill sharpener, shown at *D.*

It was the intention to bring the dull drill steel into the shop in a mine car or on a truck provided for this purpose, running on the track *X*, and place it in the dull-steel rack *A*, where it could be easily obtained by the helper, who would heat it to the proper forging temperature in the oil furnace *B;* the helper would then pin the steel in the pinning device *C*, and pass the heated steel to the sharpener operator, who would sharpen it in the drill sharpener that is shown at *D.*

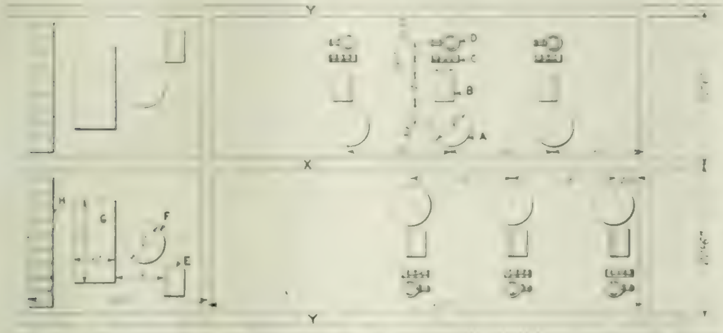


FIG. 2. ARRANGEMENT OF EQUIPMENT IN PROPOSED DRILL-SHARPENING SHOP OF UNITED VERDE COPPER CO., JEROME, ARIZ.

When the steel had been properly sharpened it was to be placed on trucks running on the track *Y* and taken to the tempering department, where it would be properly tempered by heating it to the proper temperature in the oil furnace, shown at *E*, and then quenching in the cooling tank shown at *F*.

When the steel had been properly tempered, it would be placed on the sorting table shown at *G*, and sorted in regard to gage (size of bit) and length, and then placed in the steel racks shown at *H*, where it would be kept until it was required at the mine.

It will be noted that when the requirements are sufficient to keep six sharpener units in operation, each unit can be used for sharpening one particular gage of bit, making it unnecessary to change the equipment in the sharpener, as in smaller installations where one or two units must sharpen all of the steel used. The various units should be so spaced that there will be no interference when the longest steels are being worked upon.

I am not in position to say positively that the installation described above was made, but it is shown here to illustrate the plans as formulated, and will be used as the basis of the proposed arrangements which will be shown and described later.

Another installation which may be of interest is that of the Copper Queen Consolidated Mining Co., at Bisbee, Ariz., shown in Fig. 3. The main equipment in this shop consists of the following:

A, racks for finished steel
B, racks for [illegible]
C, storage space for new steel
D, tool racks
E, forges
F, cooling tanks
G, drill sharpener
H, portable pinning device
I, air hammer
J, work bench
K, emery wheel

Also such tools, stands, anvils and other devices as may be required.

It will be noted that the arrangement of this shop is very different from the shops previously described, particularly the arrangement of the sharpening units, of which there are three. One of the most noticeable features is the arrangement of the pinning device, which is portable, being mounted in such manner that the location can be easily changed and the device moved to the most convenient place for operation.

The proposed arrangement of mine blacksmith shops described in the following are the result of information obtained during the trip mentioned, and are based on the system of work then in effect at the United Verde Extension Mining Co., at Jerome, Ariz., and the arrangement of equipment as shown in the layout of the proposed drill-sharpening shop of the United Verde Copper Co. in Fig. 2. The system referred to consisted of having two men for each sharpening unit, a sharpener operator and a helper. Each unit consisted of an oil furnace of sufficient size to take fifteen or more drill steels, a pinning device, and the drill-sharpening machine.

It was the duty of the helper to heat the steel to the proper temperature for forging, open the hole in the hollow drill steel by means of the pinning device, and pass the steel to the sharpener operator, who formed

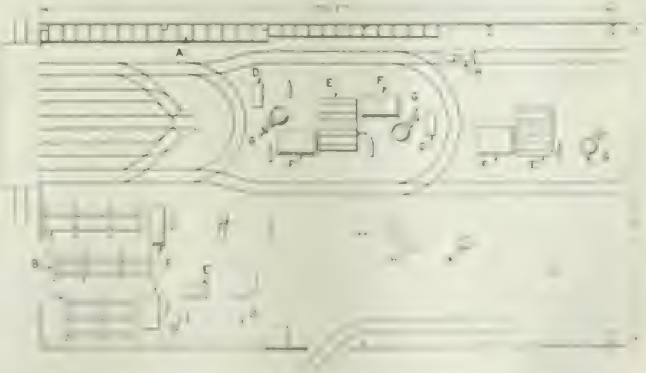


FIG. 3. ARRANGEMENT OF EQUIPMENT IN DRILL-SHARPENING SHOP OF COPPER QUEEN CONSOLIDATED MINING CO., BISBEE, ARIZ.

[illegible] the bit. By this method it is possible for two experienced men, using one sharpening unit, to [illegible] from 600 to 700 drill steels per shift of eight hours.

Probably a better idea of the system described above and of the location of the equipment may be had by referring to the accompanying photograph, which shows one of the sharpening units at the shop of the United Verde Extension Mining Co. The oil furnace is shown at *A*, the pinning device at *B*, and the drill sharpener at *C*.

It has been found that by pinning the hole in the bit of the hollow drill steel before resharpening the bit, the hole will remain open after the bit has been resharpened to serve all of the purposes sufficiently for which it is intended. The work will also be speeded up considerably. If the steel is pinned after the bit has been resharpened, it will be necessary to return to the drill sharpener and gage the bit to size, owing to the fact that when the pin is forced into the steel it causes the bit to expand and become oversize. The operation of resizing the bit is eliminated by the method described above, as the steel is brought to the desired size during the resharpening operation.

It is probable that the first installation will consist of one sharpening unit, which will resharpen all of the steels required for a mine under course of development, and such other equipment as may be necessary to take care of the work which a shop of this nature is called upon to do.

The proposed arrangement of a shop of this size is shown in Fig. 4. The equipment shown consists of the following:

A, emery wheel
B, drill press
C, anvil
D, forge
E, drill sharpener
F, pinning device
G, oil furnace
H, cooling tank
I, revolving rack for dull steel
J, rack for sharp steel

Also such stands, tools and paraphernalia as may be necessary.

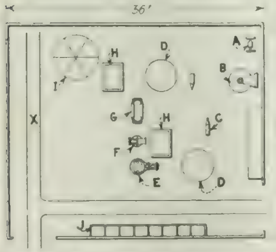
This equipment will require a building of approximately 30 ft. x 36 ft. The dull steel can be brought into the shop on a mine car or truck running on the track shown at *X*, and placed in the revolving rack for dull steel shown at *I*. It will thus be within easy reach of the helper, who heats it to the proper forging temperature in the oil furnace shown at *G*, pins the bit in the pinning device shown at *F*, and passes the steel to the sharpener operator, who sharpens the bit in the drill sharpener shown at *E*.

After the steel has all been sharpened it is reheated in the oil furnace *G* to the proper temperature for tempering and quenched in the cooling tank shown at *H*. It can then be stored in the storage rack for sharp steels shown at *J*, where it is easily obtainable when wanted. The equipment shown in this arrangement should meet all of the requirements of a small mine.

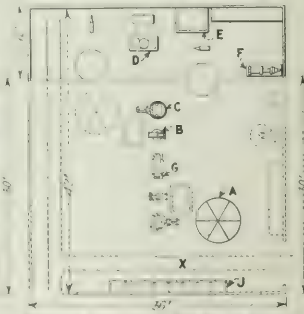
In the succeeding layouts, the preceding arrangement will be shown in dotted lines, so the expansion or new installations can be readily identified, only new equipment or such of the old equipment as it was necessary to move being shown by full lines.

FIRST EXPANSION

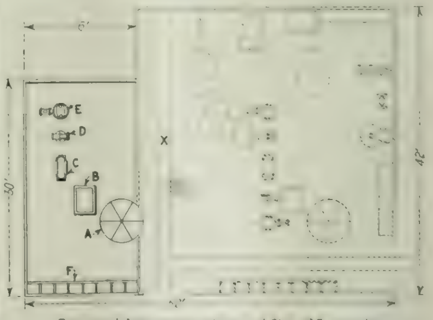
Fig. 5 shows the first step in the expansion of the shop made necessary by the demand for more sharpened drill steel demanded by the increased scale of operations. The building is enlarged by the addition of a 12-ft. extension along one side. This will permit the transfer of the two forges shown at *D*, Fig. 4, to this new section as shown (in. Fig. 5), and, by so doing, room will be made for the installation of another sharpening unit as shown at *A-B-C* in Fig. 5. The same sequence of operations in the sharpening of drill steel, as was previously described, is employed here; that is,



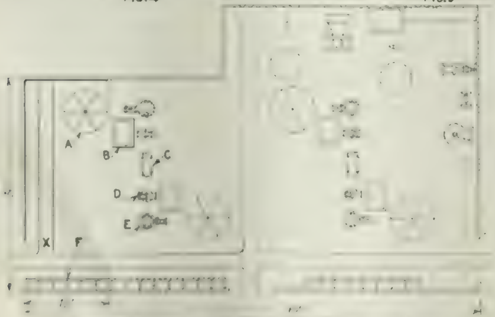
Proposed Arrangement, First Installation
FIG. 4



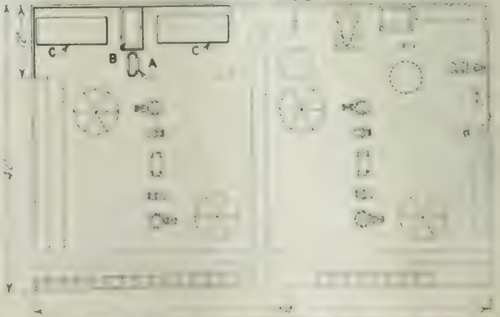
Proposed Arrangement, First Step of Expansion
FIG. 5



Proposed Arrangement, Second Step of Expansion
FIG 6



[illegible] Arrangement, Th[illegible]
FIG. 7



Proposed Arrangement [illegible] Tempering Dept
FIG 8

FIGS. 4, 5, 6, 7, 8. SUCCESSIVE LAYOUTS ILLUSTRATING GROWTH OF MINE BLACKSMITH SHOP TO KEEP PACE WITH INCREASING SCALE OF OPERATIONS the dull steel is delivered by means of car or truck running on the track *X*, and placed in the dull-steel rack shown at *A*; the steel is heated in the oil furnace *G* (which is the same one shown in the first installation, this arrangement being possible if the double-opening furnace previously described is used). The steel is then pinned in the pinning device, shown at *B*, and sharpened in the drill sharpener *C*. After the steel has been tempered and sorted, it is stored in the rack shown at *J*, until required.

It will be noted that the miscellaneous equipment has been augmented by the addition of a steam hammer shown at *D*. A hammer of about 600 lb. should be sufficient to meet the demands necessitating the installation of such a tool.

A cooling tank and a threading machine have also been added as shown at *E* and *F*. This miscellaneous equipment should be sufficient to meet all requirements for some time to come, so that, in the following proposed arrangements, only the increasing of the drill-sharpening equipment will be considered.

SECOND STEP OF EXPANSION

Fig. 6 shows the next step in the expansion of the blacksmith shop. A 16-ft. extension will permit the installation of the sharpener unit shown at *A-B-C-D-E*. The same method of handling the work that has been previously described is used here. The dull steel is brought to the sharpening unit on the track *X*, which is the same as is used for the first unit installed. After the regular routine of sharpening and tempering has been completed, the sharpened steel is stored in the rack *F* until it is required.

THIRD STEP OF EXPANSION

The installation of the fourth sharpening unit is shown at *A-B-D-E* in Fig. 7. This installation will require the building of a 12-ft. extension to the shop as shown. As was previously described when the installation of the second sharpener unit was shown, the oil furnace supplied for use with the third unit, shown at *C*, is also used for this installation.

The handling of the dull steel is practically the same as already described. The steel is brought to the unit on a truck running on the track *X* and placed in the rack for dull steel shown at *A*. The operations of sharpening and tempering are the same as those already described. The sharpened steel is finally sorted and placed in the storage rack shown at *F* until it is required.

The blacksmith shop the arrangement of which is shown in Fig. 7 should be large enough to meet the requirements of a mine of considerable size. If it is possible to secure the right kind of experienced workmen, this shop should be able to resharpen from 2,000 to 2,400 steels per shift of eight hours. This number of steels will be reduced when it is necesary to make up new steel, this operation requiring more time than is needed in resharpening a bit that has already been formed.

It has been the intention so far to have each sharpener operator temper the steel which he has sharpened. The time required for this operation will reduce the number of steels that he could turn out per shift. It may therefore be advisable, when the shop has reached the proportions last described, to install a sorting and tempering department similar to the one in the arrangement of the proposed shop of the United Verde Copper Co shown in Fig. 2. This will place the responsibility of tempering the steel, and, in case this is not properly done, steps can easily be taken to correct the fault.

Should an installation of this kind be decided upon, a continuation of the 12-ft. extension that was built to the shop for the first expansion shown in Fig. 5 would provide space for the additional equipment required. An arrangement of installation of the equipment necessary for tempering the steel is shown at *A*, *B* and *C* in Fig. 8. One oil furnace of the double-opening type will permit of two men working on this operation. The installation of a cooling tank *B*, and sorting tables *C*, as shown, is all the equipment that will be necessary. As the operator who sharpens the steel will not have to do the tempering, the cooling tanks may be dispensed with at the various sharpener units. After the steel has been tempered it should be placed in the racks provided until required.

It will not be necessary to discuss the construction of the buildings used for the blacksmith shop. This will undoubtedly be in accordance with the construction of the other buildings. Whether it is of brick, sheet metal, or of other material is optional with those in charge of the development work.

EXCEPTIONS

There are, of course, conditions of a local character which will preclude the possibility of devising a set of progressive arrangements which will prove satisfactory in all cases. The location of the shop in relation to the mine will no doubt be a determining factor as regards the method employed in handling the dull and resharpened drill steel. The human element must also be considered, inasmuch as all men are entitled to their opinion regarding the best method of doing the work. This will prove an important factor in deciding upon the layout of the shop.

I am fully conversant with the difficulties to be encountered in trying to prepare a set of drawings which will prove satisfactory under the various conditions and in all locations. The proposed arrangements shown here are presented only with the object of encouraging more consideration of future requirements at the time of the initial installations. This may result in considerable saving of both time and expense when it is necessary to enlarge the shop.

Bureau of Mines To Test Respirators And Gas Masks

Investigators have learned that the finest particles of dust, of a size far too small to be seen by the unaided eye, are the ones that lodge in the lungs and do most damage. At present little is known of the merits of the different filters used for respirators, and workmen often prefer to protect themselves with a towel or handkerchief tied around the face. In tests to be conducted by the U. S. Bureau of Mines fine particles such as cigarette tobacco smoke and fine mineral dusts suspended in air will be filtered with the different materials. The relative effectiveness of the filters will be noted as well as their resistance to passage of air and tendency to clog. The information obtained may be used to design more effective dust respirators.

The tests to be made by the Bureau of Mines will be conducted by S. H. Katz, assistant physical chemist, and L. J. Trostel, junior chemist, under the direction of A. C. Fieldner, supervising chemist.

Mining as Seen by Herodotus

A Belated Review

By Sydney H. Ball

Written for Engineering and Mining Journal

HERODOTUS was born in 484 B.C. at Halicarnassus, Asia Minor, his parents being Greeks of standing. At the time the city was under Persian rule. He received a good education, which was later broadened by extensive travel in Asia Minor, Greece, the islands of the Mediterranean, Persia, and Egypt. He is known to us through his account of the causes and battles of an earlier World War, the struggle between the Greeks and the Persians. As a background for his history, he describes most of the lands of the ancient world. Herodotus established historic chronology on a solid basis, and as a historian was impartial and broad minded. As a traveler he was, as a rule, a critical observer, although he failed in instances to discriminate between fact and fable. He was not a mining man, but mentions much of interest to mining men of the present day.

At the time, Egypt had lost its virility and was under Persian rule, and the Persian Empire itself, before his death, began to disintegrate; Athens was attempting to bring the rest of Greece under its imperial rule and Rome was a struggling young republic.

Early Gold Mining in the Near East

Gold was mined at numerous localities, most of the mines being placers, although in India lode deposits were probably worked. The gold-producing countries include Armenia, Egypt, the Caucasus and probably other portions of Russia, India, Greece and the surrounding islands, Bulgaria, and the northwestern coast of Africa. Several of these regions do not produce gold now, and although in certain instances cheap labor permitted exploitation of gravels which would not pay at the present time, in some of the streams rich patches of gravel were probably exhausted by the ancients. Herodotus recognized that placer gold was formed by the erosion of lodes, for he states that the River Pactolus, which flows through the city of Sardis, in Asia Minor, "brings down grains of gold from Mount Tmolus." (Page 348)[1]

The Carthaginians traded with the natives of the northwest coast of Africa (page 303) for gold dust in the following manner:

> "When they arrive among these people and have unloaded their merchandise, they set it in order on the shore, go on board their ships, and make a great smoke; that the inhabitants, seeing the smoke, come down to the sea and then deposit gold in exchange for the merchandise, and withdraw to some distance from the merchandise; that the Carthaginians then going ashore examine the gold, and if the quantity seems sufficient for the merchandise they take it up and sail away; but if it is not sufficient, they go on board their ships again and wait; the natives then approach and deposit more gold until they have satisfied them; neither party ever wrongs the other, for they do not touch the gold before it is made adequate to the value of the merchandise, nor do the natives touch the merchandise before the other party has taken the gold."

Such "dumb commerce" existed on the west coast of Africa until recent times.

A number of the more important of the Grecian mines were owned by the city governments, and the profits resulting from the operation of the mines were divided among the citizens. The citizens of Siphnos, in the Ægean Sea (page 194), for example, which had gold and silver mines, after setting aside a tithe for the temple at Delphi, divided the remaining profits among themselves. The Thracians (page 371) had gold mines both on the Thracian mainland and on their own island. The gold mines of Scapte-Hyle produced normally 96,000 oz. yearly. The mines on the island itself were less productive. The total of Thracian gold production is reported to have varied between 240,000 and 360,000 oz., and as a result the Thracians escaped all taxation. Herodotus visited the mines near Coenyra Thasos, which, he says, were discovered by the Phoenicians, and, he adds, "a large mountain has been thrown upside down in the search."

One can scarcely resist referring to Herodotus' statement that the Arimaspians, who had but one eye, procured their gold by stealing it from the griffins who guarded it (page 242). Even to this legend there may be a modicum of truth, as these people lived in Siberia, presumably near the Altai Mountains, or possibly east of the Urals; in either case an auriferous region.

The Legend of the Ants That Mined Gold

The great gold-producing countries of the time appear to have been northeastern Africa and India. From the latter, Darius is reported to have obtained an annual tribute of 432,000 oz. This probably required drawing of gold from stocks, as it almost equals the present production of India, which for the period 1917-20 has averaged 477,800 oz. The most important gold district of the peninsula appears to have been the extreme northern portion, possibly Thibet (page 214-15). In this desert region the gold-bearing gravel—and this portion of Herodotus has often been quoted—is stated to have been mined by ants which were supposed to be somewhat larger than foxes. The Indian gold seeker mounted a female camel, a male being on either side. He timed his arrival at the gold mines to coincide nicely with the hottest part of the day, at which time the ants hid themselves underground:

> "When the Indians arrive at the spot, having sacks with them, they fill these with sand, and return with all possible expedition. For the ants, as the Persians say, immediately discovering them by the smell, pursue them, and they are equaled in swiftness by no other animal, so that if the Indians did not get the start of them while the ants were assembling, not a man of them could be saved. Now the male camels (for they are inferior in speed to the females) slacken their pace, dragging on, not both equally; but the females, mindful of the young they have left, do not slacken their pace. Thus the Indians, as the Persians say, obtain the greatest part of their gold; and they have some small quantity more that is dug in the country."

As Sir Henry Rawlinson has perhaps correctly inferred, the alchemy of legend transformed the fur-clad Tibetan miners, whose gold was often stolen by bandits, into ants.

In addition to these gold deposits, India obtained some from its river gravels, and some was "dug"; the latter presumably refers to open cuts on the weathered portions of veins, or possibly to mere pits in gravel.

---

[1] References are to translations by Henry Cary, Bohn's Classical Library, London 1912.

DID THE CYRAUNISIANS INFRINGE M. S.?

Off the coast of Algeria was an island, Cyraunis (probably modern Kerkenna) (page 302), in which, according to the Carthaginians "is a lake from the mud of which the virgins of the country drew up gold by means of feathers daubed with pitch." This is perhaps the first reference to oil flotation, and appears to be a flagrant infringement of certain patent rights. The quantity of gold thus illegally recovered is unknown, but, even if small, considerable damages could be claimed, as the interest alone from 450 B.C. to date would amount to a tidy sum.

Owing to the difficulty of communication in Herodotus' time, the value even of gold varied among the various people of the world, although his statement that in Ethiopia gold was so plentiful that prisoners were fettered with golden chains and that copper was the most rare of all metals must be accepted with some reserve. The Massagetæ, perhaps inhabiting what is now Bokhara, possessed gold and brass in abundance, but no iron or silver. Among the Greeks, gold appears to have been worth thirteen times as much as silver (page 212), and, strangely enough, in November, 1919, the relative value of the two metals was not appreciably different.

ANCIENT PHILANTHROPIST NO PIKER

Notwithstanding the primitive mining of the day, gold, among the kings and richer citizens, was relatively abundant, and considerable stocks of gold and silver existed. Crœsus' presents to Delphi equaled, in addition to a golden statue of considerable size, 34,200 oz. of "fine" gold and 271,200 oz. of "pale" gold. He duplicated this gift to one of the Ionian shrines, and gave perhaps half as much to other temples. His contributions to charities, as enumerated, were, therefore, something over four million dollars. In Babylon, according to the Chaldean, one of the temples contained golden thrones and tables weighing some 960,000 oz. That wealth was confined to neither the kings of the time nor the temples is indicated by the fact that Pythius, (page 422) a citizen of Phrygia, owned 2,400,000 oz. of silver and 1,597,200 oz. of gold. If these figures are to be believed, at present metal prices, this private citizen was worth about $33,000,000. As no income tax existed at the time, the wealth of this Phrygian may well have been subject to his own exaggeration, and it is probable that many of the gifts to the gods mentioned above were not solid gold.

The casting of gold seems to have been common among several of the peoples of the time, as was gilding. Crecian goldsmithing was at its height. The gold of the day varied considerably in fineness, some being referred to as "pure" gold and some as "pale" gold. Prior to coining gold, Darius is reported to have refined it "to the utmost perfection," and the purest silver of that day was that coined by Aryandes, a Governor of Egypt. The purity of gold was judged by the Persians of the time by comparing its streak with that of known pure gold. It was used for personal adornment, for coinage, and for votary offerings, nor does the judgment in its display at that time appear to be worse than that of the present day.

Silver was obtained from Thrace, Macedonia, Asia Minor, and the Grecian islands. The silver mines at Laurium (page 457), which, by the way, were worked in the sixth and seventh centuries B.C., and are still actively exploited, were the property of the city of Athens. The citizens renounced their share in the profits, and with the money a navy was built for the war with Ægina. Previously, every citizen received about 2 oz. yearly, the production of this slave-worked mine being thus well over 40,000 oz. per year. Near Lake Prasias (page 312), on the border of Thrace and Macedonia, was a mine from which Herodotus reports that there was obtained yearly by the Macedonian kings 430,000 oz. of silver. The uses of silver at that time were not different from those of the present day, and already certain silversmiths were famous, Herodotus particularly mentioning Theodorus, the Samian.

Other metals are less frequently mentioned. Iron, copper, lead, and tin were used in relatively small quantities. The people of what is now Bokhara are reported to have had large supplies of copper, and the inhabitants of what is now southern Egypt held copper as the most rare and precious of all metals. Tin was reported to come from the Cassiterides (Great Britain), (page 218), but of this Herodotus, through over-caution, is skeptical.

Mineral paints were used by many of the semi-civilized or savage people of the time for body decoration. The vermilion used by the Zaveces and the Maxyes tribes living in northern Africa may in reality have been mercuric sulphide rather than red ocher. The Ethiopians of Xerxes' army smeared half their bodies with chalk and the other half with red ocher.

Flint implements were in use by Egyptians in the preparation of bodies for embalming, and the Ethiopians of Xerxes' army used stone arrows.

LIBYAN HOUSES WERE BUILT OF SALT

Salt was obtained at numerous localities, some of it by the evaporation of sea water or that of saline lakes and some as a byproduct of oil production. In northern Africa certain of the numerous hills of rock salt were mined. It is stated that south of Gibraltar "the houses built of blocks of salt, for in these parts of Libya no rain falls, for walls being of salt could not stand long if rain did fall. The salt dug out there is white and purple in appearance." (Page 300.) In the oasis of Ammon, such salt houses still exist, or did a few years ago. Sodium carbonate, obtained by the Egyptians from alkali lakes, was used in embalming. The Egyptians also produced alum and were evidently the most advanced chemists of the time. The Ethiopians are reported to have embalmed the bodies of their dead much as did the Egyptians, and then to cover them with gypsum. "They then put around it a hollow column made of crystal, which they dig up in abundance and is easily wrought." (Page 180.) This may possibly refer to gypsum, but perhaps, after all, to nothing but more of a glaze over the mummy case.

Engraving of agates and other semi-precious stones was one of the most admired arts of the day. Notwithstanding the fact that the Persians were at that time in commercial contact with India and that Herodotus traveled widely in Persia, it does not appear that the stones which we rank today as precious were widely used. It is probable that Indian gem mining, as an important industry, postdated Herodotus' time and that the gems found were claimed and hoarded by the local potentates. In fact, precious stones in quantity were only introduced into western Asia and Europe after Alexander's conquest of India, a century later. Polycrates (page 188), tyrant of Samos, however, had a true emerald, presumably from Egypt, in his seal ring engraved by Theodorus. This, on the advice of Amasis, king of Egypt, he threw into the sea as his most valuable possession, so that his good fortune might not be too complete. On the fifth or sixth day, it will be remembered, a loyal fisherman, who had caught an unusually fine fish, presented it to his king, and therein his chef found the ring. Upon this being recounted to Amasis, he declared that any one with such good luck as Polycrates could come to no good end, and, fearing international complications, he renounced his friendship.

CRYSTAL EARRINGS FOR THE EGYPTIAN CROCODILE

The shining "emerald" pillars in the temple dedicated to Hercules, at Tyre, were presumably—as are many of the other great "emeralds" of antiquity—green glass. Crystal was wrought by the Egyptians into earrings for the sacred crocodiles. The Phœnician trade in amber (page 218) from the Baltic coast had long been established, although Herodotus, as in the case of tin from Cornwall, was unwilling to assume the responsibility of sponsoring the report.

To be popular in 1921 one must, of course, address the oil world, and Herodotus showed his modernity by not overstepping this convention. The occurrence of asphalt is mentioned in Mesopotamia, southwestern Persia, the Island of Zante, Macedonia, and Cyraunis, an island off Libya. The Mesopotamian and Persian occurrences sound most up to date, and recently oil development began in Macedonia.

The bitumen used in constructing the walls of Babylon was brought down in lumps by the waters of the Euphrates River and came from what is now presumaby Hilla (the ancient Hit) (page 78). On the Island of Zante there were several pools from which asphalt was obtained, the largest being seventy feet in diameter and thirteen feet deep (page 302):

"Into this they let down a pole with a myrtle branch fastened to the end, and then drawn up, pitch adhering to the myrtle. It has the smell of asphalt, but is in other respects better than the pitch of Pieria (Macedonia). They pour it into a cistern dug near the lake, and when they have collected a sufficient quantity; they pour it off from the cistern into the jars. All that falls into the lake passes under ground, and appears again upon the surface of the sea, which is about four stades (one-half mile) distant from the lake."

ASPHALT, SALT, AND OIL WELLS

Herodotus was perhaps the first to refer to the association of salt and oil. Regarding a well near Ardericca, at the head of the Persian Gulf, he states that "it produces three different substances, for asphalt, salt, and oil are drawn up from it, in the following manner: It is pumped up by means of a swipe, and instead of a bucket, half of a wine skin is attached to it; having dipped down with this, a man draws it up and then pours the contents into a receiver; and being poured from this into another, it assumes three different forms: the asphalt and the salt immediately become solid, but the oil they collect, and the Persians call it rhedinace; it is black and emits a strong odor" (page 398-99).

The principle of the pipe line was known, for when Cambysës, son of Cyrus, was en route to fight Amasis, King of Egypt, it is stated, in order to permit Cambyses' troops to pass over the desert region, "that the king of Arabians having sewn together a pipe of oxhides and other skins, reaching in length to the arid region, conveyed the water through it."

Operating Ventilation Doors By Compressed Air

It has only been in recent years that the proper ventilation of metal mines has received serious consideration, says E. D. Gardner, mining engineer, in Serial 2273, *Reports of Investigations*, U. S. Bureau of Mines. Increasing temperature and humidity with greater depth in some of the larger mines of the West prevented the efficient operation of the mines and made the installation of mechanical ventilation systems necessary. Doors that interfere with tramming are generally needed to control properly the mechanically induced air currents and are one of the inherent disadvantages of the system. In fact, the necessity for the use of doors in the main haulageways has discouraged the installation of mechanical ventilation in some metal mines.

A number of mining companies in Arizona are using ventilation doors which can be opened and shut mechanically by the motorman without leaving his seat or stopping his train, and thus interfere very little with the transportation of the ore. The Copper Queen branch of the Phelps Dodge Corporation at Bisbee introduced these ventilation doors and adapted them from those in use in the company's coal mine at Dawson, N. M. Other mining companies have installed the same type of door, and it is now being used in a number of districts in Arizona.

The doors at the Calumet and Arizona mine, in the Bisbee district, are representative of those in use in other mines. They are substantially built of 2-in. lumber, are air tight, are well placed and have two openings or passageways. The main door, which is used for the motor trains, is 5 ft. wide by 5 ft. high, and is opened by compressed air and closed by a counterweight. At the side of the motor door is the man door, which is 18 in. wide by 5 ft. high and is opened and closed by hand.

The mechanism for opening the main door consists of a section of 5-in. pipe about 5 ft. 6 in. long, threaded at both ends and used as an air cylinder. A piston fits in the cylinder and is attached to a 1-in. plunger rod which passes through a stuffing box at one end of the pipe. The free end of the rod is attached to a rope that goes over a pulley and is fastened to the door. A ¾-in. pipe connection from the compressed-air line is tapped into the cylinder at the packing end. When the air is turned on it forces the piston to the other end of the cylinder and thereby opens the door. The door is held open as long as the air pressure is maintained, and is closed by the counterweight and the force of the air current when the pressure is released.

Tests on Leaching Gold Ores

Gold ores containing stibnite have been leached with alkaline sulphides at the Northwest station of the U. S. Bureau of Mines. A report covering all the work done on antimony at this station of the Bureau will, it is announced, be published at a later date.

Mine Operators of Note

William J. Loring

WILLIAM J. LORING is and has been a gold miner. He successfully progressed through the stages, starting as a boy of twelve, single-jacking on a side-hill mining claim at 50c. per day, to a miner, mill man, mill superintendent, mine manager, and up through various positions of larger responsibility to his present position as director of the destinies of important mining companies. He is a 100 per cent product of the mining industry.

That industry, an active mind, an energetic body, and keen observation will find a way to advance up the ladder of success is easily demonstrated by a study of Mr. Loring's career. He was born near Half Moon Bay, Cal., on March 6, 1869. His father was a lawyer. He received a common-school education in the schools of Amador County, Cal. As a boy he became interested in the mining life which centered about his home in Amador City, to which his parents had moved.

While yet a school boy, young Loring filled in his spare time working in the mines and mills wherever he could find a job. At Plymouth, he broke ore and shoveled it into the feeders in the old Empire mill, and at fourteen he secured regular employment at this mill on the same job. So well did he fulfill his duties that his employers steadily advanced him, until he became assistant amalgamator and concentrator man, remaining at this work until the property was closed down by Alvinza Hayward, Walter Hobart, Sr., and their associates in 1888.

At the age of nineteen Mr. Loring was considered a good mill man and easily secured employment under Walter Tryon at a small mill. Later he was transferred to the Utica mill, which was under the superintendency of Charles D. Lane. He remained with the Utica company during the expansion of this company's milling facilities and eventually became mill superintendent in charge of stamp mills aggregating a total of 160 stamps. W. C. Ralston was impressed by the ability of Mr. Loring and secured his services as superintendent of the Melones mine, at Robinson's Ferry. This mine was in the beginning stages, and Mr. Loring took charge of the erection of a sixty-stamp mill and the construction of a water-power plant to operate it. Hardly had this work been completed when opportunity opened out a wider horizon for Mr. Loring. Herbert Hoover, who at that time was a partner in the English mining firm of Bewick, Moreing & Co., asked Mr. Loring to go to West Australia to take charge of mining properties. Hoover's attractive offer was accepted, and Mr. Loring left California for Australia in 1902. He first became superintendent of the Sons of Gwalia mine and rapidly put that mine into profitable operation by reducing costs, increasing ore reserves, and energizing the operating organization.

In [illegible] W. A. Prichard and Mr. Loring became joint general managers for Bewick, Moreing & Co. in Western Australia. This firm was operating sixteen mines in Western Australia, and Mr. Loring was given charge of the mines under the control of the company outside of the Kalgoorlie district. In a short time other changes took place, and Mr. Loring became general manager for all of the Australian properties under the direction of Bewick, Moreing & Co. Mr. Loring soon became a partner in the firm by taking over Hoover's interest in 1908. He gave up his Melbourne office and established his headquarters in London.

In 1908, Mr. Loring went to Burma and started the development of the properties of the Burma Mines, Ltd. These properties have since become one of the great mines of the world. Since then he has traveled extensively, visiting most of the gold-mining regions of the world.

During the war, Mr. Loring returned to the United States and made his headquarters in San Francisco, where he has since remained. From this vantage ground he undertook the development of mining properties in California in which he was already interested, and turned his attention also to Nevada.

One of the first properties which he took over was the old Plymouth mine, where he had worked when a young lad at school. The reopening of this property had been started in 1911, and had been conducted under the direction of Albert Burch. Mr. Burch held an option on the property, which option was subsequently taken over by Mr. Loring and assigned to the California Exploration Co., Ltd., a company formed by Bewick, Moreing & Co.

In the war period, the attention of Western mining men was attracted to tungsten mining by the representations made of the critical need for the development and mining of war minerals. With characteristic energy Mr. Loring went into tungsten mining and organized the Pacific Tungsten Co. This company opened up and operated tungsten properties near Mill City, Nev. A mill and mining plant were erected and operations started, but the unexpected termination of the war left the enterprise without a market for its product.

The consolidation of several properties on the Mother Lode at Carson Hill, Cal., and their development into an important gold producer were successfully accomplished by Mr. Loring during the last few years. In the process of gathering together the several properties, he secured an option on the Morgan group of claims. A careful examination of the Morgan adit led to the discovery of a promising lead. This was opened up, and a rich orebody was found. Rapid development followed, and the Morgan group was purchased in 1918 for $800,000. The Melones property was next taken over under option.

Not all of Mr. Loring's mining ventures have been successful. Like other operators, he has had some failures. His successes can be ascribed in part to his practical knowledge and experience and in part to his willingness to take a chance.

Mr. Loring gets down to his office at 6 o'clock in the morning, and is as likely as not to phone his mine superintendents and be in touch with mine operations before the average business man starts for his work. He puts in a longer day than his assistants and is more likely to be found at one of his mines than at his office. Widely known among engineers and mining men and with the background of active participation in many mining activities, he is an [illegible] leader for the American Mining Congress, which selected him for its president in 1921.

BY THE WAY

Resolutions

The whereases of most resolutions being usually trite and tedious, we shall omit them from the following, which we offer for the consideration of the resolutions committee of the Mining Congress:

RESOLVED, That the "copper-collared" press of Arizona lay in a new stock of collars while the metal is cheap.

RESOLVED, That thirteen cents is an unlucky price for copper and that the producers skip it and ask fourteen.

RESOLVED, That the Mining Congress Convention get down to brass tacks at the start and begin its sessions at the appointed hour, instead of thirty or sixty minutes later—the copper and zinc in the tacks to come from American producers.

RESOLVED, That the speaker who insists on reading a paper already in the possession of the audience be shot forthwith, brass cartridges being used.

RESOLVED, That everyone buy something made of copper, if it is only a washing machine. This will help the Guggenheims and others as well as the wife.

RESOLVED, That a collection be taken at the annual banquet to buy shoes for the copper men during the coming winter.

Wanted—A Plumber

There was a bad leak in Los Angeles recently, something that never could or would have happened in San Francisco. They are *so* different in San Francisco. It seems that a certain dentist, running short of gold for filling teeth and becoming desperate, went out to the Santa Monica Mountains, where, probably through his being a member of the Chamber of Commerce, he discovered all the gold he could possibly want—billions of it. Fully fifty assays were made, so there is no doubt of it. According to reports, which vary just enough to dispel all doubt as to their truthfulness, he found a deposit of flour gold, assaying $59.95 per ton. It was Monday when the assays were made, otherwise it might have been $60. Anyhow the gold is packed in a ledge of shale, which may yet prove to be oil shale, that has been traced for three miles and is 1,000 ft. wide in places. Experts declare that the gold can be extracted for $2 per ton. The gold was discovered when the specimens were subjected to a heat of 480 degrees LL.D. Panning or any other process would not disclose it except the application of intense heat. The dentist sealed his lips, but, not knowing how to keep his mouth shut, which is not taught in dental colleges, he kept it open instead—wide open; and the story got out. The new discovery will shade King Solomon's mines, it is thought, or the California days of '49. It is said to be the first time a deposit of flour gold has been found under the same conditions anywhere in the world except in Russia.

This discovery is a sad blow to Messrs. Lawrie and McFadden. Why the onus of a bonus for gold producers when nature's vast storehouse in the Santa Monicas is chock full of yellow metal that can be extracted at low cost? Even the representatives from the gold districts will admit the cogency of this argument. Of course there are doubting Thomases who say it is all just some more Los Angeles bunk manufactured purely out of jealousy of the notoriety that the City by the Golden Gate has recently been enjoying.

Suggestive

The Rainbow Castle Company, of Los Angeles, has received a permit from the State Commissioner of Corporations to sell 3,000 shares of stock, 2,000 common and the rest preferred. The name of the company is attractive: it suggests the well-known pot of gold, could we find which we would straightway build us a castle in Los Angeles' wonderful air.

Out of Sight, Out of Mind

"They do say, m'son," said Cap'n Dick, "as 'ow tha cost o' livin' 'as been commin' daown, an' every naow an' again we sees a lot o' these 'ere statistics that show 'ow much it takes a man to support 'is missus an' family, pay 'is h'income tax, an' still 'ave h'enough to see one o' these 'ere movies naow an' again. But it h'appears to me that tha price o' pasty steak still 'angs pretty 'igh, an' a chap 'as to watch h'every chance 'e gets to h'economize. Coorse, naow, there's different ways o' doin' that; some 'as one scheme an' some 'as h'another. I remember 'earin' tell o' Billy Pascoe, 'oo wuz keepin' bachelors 'all near tha Meadow mine. One h'evenin', jus' as 'ee wuz gettin' supper, a 'en walked h'into 'is shack. 'Dam-me, old 'en,' sez Billy, 'Nobody seen thee come h'in, you, an' nobody's goin' to see thee go h'out.' An, m'son, they didn't."

At the Red Bird Mine

H. F. Emerson got off with both feet forward when he wrote a certain report on the Red Bird mine. One can only guess where the Red Bird is, but Mr. Emerson begins as follows:

> It is seldom that nature signals to man where its hidden treasures are to be found as plainly as here at this property, where a great intrusion has forced itself upward through the limes and shales of sedimentary origin and left this great chimney or blow-out of highly colored mineral-bearing rock beckoning and awaiting development.
>
> Here you have a most complete example of the workings of nature's laboratory, fire and water, solids and liquids, acids and alkalies, heat and cold.
>
> When this portion of the country was covered with water and the rivers had brought their muds and clays and sands from the mountain sides and deposited them in these waters, and the soft sludge of lime precipitate was in process of forming the top layers of limestone which cover this section of the country, an eruption occurred and the gases found vent in the hill or anticline on which this property is located; then a seething, boiling, bubbling mass frothed and foamed and sizzled as it was constantly forced upward by the power of the unspent fires beneath.
>
> These fires were pouring out hot gases which were being condensed by the cooling liquids above, and a tremendous chemical change took place. Rocks, pebbles, and boulders were shot upward into this mass and were squeezed and pressed into compact formation. These fragments were torn and broken from the ledge of the primary formation lying below, which in this case was porphyry carrying rich values of gold and silver. Much of this gold was carried upward in the gases and in solution and was deposited by precipitation throughout the entire mass, so that all of the limestones, the conglomerates, the shales and the porphyries are impregnated with fine gold.

An excellent start. Mr. Emerson must have been present at the birth of the Valley of Ten Thousand Smokes. It is to be regretted, however, that his imagination continues to run riot to the end of the report, so that at the end one has a complete picture of a large mill supplied from a wonderful orebody, which Mr. Emerson says he did not sample.

THE NON-METALLIC INDUSTRY

Converting Dolomite Into Magnesite

Experiments Which Were Made in an Effort To Utilize a Cheap and Abundant Eastern Limestone — Simple Calcination and Leaching an Effective Method — Product Higher in Lime Than Natural Mineral, but Compares Favorably With It

BY DJEVAD EYOUB

Written for Engineering and Mining Journal

PREVIOUS TO THE GREAT WAR the United States imported almost all of the magnesite used in this country. During 1913, the last normal year, 149,000 tons of magnesite was imported into the United States. Most of it came from Austria and Greece. Of course, the advent of war closed this channel. Prior to the cessation of imports, calcined magnesite sold for $20 to $25 per ton at Atlantic ports. During 1916, $65 to $70 was quoted for calcined magnesite in New York and Philadelphia. These high prices gave a sudden impetus to magnesite mining in California, and brought about the successful prospecting and production of it in Washington. At the same time it interested several New York financiers in making a research to ascertain if magnesite could not be successfully made from dolomite, a common rock in the vicinity of New York and Philadelphia.

During the latter part of 1916 I was engaged to study the problem of commercially extracting magnesium oxide and other magnesium compounds from dolomitic limestones and dolomites. Magnesite in its crude state is $MgCO_3$, whereas dolomite is a double carbonate of magnesium and calcium. The problem plainly resolves itself into the elimination of the calcium. At the outset it was evident that the method of treatment should be of such character as to give a salable product at low cost. Therefore the use of chemicals should be minimized if not obviated entirely. This eliminates many chemically plausible procedures.

A study of the solubility tables for the compounds of calcium and magnesium will reveal the interesting fact that $Ca(OH)_2$ is about fifteen times more soluble than $Mg(OH)_2$.

In the laboratory where my experiments were conducted there were twenty 100-lb. samples from fifty quarries in the Westchester County, N. Y. These were marked and analyzed for CaO, MgO, Fe_2O_3, Al_2O_3, and silica. Ten of these samples were immediately discarded on account of their high silica content. A five-pound sample of each of the remaining samples was subjected to calcination at 800, 1,200 and 1,500 deg. F. The samples were crushed in the laboratory crusher so that 100 per cent would pass through ten mesh. It was found that it was not necessary to keep the rock in the oven for over fifty minutes. After calcination, the samples were dumped into galvanized iron tanks of twenty gallons' capacity half filled with water and were vigorously mixed, with paddles improvised in the laboratory, for eight or ten minutes. The mixture was allowed to settle, and the bitter-tasting calcium hydroxide solution was siphoned out. The residue was washed with fresh water and allowed to settle for the second time. Then the precipitate was dried and exposed to various temperatures and analyzed for lime, magnesia, iron oxide, and silica.

When the results were tabulated it was clear that in the primary calcination the low and the high temperatures were yielding unsatisfactory results. After various interpolations, from 950 to 1,000 deg. F. was found the most suitable for the purpose of the investigation. At higher temperatures lime was found to make a certain percentage of insoluble compounds, and at the lower temperatures the dissociation of the dolomite was not complete. It was clear that the nearer the temperature of the water to freezing, the better would be the product.

Six of the ten samples gave satisfactory results. The product was submitted to various composition flooring houses in New York as well as to the buyers of magnesite for refractory purposes. Their approval was almost unanimous. It should be mentioned in this connection that lime over 3 per cent renders the product undesirable for the flooring business, though it is not considered detrimental for lining furnaces. The average percentage composition of the six samples referred to is as follows: MgO, 81.20 per cent; CaO, 4.10; insoluble, 13.90 per cent. It is interesting to compare this with the products marketed:

	[illegible]	[illegible]	[illegible]
MgO	[illegible]	[illegible]	[illegible]
CaO	[illegible]	[illegible]	[illegible]
Insoluble	[illegible]	[illegible]	[illegible]
	[illegible]	99.05	[illegible]

Magnesite is one of the few articles that has not experienced serious reduction from its war-time price. It sold for from $70 to $75 during hostilities and it sells for from $60 to $65 now. These prices are for the Atlantic seaboard (f.o.b. California and Washington points it is $16 to $20 [illegible]). Owing to the tariff imposed, $10 per ton on the crude and $15 per ton on the calcined, the Grecian and the Austrian products have not been very abundant in the market.

It appears that most of the magnesite consumed in the United States is used in the East, where the gigantic steel plants, large paper industries, and growing flooring industries are situated. Yet the bulk of the magnesite used comes from the Pacific Coast. It is [illegible] that the large and extensive dolomite deposits of the East will in a near future be exploited for the artificial production of magnesite. The treatment charges for this could be made considerably less than the transportation charges of $10 or more from the Pacific Coast to the Atlantic seaboard.

HANDY KNOWLEDGE

Guniting at United Verde Extension

Much useful information is given in a paper describing the United Verde Extension plant and gunite methods, read by E. E. Campbell at a recent meeting of the Arizona Chapter of the American Mining Congress. Mr. Campbell said in part:

"During the period when the mine was poorly ventilated, timber repair costs were excessive, due to heavy ground and to short life of timbers. This led to experiments being carried out in the use and economy of concrete and gunite in supporting ground heretofore timbered. The results of these experiments show conclusively that, in most cases, in permanent workings either concrete or gunite can be used to far better advantage than timber. Timber has already been removed from several hundred feet of tunnels through heavy ground and these portions concreted with excellent results, at a cost of approximately twice the cost of timber repairs. Many thousand feet of timbered drifts, through lighter ground which requires supporting, have had the timbers removed and these workings have been gunited with satisfactory results, at a cost less than one-fourth that of timber repairs.

"The following is a record of cost of guniting a representative section of the Josephine tunnel, which is the big haulage tunnel on the 1,300 level.

Costs of guniting tunnel	
Size of tunnel	10 x 10 ft.
Footage gunited	4,098 ft.
Mixture used, 1 cement to 3 sand	
Application, two coats	
Labor	$2,581.29
Cement (2,056 sacks at $1.10 per sack)	2,250.60
Sand (263 cu.yd. at $2.50 per cu.yd.)	657.50
Machinery repairs and supplies	282.84
Total cost	$5,772.23
Cost per linear foot of tunnel	$1.40
Cost per sq.ft., approximately	.046

Cost of guniting in 1,100 drifts:	
Size of drifts	6 x 8 ft.
Footage gunited	733 ft.
Mixture, 1 cement, 3 sand	
Application, two coats	
Labor	$305.62
Cement (229 sacks at $1.10 per sack)	251.80
Sand (27 cu.yd. at $2.50 per cu.yd.)	67.50
Machinery repairs and supplies	12.21
Total cost	$637.13
Cost per foot	.869
Cost per sq.ft.	.043

"The following is a record of comparative figures on shaft concreting carried on under two different contract conditions. These figures are most instructive, as they show a wide difference in results attained when the workmen participated in a bonus on the amount of completed work done and when their recompense does not depend on what they accomplish.

"During the last year the Edith shaft was concreted from the surface to the 1,400 level. The first section of this work, 575 ft., was let on the following basis: The contractor submitted an estimated cost within which he was to complete the work and receive as a bonus 50 per cent of any saving he could make on the estimated cost. The contractor was given a free hand in choosing his crew, and the men were paid current shaftman's wages. The company paid all expenses of the work, which was completed well within the estimated amount, the contractor receiving a bonus of $3,075, which amounts to $5.34 per ft. of work. The total cost per foot of completing this section, including the concreting of two stations, was $43.14.

"The remainder of the work, totaling 630 ft., was let on the following basis: Every man on the job was paid the current shaft rate, plus a bonus per shift, the amount of which depended upon the average number of feet of work completed per day for the entire job. Under this scheme the men received as bonus $2,056.50, or $3.26 per ft. of work.

"The total cost per foot of completing this section, including the concreting of five stations, was $31.35 per ft., as compared with $43.14 under the other plan.

"In comparing the two jobs, the first section has the handicap of a partly trained concreting crew, with the advantage of having only two stations to concrete and under the second scheme there was an advantage of having trained men, which advantage was offset by having five stations to concrete. The ground in both cases was practically the same.

"The following is a detailed compilation of the costs in both operations:

EDITH SHAFT CONCRETING

"Three-compartment shaft (two hoisting compartments 4 ft. x 5 ft. 6 in. and one manway and pipe compartment 5 ft. 2 in. x 5 ft. 6 in.), shaft wall containing six pipes in varying sizes.

"Shaft concreted from 1,400 level to surface, a distance of 1,205 ft., including seven stations.

"Work started Feb. 1, 1921; completed July 25, 1921.

"Work was done in two sections, first section from 800 level to surface, 575 ft. on contract basis.

"Second section, 1,400 level to 800 level, 630 ft., was done on bonus basis on footage made per day.

"The actual cost of mixing and placing the concrete in each section, not considering the preliminary cost of installing crushing plant, removing old pipe lines, placing guides and chairs in the concreted sections, was in each operation as follows:

FIRST SECTION

575 ft., including two stations.
Work started Feb. 1, 1921, finished April 21, 1921—eighty days.
Average advance 7.19 ft. per day.

Costs:	
Labor (including supervision at $10 per day)	$8,827.20
Cement (6,564 sacks at $1.10 per sack)	7,220.40
Sand and gravel (1,498.1 cu.yd. at $2.50 per cu.yd.)	3,745.25
Power used hoisting and crushing (25,380 kw.-hr. at 2c.)	507.60
Reinforcing iron (10 lb. per ft. of shaft at 10c. lb.)	575.00
Form lumber, $1.50 per ft. shaft	862.50
Bonus paid	3,075.00
Total cost for 575 ft.	$24,812.95
Cost per ft.	$43.14
Cost per cu.yd. of concrete in place (1,231 cu.yd.)	$20.15

SECOND SECTION

Distance concreted, 630 ft., including five stations.
Work started May 1, 1921, finished July 25, 1921—eighty-six days.
Actual time of concreting shaft, after deducting the time lost in cutting new stations, was sixty-nine days, or an average per day of 9.13 ft.

Costs:	
Labor (including supervision at $225 per month)	$5,068.50
Cement used (6,256 sacks at $1.10 per sack)	6,881.60
Sand and gravel (1,434.5 cu.yd. at $2.50 per cu.yd.)	3,586.25
Power used hoisting and crushing (29,310 kw.-hr. at 2c.)	586.20
Reinforcing iron (10 lb. per ft. of shaft at 10c. lb.)	630.00
Form lumber (640 ft. of shaft at $1.50 per ft.)	945.00
Bonus paid	2,056.50
Total cost of completing section	$19,754.05
Cost per ft.	$31.35
Cost per cu.yd. of concrete in place (1,174 yd.)	$16.82

"The mixture used was one part cement, two parts sand, five parts crushed rock, or 5½ sacks of cement, 10 cu.ft. fines, and 23 cu.ft. crushed rock per cu.yd. of concrete in place."

United Verde's Cottrell Plant

C. R. Kusell, in discussing the research work done by the United Verde Copper Co. at the recent meeting of the Arizona Chapter of the American Mining Congress, described the million-dollar Cottrell precipitation plant that is now being installed. "This plant," said Mr. Kusell, "which is now under construction, is novel in that it includes three different types of Cottrell treaters arranged in parallel. The total capacity will be 800,000 cu.ft. of gases per minute. One-half of this will be handled by down-draft vertical pipes, 12 in. in diameter; one-quarter by the Tooele straight-line horizontal-type utilizing sheets of corrugated iron for the receiving electrodes; and the fourth quarter by a modified Hayden straight-line horizontal type using chain screens for the receiving electrodes.

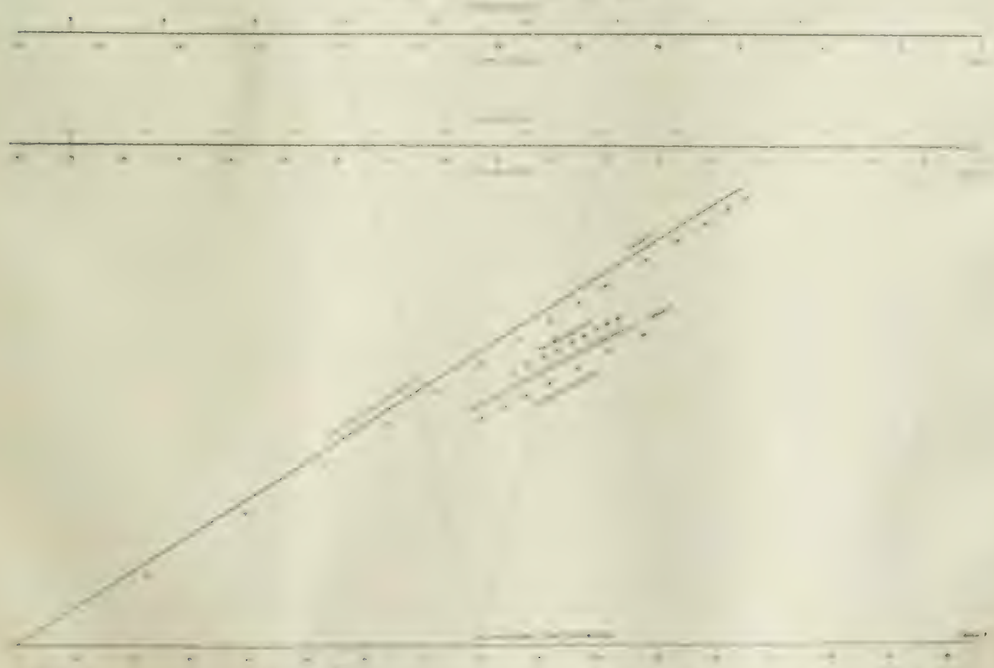
"The straight-line treaters are cheaper to construct, and it has been demonstrated at Tooele and Hayden that they are efficient on easily treatable gases such as roaster gases. It was not known how efficient this type would be on the more difficult gases from the blast furnaces and converters, and as a precaution enough capacity in the pipe type was decided upon. The whole installation is so arranged that the gases may be treated separately or mixed. As the expense of building return flues to the old stack was not much below the cost of a new chimney, the latter was decided upon. It is expected that operation of this will yield much interesting and valuable data besides being a profitable investment.

"Analysis of products precipitated in an experimental Cottrell apparatus revealed that a large portion of the zinc, which is present to the extent of 1 to 3 per cent in the ore smelted, is concentrated in the blast furnace and converter fumes. As a result, research work was started on the possibility of getting the zinc out of the system in the form of some valuable byproduct. After a survey of the market for zinc products, it appeared that lithopone presented the greatest possibilities. Lithopone is made by precipitating a pure solution of zinc sulphate with a solution of barium sulphide, and the resulting white product is zinc sulphide and barium sulphate. It is used principally as a paint pigment and a constituent of mechanical rubber goods, other minor uses being in the manufacture of paper, linoleum, oilcloth, and window-shade cloth. Although it only contains a little over 20 per cent zinc, it has been commanding a higher price than has metallic zinc or spelter.

"Laboratory investigation finally yielded good results in the treatment of the fume from the Cottrell process in the preparation and purification of a zinc sulphate solution and in the subsequent steps to make a good grade of lithopone.

Alignment Chart for Determining Oil Yields in Assaying Oil Shale

[illegible] Bureau of Mines



[illegible]

THE PETROLEUM INDUSTRY

The Inorganic Origin of Petroleum

By Hiram W. Hixon

Written for Engineering and Mining Journal

IN THE ARTICLE[1] by Albert G. Wolf on "Salt Mining in Louisiana," there is an interesting description of the salt domes of the Gulf Coast. The statement is made therein that "The origin of these salt domes is an unsettled question too complicated to go into. The theories of formation vary from evaporation of sea water to the intrusion of salt in a molten or plastic state." I herewith submit a hypothesis not advanced by Mr. Wolf:

The increase of temperature with depth will, at some depth moderate compared to the earth's diameter, result in a critical temperature for all matter. Thereafter all of the interior mass, below a depth of say 200 or 300 miles, will be in a gaseous condition, and denser than the solids that will form out of it. Gravitational compression is the cause of the density, and the conditions of equilibrium make it necessary that the interior mass shall be denser than the crust of solids which rests upon it. All known elements can be volatilized in the electric arc, which is supposed to have a temperature of about 5,000 deg. C. With an increase of 1 deg. C. per 100 ft. of depth, or say 50 deg. C. per mile, the temperature of the electric arc would be equaled at a depth of 100 miles.

Earth's Interior a Dense Gas

A critical temperature for any substance is the temperature above which that substance is in a gaseous condition regardless of pressure. Having passed the critical temperature of all matter, the interior mass of the earth is therefore in a gaseous state, and by the conditions of equilibrium, is shown to be denser than the solid crust which floats upon it. The crust floats on the gaseous interior for exactly the same reason that ice floats on water; that is, because it expanded when it changed from a gas denser than a solid to a solid, due to secular cooling. This expansion on change of state is the active cause which tears apart the cold crust in long rift cracks and furnishes a path of least resistance for volatile material in the interior to reach the surface. As expansion is in three dimensions, it follows that there should be two sets of such cracks at right angles to each other, and at the intersection of these cracks, which have been called lines of orogenic movement, the salt domes are found.

The seal or cap rock is due to some elastic member of the geologic section, probably shale, which will stretch under pressure without fracture. The volatile material, consisting of salt, sulphur, and petroleum, and sulphuric gases, comes up along the cracks as the path of least resistance, and being under a rock pressure equal to the depth from which it comes, is capable of making room for itself and doming up any rock mass which will not crack. The alignment of the salt domes, as shown on the map accompanying the article by Mr. Wolf, is characteristic of all the others, and is explainable on the basis of the rift cracks as above described.

Block Faulting of Frequent Occurrence

These rift cracks, rift valleys, and graben are much more numerous than generally supposed. For example, there is a series of them in East Africa which is occupied by lakes extending from Lake Nyassa through Lake Tanganyika and the great Rift Valley, the Red Sea and Dead Sea, over five thousand miles in length. In the United States there is the block faulting of the Great Salt Lake Basin, the basin of Death Valley, Yosemite Valley, and Lake Tahoe, as well as the basin of Lake Superior, to mention the best-known examples.

The explanation of these dropped blocks is to be found in the slumping down of segments between cracks, or the dropping of wedge-shaped pieces on the sides of rift cracks. The cracks themselves are caused by the expansion of the sub-crustal material in changing from a geseous state denser than the solid to a solid.

Where there is no cap rock which will stretch without fracture, the crack extends through to the surface, and anything of a gaseous nature which comes up the crack escapes into the atmosphere, and is blown about and dissipated. The cap rock or seal above the crack is an all-important condition for the accumulation of the salt, sulphur, and oil in the salt domes. The process by which the salt, sulphur, and petroleum are accumulated and condensed is expressible in one word: sublimation.

Petroleum of Inorganic Origin

It is well known that salt and sulphur come from the interior and are a part of the material extruded from volcanoes, but it is not so commonly known that petroleum is also of inorganic origin. Illustrating the differences between petroleum and organic oils, whether animal or vegetable, the following list may be studied to some advantage by those who hold that petroleum is of organic origin:

First: All organic oils, whether animal or vegetable, have both of the elements of water, H and O, as a part of their composition. This makes these oils carbohydrates. The oxygen cannot be driven off unless the oil is destroyed by heat. The familiar process of frying anything once, as practised by some cooks, will illustrate the point. Petroleum, on the other hand, has no oxygen in its composition, and is a mixture of hydrocarbons of the composition expressed by the formula C_nH_{2n+2}.

Second: All organic oils, and organic matter generally, are good fertilizers and promote plant growth. Petroleum kills all plants and is used to kill weeds and grass on roads and railways.

Third: Organic oils, both animal and vegetable, have food values for animals and men. Petroleum has no food value, and the lighter hydrocarbons, such as kerosene and gasolene, are poisonous and are used as insecticides.

---

[1] *Engineering and Mining Journal*, [illegible] 1921.

Fourth: All organic oils when boiled with caustic soda and potash yield soap and glycerine. Petroleum does not.

Fifth: Organic oils when exposed to sun and air become rancid. Petroleum evaporates, but does not become rancid.

These radical differences of composition and properties show plainly a difference of origin. If petroleum were of organic origin, it would undoubtedly have oxygen in its composition, as oxygen is inextricably connected with all process of organic growth and decay. If petroleum were of organic origin, it would have some of the properties of organic oils, and it has none of them except an oily texture, and another things than oils have that; for example, concentrated sulphuric acid.

To deny the organic origin of petroleum demonstrates nothing; it is essential, to the development of a logical theory concerning its genesis, to prove that it can be of inorganic origin.

PETROLEUM HYDROCARBONS IN METEORITES

It was found several years ago that meteorites which were freshly fallen had hydrocarbons of the petroleum type as a part of their composition. Reference to this may be found in Chamberlin and Salisbury's "Geology," in that part which deals with the planetesimal hypothesis. If the earth be conceived to be an aggregation from planetesimals or meteorites, we can at once see why it should have hydrocarbons in its gaseous interior. The hydrocarbons and many other gases would be held there by the power of diffusion, which may have placed them there originally in case the planetesimal hypothesis be not correct. As between the gaseomolten theory or the planetesimal hypothesis there is no difference as regards the presence in the earth's interior of hydrocarbon and all other gases, including steam, for volcanic action.

Applying the theory of the origin of the salt domes and the inorganic origin of petroleum as outlined to the Appalachian oil fields, the following differences arise, due to the *absence* of "sands" in the Gulf Coast section: The salt, petroleum, and sulphur are confined to the domes of their immediate flanks. In the Appalachian oil fields the rift cracks end in "sands," which are porous and allow the oil, gas, and salt water to spread out laterally under large areas covered by an impervious blanket seal of shale, which has stretched under the pressure of the overlying rocks and prevented the cracks from extending further upward.

The oil and gas spread from the rift crack source laterally, and not up the flanks of the anticlines or toward the center of a dome, as supposed by the advocates of the organic theory. The anticlines and domes are also the direct result of elevation by reduction of density due to the local accumulation of leavening gases and light material. In fact, the cart has been placed before the horse, and effect has been mistaken for cause.

The domes and anticlines are not the cause of the accumulation of oil and gas, but the effect of that accumulation over the rift cracks, which are invisible but none the less there.

Petroleum Imports Decreased and Consumption Increased in August

The outstanding facts of petroleum statistics for August, according to the U. S. Geological Survey, compared with those for July, are the decrease in imports of more than 4,500,000 bbl. and the increase in consumption of 1,250,000 bbl., which, despite an increase of production of 636 000 bbl., resulted in a substantial check to the accumulation of stocks of crude oil that has been in progress for many months. The output for August was approximately the same as that for March, and only 1,000,000 bbl. below the record production of May, yet it should be noted that in its total value the August production is far below that of other months, having only about one-third the value of the smaller output of August, 1920. Another significant fact is that the number of productive wells completed during August is the smallest for the year and, indeed, for many months.

Stocks during August increased only 671,000 bbl., whereas since the beginning of the year stocks of crude oil have been increasing at rates between 6,000,000 and 8,000,000 bbl. a month. During August stocks of

PETROLEUM PRODUCED IN THE UNITED STATES IN JULY, 1921, AUGUST, 1921, AND AUGUST, 1920

(Barrels of 42 U. S. Gallons)

	July, 1921		August, 1921		August, 1920	
	Total	Daily Average	Total	Daily Average	Total	Daily Average
[illegible]	[illegible]	[illegible]	10,217,000	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Central and Northern Texas	[illegible]	178,161	5,253,000	[illegible]	[illegible]	[illegible]
Coastal Texas	[illegible]	82,484	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	1,842,000	59,419	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	4,290	144,000	[illegible]
[illegible]	1,400,000	[illegible]	1,900,000	61,290		
Wyoming:						
Salt Creek	[illegible]	21,681	[illegible]	[illegible]	[illegible]	[illegible]
Big Muddy	[illegible]	[illegible]	148,000	4,774	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	88,000	[illegible]	[illegible]	[illegible]
Elk Basin	[illegible]	1,580	45,000	[illegible]	[illegible]	[illegible]
Other districts	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total Wyoming	1,143,600	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	18,258	675,000	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	444,000	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3,742	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2,484	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	24,000	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	9,000	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(a) Revised. [illegible]

California petroleum increased 2,173,000 bbl. and net stocks east of California increased 1,611,000 bbl., but stocks of Mexican petroleum held by importers in the United States decreased 3,113,000 bbl. The quantity of these stocks on Aug. 31—168,023,000 bbl.—is more than 52,000,000 bbl. greater than a year ago, an increase of 46 per cent.

Production in California decreased during August as compared with July, 221,000 bbl., which resulted in the state losing first rank to Oklahoma. Decreased production during August is reported also for Kansas, Louisiana, West Virginia, and Tennessee, but increases are reported from other producing states. Arkansas continued its remarkable gain, and in August produced almost as much as Louisiana, it being possible that when complete figures become available the state will have surpassed Louisiana in rank.

The figures in the table on page 623, compiled from company reports to the U. S. Geological Survey, show the quantity of petroleum removed from producing properties.

Prospecting for Oil in Australia

SPECIAL CORRESPONDENCE

The bonus of £50,000 offered by the commonwealth government for the discovery of oil in commercial quantities in Australia has stimulated prospecting for petroleum in several of the states. The efforts in this direction that have attracted most attention lately are those of the South Australian Oil Wells Co., not in South Australia but in Victoria. This company, which is really a Melbourne concern, originally directed its attention to South Australia, but not long ago was reported to be in difficulties with its latest bore there—one sunk at Tantanoola, near Mount Gambier. Now, however, the company has obtained an option over an area at Moutajap, near Hamilton, in Victoria, where a bore put down for water several years ago was said to have disclosed the presence of petroleum. This bore, now down 172 ft., has been inspected by the company's superintendent, H. G. Dod, who has had considerable experience in the Californian oil fields, and he has reported that oil sands proved by the drill have shown the existence of oil and that the indications of oil in the locality are favorable.

Mr. Dod asserts that thick beds of carbonaceous shale contain the organic matter necessary for the formation of supplies of oil, that there are the proper series of strata favorable to the concentration of oil, and that the actual occurrence of petroleum in the shallow bore gives indications of becoming stronger with increasing depth. He writes confidently, and says the possibility of striking payable oil is good. The company has secured leases covering about 500 acres, and intends letting contracts soon for deepening the present bore and putting down others.

In Western Australia, where large areas have been taken up under oil licenses, prospectors have lately sunk a bore 130 ft. on the Fitzgerald River, near Bremer Bay, and claim to have reached oil sands at 28 ft. The discoverer, who has been prospecting the country for oil for eighteen years, speaks glowingly of his prospects, but there has not yet been time for his conclusions to be confirmed by independent evidence. A government geologist is now inspecting the field. Similar indications to those nearer Bremer Bay, which is in the south, have been found in the far north of the state, and geological evidence favors the latter section of the country as against the south.

In Queensland, efforts are still being made to continue drilling at the Roma state bore, in which a broken bit and a part of the stem are jammed about 3,300 ft. down. The driller is doing preparatory work before starting to deflect the bore at 3,000 ft. and if possible drill beyond the obstruction below. He has been occupied at this task for two months or more.

Nothing has been heard for some time of the drilling which was begun last year at Woolston, near Brisbane. This drill was begun on the faith of a "diviner," and the latest report from the locality, published as long ago as last February, was that a depth of 600 ft. had been reached. The diviner was then reported to be "expecting results."

Crude Oil Advances in Price

SPECIAL CORRESPONDENCE

The Texas Co. announced an advance of 25c. per bbl. in the price of North and Central West Texas crude oil on Sept. 28. This advance was met the same day by the other large companies. A second advance of 25c. was made on Oct. 1 by the Sinclair Oil Co., making the price $1.50 per bbl. The price of mid-continent oil, grades Cushing, Yale, Comanche, and Duncan, was also advanced 25c. on Oct. 1 by the Sinclair and Magnolia companies. The advance was met by the Texas Co., and other large companies are expected to follow. During this same week the Standard Oil Co. of Louisiana made two 10c. advances in the price of Eldorado, Ark., crude oil, making the prices 90c. for 34 deg. Bé. and less and $1 for over 34 deg. Bé.

Chile Increasing Consumption of Fuel Oil

Oil is the principal fuel of the Chilean nitrate region, but Iquique is worth consideration as a market for coal, although at present there is no market for the latter, according to a report by Homer Brett, U. S. Consul at Iquique.

Oil has the advantage over coal in this port in that it is handled in the most modern fashion. There are on the shore seven tanks of 33,000 bbl. capacity each, and through pipes running out into the harbor they can pump into bunkers or out of tankers. The railway that serves the nitrate region has many tank cars in use and more under order. Besides these advantages in handling, there is an equally great one in merchandising methods. Oil is brought to Iquique by the producers, kept in stock by them, and sold direct to the ultimate consumer, whereas coal, both at the point of origin and here, is passed along by an almost endless train of agents, brokers, exporters, importers, wholesalers, and retailers. A tank steamer puts out 7,000 tons of oil in a few hours, while a steamer with four hatches does well to discharge 7,000 tons of coal in Iquique in eleven days.

Oil will probably not displace coal for use in the greater part of Chile, but in the nitrate district it has largely done so, and will completely replace it unless better methods of handling and selling coal are put into effect. The freight situation will then be affected, as regular steamers would have to come for nitrate in ballast, and tankers cannot, or at any rate have not, yet carried nitrate as cargo.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Boston Section of A. I. M. E. Opposes Engineers Licensing Bill

The sixty [illegible] meeting of the Boston Section of the A. I. M. E. was held at the Engineers Club at Boston, Mass., on Oct. 3, 1921. The meeting was called to order by S. W. Hutchinson.

In the absence of Prof. E. E. Bugbee, Mr. Hutchinson gave an résumé of the report describing the efforts of the joint committee representing the engineering societies of Massachusetts in opposing the Engineers Licensing Bill in that state. Following this report, G. H. Clevenger made a motion, which was seconded by S. J. Jennings, commending Professor Bugbee for his activity and approving his action and that of the committee. After discussion by A. H. Rogers and Mr. Jennings, the motion was passed unanimously, and Professor Bugbee was reappointed as representative for this year.

Mr. Hutchinson reported the plans of the program committee for the next two meetings and then introduced C. W. Goodale, who gave some interesting reminiscences of the formation of the Institute in 1871 and the first meetings.

Mr. Goodale was followed by G. H. Clevenger, who described some lively and interesting meetings at Butte, Denver, Salt Lake, and San Francisco. G. G. Wolkins and S. J. Jennings followed with some observations on the Scranton meeting and the anthracite coal field, the consensus of opinion of all who had attended being that the meeting was admirably managed and most interesting.

The remainder of the meeting included a discussion of anthracite and bituminous coal costs, methods, and production, by F. W. Denton, Mr. Jennings, Mr. Wolkins, and Mr. Rogers.

San Francisco Section A. I. M. E. Meets Director Bain

A large and enthusiastic gathering of the San Francisco Section of the A. I. M. E. greeted H. Foster Bain, director of the U. S. Bureau, of Mines, on the evening of Oct. 4. Marion E. Rhodes, chairman of the House Committee on Mines and Mining, who is accompanying Director Bain, in addressing the section stated that the Committee on Mines and Mining occupied a [illegible] position on the proposed bill revising the existing Federal mining laws and invited mining engineers and operators to communicate with the committee and express their views upon it as far as possible.

Referring to the McFadden bill, Mr. Rhodes said that it is conceded that there are [illegible] fewer reasons for the passage of this legislation than there were a year or more ago. He touched briefly on the war minerals relief legislation, pointing out that the claims that would have to be met if the legislation were to be enacted would aggregate a half billion. He stated there was a more widespread demand for tariff legislation than ever before. In his opinion, Congress ought to impose protective duties that would permit many mining enterprises to revive that are now dormant through the inroads of foreign competition. He said: "We are going to do what we can to infuse new life into the mining industry."

Dr. Bain, the next speaker, discussed Institute affairs briefly and then took up revision of the Federal mining laws. In detail he discussed many of the provisions of the proposed laws and showed how they would operate to simplify and clear up existing difficulties and anomalies.

Utah Mine Operators Discuss Problems

The Utah Metal Mine Operators' Institute held meetings at the Commercial Club of Salt Lake City on Oct. 7 and 8, ending with a dinner and dance on Saturday evening at the Hotel Utah. During the Friday morning session the following papers were presented: "Requirements of Hoist Signaling in Metal Mines," by Leonard Wilson, consulting electrical engineer, followed by discussion led by T. P. Billings, O. N. Friendly, and W. H. Cole; "Improved Methods of Stoping Suitable to Utah Mines," by A. S. Winther, general superintendent, Utah Consolidated Mining Co.; "The Mitchell System," by J. B. Hafner, foreman, Titanic Standard mine; "Top Slicing," by A. P. Mayberry, superintendent, Centennial Eureka mine; followed by discussion led by Joseph Hyland, R. E. Phelan, and J. A. Norden.

The Friday afternoon session included the following papers: "The Field for Storage Battery Locomotives in Utah Mines," by E. A. Hamilton, superintendent U. S. Mines, Bingham, followed by discussion led by [illegible] and H. T. Plumb; "Efforts of the American Mining Congress in Standardizing Mining Machinery and Materials," by H. C. Goodrich, chief engineer, Utah Copper Co., followed by discussion led by Charles Zabriskie and F. H. Hedrick.

The Saturday meeting covered the following papers and discussions: [illegible] in [illegible] Gases [illegible] Drills," by A. J. May, superintendent, [illegible] mine, followed by discussion led by Lew Meyer [illegible] and A. G. Mackenzie; "The Present Status of the [illegible] Drill," by H. G. Snyder, [illegible], followed by discussion led by William Owens and H. [illegible] and "Should Metal Mine Operators of Utah Conduct Future Meetings of this Kind," by L. S. Cates, manager, Utah Copper Co., the discussion being given by E. F. Birch, A. G. Makenzie, D. D. Muir, and J. F. Johnson.

Natomas Co. Entertains California Dredge Operators

Gold-dredge superintendents of California held their monthly meeting at Natoma and vicinity on Sept. 27. They were the guests of the Natomas Company of California. L. D. Hopfield, in charge of the gold-dredging operations at Natoma, planned an interesting day's entertainment, which began at the Fair Oaks rock-crushing plant. At this plant the waste rock resulting from dredging operations is washed and part of it crushed. Washed gravel and crushed rock in several sizes are shipped to many points in the state for road building and construction purposes.

After luncheon Natoma No. 8 was visited. Natoma 9, which recently sunk, was next inspected. The dredge pond has been unwatered and the dredge is being dismantled. The hull rests on its side, making an unusual and spectacular sight. Natoma No. 7, to which the guests were taken also, is being dismantled preparatory to moving it to another area. After supper at Natoma, the regular meeting was held at the club house of the company. Charles W. Gardner presented a paper, "Drilling Results and Dredging Returns," a continuation of the discussion introduced by C. H. [illegible] at the Nevada meeting of [illegible].

R. G. Smith, engineer assistant to L. D. Hopfield, made [illegible] reply to Mr. Gardner, and showed that the recovery of the dredge was an important factor in [illegible] discrepancies between the results obtained in the [illegible] and the [illegible] made in operation.

Pennsylvania State College Plan of Industrial Training

[illegible]

istics which entered into its success or failure.

According to the Extension staff, the chief reasons for the poor results obtained in most industrial classes are the differences in previous education and experience on the part of the students, their varying capacity for study, the use of the wrong kind of lesson material, and the fact that too often they have to study what is offered rather than what they want.

These objections, together with many others, have been completely removed by the new State College plan, which is, in effect, a combination of class and correspondence study. There the student studies anything he wants, regardless of the fact that no others may be taking the same subject. He may select anything along the lines of shop mathematics, drawing, electricity, power-plant subjects, mechanics, strength of materials, or design, and his lesson material will be elementary or advanced, according to the amount of his previous education and experience.

Bureau of Mines Submits Standard for Permissible Explosives

Standard specifications for the testing and use of permissible explosives for use in mines, "Bureau of Mines Schedule 17," are now before the American Engineering Standards Committee for consideration and approval as tentative American standards. These standards are the result of thirteen years' experience by the Bureau of Mines in testing and in assisting manufacturers to develop explosives which offer the minimum hazard, when properly used, in gaseous and dusty mines.

Standard methods of testing explosives were first published by the U. S. Geological Survey as "Explosives Circular No. 1" on May 15, 1909, together with the first list of seventeen permissible explosives. By 1915 data on the testing of upward of 200 explosives had been accumulated, and 134 explosives had been placed on the permissible list. In June, 1915, the Bureau of Mines called a conference of representatives of manufacturers of explosives to discuss the methods of testing employed and to determine the tolerances to be permitted in the retesting of field or of manufacturers' samples. As a result of this conference, a series of tolerances was issued on July 1, 1915.

In November, 1920, the Bureau of Mines reviewed the rules and regulations then governing the testing and placing of explosives on the permissible list. In this review the committee took into consideration the data accumulated in the testing of 290 different explosive materials, of which 195 had been classed as permissible. The revised rules formulated as a result of this study were submitted to the explosives manufacturers of the country for their comment and criticism. With these comments in hand a final revision was made and approved as "Schedule 17" on April 8, 1921.

The committee would be glad to learn from those interested of the extent to which they make use of these specifications, and to receive any other information regarding the specifications in meeting the needs of the industry.

Men You Should Know About

David White was in Nashville on Oct. 7 to confer with state geologists.

D. F. Hewett is doing field work for the U. S. Geological Survey near Good Springs, Nev.

Morton Webber has returned from Mexico to New York, and left for Canada on professional business.

S. Paul Lindau has accepted the position of engineer for the western branch of the United States Gypsum Co.

Dr. Gustaf Alling, a mining engineer of Stockholm, Sweden, is in the United States to make a study of hygienic conditions in mines.

P. A. Anderson, mining engineer, and **Folke Westerberg**, civil engineer, both of Kiruna, Sweden, are visiting the Michigan iron ranges.

M. C. Lake, of Wilkes-Barre, Pa., geologist for M. A. Hanna & Co., inspected the company's properties at Crystal Falls, Mich., recently.

George H. Garrey, consulting geologist for the Tonopah Belmont Development Co., arrived in Tonopah on Sept. 28 from his Philadelphia headquarters.

A. J. Collier, of the U. S. Geological survey, has returned to Washington after having been engaged in classifying mineral land on the Fort Belknap Indian Reservation.

Alfred H. Brooks, head of the division of Alaskan Mineral resources of the U. S. Geological Survey, returned to Washington on Oct. 10, after having spent the season in Alaska.

Howard R. Ward, of New York, will be in the West during October and November, making examinations of mining properties in Arizona, Baja California, and northern California.

Prof. A. E. Seaman, who has been conducting geological work in the Crystal Falls (Mich.) district for the McKinney Steel Co., has taken up his duties at the Michigan College of Mines.

H. Foster Bain, director of the U. S. Bureau of Mines, has found it necessary to curtail the latter part of his Western trip, and is expected to return to Washington by the middle of the month.

Martin Schwerin, manager of the Spar Mountain Mining Co. for the past three years, will resume the practice of consulting mining engineer on Jan. 1, with offices at 42 Broadway, New York City.

Alvin E. Richards, formerly superintendent of the Tobin Mine of McKinney Steel Co., is now superintending operations at the Imperial mine, Michigamme, Mich., for the Henry Ford interests.

Arthur L. Walker, professor of metallurgy, will attend the convention of the American Mining Congress to be held at Chicago, Oct. 17, as representative of the engineering schools of Columbia University.

C. V. Corless, general manager of the Moud Nickel Co.'s operations in Canada, has returned from a consultation with the head office in England. He states that there will be no further curtailment of mining and smelting work.

George S. Rice, chief mining engineer of the U. S. Bureau of Mines, assisted personally last week in some of the final tests of the effect of automobile exhaust gases in a tunnel which were made at the experimental mine at Pittsburgh.

Bernard MacDonald, previously in charge of the mining and milling operations of the Veta Grande unit of the American Smelters Securities Co., in the Parral district, has opened an office in the city of Parral and will take up private professional work.

George L. Heath, formerly chief chemist for the Calumet & Hecla Mining Co., has joined the faculty of the Michigan College of Mines at Houghton. Other new members of the faculty are **R. R. Seeber**, formerly manager of the Winona mine, but more recently in Nova Scotia, and **W. C. Polkinghorne**, who was superintendent of the Ahmeek stamp mill at the time of its suspension last April. Messrs. Seeber and Polkinghorne are graduates of the college.

Mining and metallurgical engineers visiting New York City last week included: **C. L. Colburn**, Pittsburgh, Pa.; **George A. Packard**, of Boston, Mass.; **A. L. Flagg**, of Phoenix, Ariz.; **H. W. Edmonson**, of Eden, Vt.; **Warren D. Thompson**, of Boston, Mass., and **A. L. Lewis**, of Chile.

Society Meetings Announced

The annual meeting of the **Society of Economic Geologists** will be held, in conjunction with the annual meeting of the **Geological Society of America**, at Amherst College, Amherst, Mass., Dec. 28-30, 1921.

Obituary

Charles W. Whitley, vice-president of the American Smelting & Refining Co., died on Oct. 9 of pneumonia, at the age of fifty. Mr. Whitley had extensive business interests throughout the West and represented the A. S. & R. Co. in Salt Lake City until three years ago, when he came to New York to assume the vice-presidency of the company.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

Recent experiments of the Anaconda Copper Mining Co. in the manufacture of a rust-proof copper shingle have attracted some attention, as being part of a movement to create new uses for copper. The slogan "Buy Something Made of Copper" is also being widely used in the Southwest.

The United Verde Extension Mining Co. has acquired coal mining rights on 200 acres of land at Gallup, N. M., thus insuring a supply of fuel for its powdered-coal-fired reverberatories. Plaintiffs in a smoke damage suit against the company have been awarded nominal damages.

A departure from its usual metallurgical practice is to be made by the Springs Mines, in South Africa, which company intends to abandon stamp milling and amalgamation in extending its treatment plant and adopt an all-sliming and direct cyaniding process.

The McFadden gold bonus bill stands little chance of passing, if Secretary Mellon, of the Treasury, has anything to say about it. His reply to the Western Senators, recent request will be given out soon.

A conference on the exchange situation is proposed in a bill, hearings on which have been started by the House Committee on Banking and Currency.

Iron-making conditions in the Birmingham district of Alabama are showing a slight improvement and the future is brighter. The situation in the Lake Superior district is still very dull, though various companies are hastening to ship their stockpiles before cold weather sets in.

"Buy Something Made of Copper" Slogan in Southwest

Calumet & Arizona Offering $50 for Best Suggestion—New Cornelia Making Copper Road Signs and Other Articles

The slogan "Buy something made of copper" has spread all over the Southwest. Leading in the movement is the Calumet & Arizona Mining Co., which is offering a $50 prize for the best suggestion received for utilization of copper. The New Cornelia, a C. & A. subsidiary, is "casting" articles, such as automobile radiators, road signs of several sorts, and kitchen utensils, all perfected in the sulphuric acid tanks at Ajo. One practical use for copper sheets is in roofing a new home in Jerome for Lewis Douglas. The owner wants the copper to turn green, but it oxidizes brown in the dry Arizona air. So he is having the roof painted with acids to bring out the desired hue.

U. V. Extension Gets Coal Mining Rights at Gallup, N. M.

Announcement has been made by George Kingdon, general manager of the United Verde Extension Mining Co., that he has secured for his company coal mining rights on 200 acres of land at Gallup, N. M. The purchase was from the Mutual Coal, Light and Power Co., which has retained surface rights to forty acres within the Gallup townsite, this tract to be divided into town lots. With the coal land is included a right of way for a railroad to the main line of the Santa Fe railroad from the property's coal tipple. The purchase is of much importance, in that it assures a fuel supply for the Extension's reverberatory furnaces, which are operated with powdered coal, instead of oil. Until copper production is resumed at Clemenceau, the Gallup coal property will be operated, under lease, by H. R. Wypur and associates.

Anaconda Makes a Copper Shingle Experimentally

Copper-Zinc Alloy Used Said To Be Rust-Proof—Question of Cost Remains To Be Solved

Production of a metallic shingle at the Washoe Reduction Works of the Anaconda Copper Mining Co. created some interest recently in metallurgical circles in Butte, this experiment appearing to promise much in the way of the development of a new enterprise for the Anaconda company, and, incidentally, further emphasizes the attention this copper producer is giving to the matter of a diversification of its activities. These shingles are made of an alloy of copper and zinc and are said to be impervious to rust. They are 10 by 24 in. in size, are thin, tough and give a neat appearance to a roof, a small building at the smelter having been covered with them. It is believed that the color can be varied. All that remains is to bring the cost of manufacturing down to that point where they can be placed upon the market in successful competition with the wooden article, and it is believed that this can be done.

Attention is also being given to the manufacture of a [illegible] made up of the same alloy, and the [illegible] believe they have a product which will be heard from later. The experiments of the Anaconda are in line with the program of the copper producing companies to promote new uses to which copper may be applied in order to create new markets.

Outlook at Birmingham Reported To Be Better

Ten Furnaces Expected To Be in Blast Oct. 16—Rumored That Various Ore and Coal Mines Will Resume

The October schedule for Birmingham district iron makers would seem to clearly indicate that the bottom for pig-iron making in Alabama has finally been reached and that an upward trend of affairs toward normal may now reasonably be taken as an established fact. Heretofore, under similarly depressed and bad market conditions there would have [illegible] been eight to ten stacks in blast with almost 300,000 to 400,000 tons of iron in the furnace or the warrant yards, and with stocks still accumulating, whereas early in 1921, under recent unprecedented conditions, [illegible] and depressing, furnaces continued to go out of blast until only two stacks remained active out of a possible total of forty-odd furnaces, and an average total of about twenty-seven.

In the Birmingham district today, [illegible]

[illegible]

Three new furnaces are to be put in blast, making ten in all which should be in active operation by Oct. 16.

No. 2 stack of the Woodward Iron Co., which has recently been under repair, will be fired at once, making the full bank of three furnaces at Woodward in blast.

The Republic Iron & Steel Co. should have its No. 1 Thomas furnace, a 300-ton stack, in blast by this time.

A third new addition to October iron making will be the No. 1 furnace of the Alabama Company at Gadsden.

No announcement of increased iron production in the immediate future has as yet been made by the Tennessee Coal, Iron & R.R. Co., four of whose Ensley furnaces are now running on basic iron.

Three of the six open-hearth furnaces of the Gulf States Steel Co., idle since early this year, were again lighted on Sept. 30, all departments now being active except the iron furnace, which is not likely to resume before late in the year.

Should conditions warrant, there are still eight furnaces in the Birmingham district which could be blown in at twenty-four hours' notice, five within a week, and six more in from sixty to ninety days.

In view of the more active iron-making program, considerable attention has been and is being given to resumption by ore and coal mines.

All the ore at present mined by the Tennessee Coal, Iron & R.R. Co., on Red Mountain, is going to its four furnaces in blast at Ensley, two of its Muskoda mines having recently resumed operations.

Muskoda No. 6, which is the largest ore mine of the Tennessee company on Red Mountain, working the largest number of men, is again operating three days per week, and will for the present continue to be so operated. Muskoda No. 4, the starting up of which was announced, has been delayed by shaft repairs.

It is rumored that Raimund Mines will resume operations on or about Oct. 15, but no official announcement has yet been made to that effect.

The fact that repair and a general clean-up program has been in progress at the Sloss mines is assumed to indicate that their opening up is imminent, although the Sloss Sheffield Steel Iron Co. has as yet no furnaces again in blast and has made no official announcement of activity either in mining or in iron making.

The ore mines of the Woodward Iron Co. will soon be approaching normal output, with the full complement of stacks at Woodward in blast.

Some entirely new developments in Alabama iron making may be foreshadowed by the filing on Sept. 21 of two mortgages in DeKalb County, one given by the White Coal & Iron Co., for $1,500,000, the other, issued by the Palatine Mining & Development Co., for the same amount, both mortgages being in favor of the Chicago Title & Trust Co., of Chicago, covering mineral lands recently acquired, both coal and iron, in DeKalb and Marshall counties, Alabama. It is understood that the property so acquired is the original holdings of the Fort Payne Coal & Iron Co., succeeded by the Fort Payne Co. about thirty years ago, after its failure. Should the announced program of the present owner of these properties be carried out, some developments of interest may be looked for in and around Fort Payne at an early date.

Hecla Injunction Suit Out of Court's Jurisdiction

Plaintiffs Announce Intention of Applying to Idaho Court — Will Bring Bunker Hill & Sullivan into Case

Judge Huneke, of the Superior Court of Spokane County, Wash., decided on Oct. 5 that his court had no jurisdiction in the suit brought by Eugene R. Ray and Sarah E. Smith, minority stockholders of the Hecla Mining Co., who sought to restrain the directors of the company from proceeding with the contract for purchase of an half interest in the Star mine. The court sustained a motion made by the defense for dismissal. The temporary restraining order was held in effect for five days pending the security of an injunction by the plaintiffs in Idaho courts and to permit the plaintiffs to bring the Bunker Hill & Sullivan company into the case. The order was based on the fact that the Bunker Hill company had an interest in the suit and being an Oregon corporation was beyond the jurisdiction of the Washington courts. The plaintiffs announced their intention of applying immediately for an injunction from Idaho courts.

North Broken Hill Report Shows Net Loss for Year

By Cable From Reuters
to "Engineering and Mining Journal"

London, Oct. 10—Despatches received today from Melbourne, Australia, report that the operations of North Broken Hill, Ltd., show a net loss of £62,242 for the past year.

Rio Tinto Passes Dividend

By Cable From Reuters
to "Engineering and Mining Journal"

The Rio Tinto Co., Ltd., failed to declare an interim dividend on its ordinary shares. The half yearly dividend on the preference shares was, however, maintained.

Taxes Increase 30 Per Cent at Ironwood, Mich.

The total tax rate in the city of Ironwood will this year amount to about $5.20 per $100, which is an increase of nearly 30 per cent over last year's rate. The mining companies pay about 80 per cent of the taxes in the city, and they are in consequence greatly affected by this increase. The state tax was decreased considerably, but the city's tax was increased much more.

Mining Conditions Improving In British Columbia

Gold Production May Drop in 1921, But Outlook Is Brighter—Silver Situation Better

By Robert Dunn

Victoria—Activity both in placer and lode gold mining is becoming more marked in British Columbia. As to the former, however, it is too late in the season to expect that the revival will have much, if any, effect on the year's output. A general survey of the placer and lode mining situation points to a decline in the total value of the year's work in comparison with the output of the previous year.

The Nickel Plate mine was the big producer in the past. Its output was much less than usual in 1920, and the mine was closed down entirely in the fall. In 1921 it has been doing nothing. The Rossland mines, another important source of gold heretofore, have been operating in desultory fashion. The Britannia Mining & Smelting Co., on Howe Sound, the gold production of which is usually not inconsiderable, has been idle for months, the only work being that of development.

On the other hand, the Nickel Plate has again opened up, and there are clear signs of bigger operations at Rossland; the Britannia will be a substantial shipper again as soon as the mill now being built to replace the one burned down is completed. A few months will accomplish this work. The Belmont-Surf Inlet mine on Princess Royal Island, which last year produced more than 44,000 oz. of gold, 20,000 oz. silver and more than 500,000 lb. of copper, has been doing work involving, among other things, the construction of a tramway to connect the Pugsley mine with the Belmont mill. With this finished the output will be materially increased. The Hidden Creek mines and the smelter of the Granby Consolidated Mining & Smelting Co., have been working steadily, and some gold has been produced. Probably about the same quantity will be shown for 1921 as in 1920.

The output in 1921 of the Premier Mining Co., on Salmon River, can only be estimated. Last year 800 tons of ore was shipped, carrying 2,283 oz. gold and 77,352 oz. silver. Doubtless this, because of the expensive transportation, was selected ore. With these charges reduced, and especially with the aërial tramway completed, more ore, probably of a lower average grade, will be shipped. Everything considered, it is probably that the gold output of the Premier will show a considerable increase.

In addition to these, the Dolly Varden, near Alice Arm, produced, when shipping, considerable lode gold, and there are prospects both in the Portland Canal and the Alice Arm sections, and elsewhere which have promise. Among these are the Emancipation, near Hope, where a new mill is being installed; the Nugget, at Sheep Creek, where the orebody has been proved;

the Pioneer and the Lorne mines, in the Bridge River district; and the newly discovered gold area of the Whitewater region, in the Lillooet district, to which a rush of prospectors is expected next season.

As to placer mining, it is stated by one of the prominent operators of the Cariboo that the production there will be about the same in 1921 as it was in 1920, when it was 3,300 oz., which came from the officially designated divisions of Cariboo and Quesnel. It is thought that the output from the Cassiar will show a slight decline in 1921. The 1920 production in the Cassiar division, covering the Atlin, Stikine, and Liard districts, was 6,930 oz.

However, there is a marked quickening of interest in placer mining. Dredging and hydraulicking leases are in demand. Individual claims are being staked and worked more extensively than for years. This applies not only to the established camps of the Cariboo and the Cassiar, but as well to the less generally known fields of the Kootenays. The Wild Horse Creek Placer Gold Mining Co., on Perry Creek, is about to close the season's operations and is looking forward to a satisfactory clean-up. Other hydraulicking operaations have been under way on this creek during the season, with good result. The Roses Gulch Placer Gold, Ltd., organized at Vancouver, has four claims at Quesnel for the exploitation of which capital is being raised.

Summing up, there may be a decline in the gold production of British Columbia for 1921, but given a continuance of the present trend toward more normal conditions, the industry should show a notable improvement next year.

Regarding silver production it may be noted that the market has been down and that the independent operators of the chief silver districts of British Columbia, namely, the Slocan and other sections of the Kootenays, have been doing very little. Now, however, conditions are changing. Early in October silver was back to 71¾c. per oz. This, together with the announcement of the Consolidated Mining & Smelting Co. that a change will be made in the schedule of treatment charges and that hereafter cash will be paid for ore, has had an inspiring effect on the mining industry throughout the Interior. Mines that either have been shut down or working on development alone are being put in condition for shipment, and there is not the slightest doubt that the output will be materially increased in the immediate future. Apparently the effect of the new buoyancy is not confined to the Kootenays, as it is reported on good authority that the Taylor Mining Co. is to proceed with further development of the Dolly Varden mine, at Alice Arm, which has been practically closed down for some months. It is said that 4,000 tons of ore will be shipped in November. On the Wolf group adjoining, belonging to the same company, a compressor plant is being installed, and 500 ft. of tunnel work will be done during the winter. The hydro-electric plant placed on the Wolf last summer will supply the power needed at the Dolly Varden and in the development of the Wolf.

NEWS FROM WASHINGTON

By PAUL WOOTON

Special Correspondent

Mellon Against Gold Bonus

Secretary of Treasury Does Not Favor McFadden Bill — Reply to Senator Oddie To Be Made Public Soon

The Secretary of the Treasury does not favor the payment of a bonus to stimulate gold production. This is set forth clearly in his reply to Senator Oddie of Nevada, who transmitted to him the recent resolution signed by twenty-two Western Senators in which arguments were presented for the need of increasing gold production.

The text of the reply of Secretary Mellon has not been given out as yet, but it is understood that his attitude is practically the same as that of the Treasury Department during the preceding administration. Senator Oddie expects soon to give out Secretary Mellon's letter, accompanied by a statement pointing out some of the exceptions that he takes to the Secretary's premises and conclusions.

Over Half of Rail Tonnage Mine Products

During the quarter ended June 30, 1921, the Class 1 railroads of the country carried as revenue freight 124,145,-[illegible] tons classified as products of mines. The division of the tonnage is as follows: Anthracite coal [illegible]; bituminous coal [illegible]; coke, 1,563,567; iron ore, [illegible]; other ores and concentrates, [illegible]; base bullion and matte, 93,416; clay, gravel, sand and stone, 22,843,027; crude petroleum, 1,159,380; asphaltum, 328,825; salt, 627,908; and other products of mines, 711,901. The total tonnage hauled during the second quarter of all commodities was 222,575,624 tons. Thus the products of mines represented more than one-half of the grand total.

The tonnage of the other groups is as follows: Products of agriculture, 21,-385,267; animlas and products, 5,775,453 tons; products of forests, 19,746,413 tons; manufacturers and miscellaneous, 41,894,693 tons.

Conference on Foreign Exchange Proposed

House Banking Committee Starts Hearing on Bill Authorizing Meeting

Hearings were begun Oct. 8 before the Banking and Currency Committee of the House of Representatives on the bill which would authorize the President to invite Great Britain and France to send three representatives each to Washington to meet three representatives of the United States in a conference on the exchange problem. Representative McFadden, the chairman of the committee, attributed the slowness of business recovery to the uncertainties of exchange. H. N. Lawrie, the economist of the American Mining Congress, appeared before the committee and urged the passage of the bill. He said the mining industry is particularly dependent on export trade if full time operation is to be maintained.

Production of Copper in Alaska Likely To Increase

Large Producers Have Long Life in Prospect, in George S. Rice's Opinion —Extensive Mineralized Areas Exist

Every indication points to a progressive increase of copper production in Alaska, according to George S. Rice, chief mining engineer of the U. S. Bureau of Mines, who recently returned from an extended trip through that territory. Mr. Rice bases his belief on the fact that the large [illegible] evidence of being long-lived [illegible] reason to suppose that the [illegible] lode-like deposits will not continue to find [illegible]

Extensive copper mineralization is known to exist in many districts other than the areas from which present production is coming. [illegible] they have [illegible] to enable them to handle the heavy and comparatively low-valued product. It is Mr. Rice's belief that new copper lodes will be brought in from time to time, and that doubtless some of these will be of sufficient size to justify railroad branches. Nothing less than rail transportation will permit of any extensive development of these deposits. At the time of Mr. Rice's visit the copper output of Alaska was practically normal.

NEWS BY MINING DISTRICTS

London Letter

Arizona Copper Co. Shareholders Disappointed at Terms—Springs Mines To Try All-Sliming and Direct Cyanide Treatment in New Unit

By W. A. Doman

London, Sept. 30.—Not for a long time have we had such a sensation as that connected with the Arizona Copper Co. As is well known in the United States, the directors have been in negotiation with an American corporation for the sale of the whole undertaking. The name of the corporation was kept secret; it now appears from an official announcement to be the Phelps Dodge. Silence was preserved as regards terms, and only rumors or suggestions got on to the market. (The story is given on p. 586 of *Engineering and Mining Journal* of Oct. 8, 1921, and on p. 639 of the Oct. 15 issue.)

Shareholders of the Arizona company are naturally disappointed at the terms, and have endeavored to sell. This has caused a fall in the price from about about 35/— to 18/—for the 5/— shares. Holders are also angry at the brief period given them in which to consider the terms. They state that no effective opposition can be organized, and a clause in the purchase agreement is that the offer must be accepted by Oct. 3. The Scottish banks are reported to have lent money on large blocks of Arizonas, which means that unless the price rallies the loans will be called in.

A bold departure from recognized Rand metallurgical practice is being made by Springs Mines. As a result of experiments the directors have decided to abandon stamp milling and amalgamation, when extending the treatment plant, in favor of "all-sliming" and direct cyanide treatment. They claim that the change will result in reduced capital expenditure, a probable saving in operating costs, and increased extraction of gold contents. Evidently the views of G. A. and H. S. Denny, held and advocated for so many years, on the advantages to be derived from the all-sliming process, have made great impression upon C. R. Davis, the consulting engineer of Springs Mines, and as a result of experiments the directors of the company have come to the conclusion above stated. It will be noticed that the directors make only one definite claim—that capital expenditure will not be so heavy; the other advantages expected come under the head of probabilities. Lower capital expenditure and operating costs will be welcome.

The directors of Mason & Barry announce that negotiations are being carried on which may lead them to recommend the sale of the company's property in Portugal.

Johannesburg Letter

Accident at Consolidated Langlaagte—Stabilizing Price of Gold Recently Discussed

By John Watson

Johannesburg—At the Consolidated Langlaagte mine on Aug. 23, as a number of natives were ascending the ladder-way, which is about 35 ft. long and set at an angle of about 38 deg., a wooden box-launder connected with a sump burst. The result was that slimy water, silt and timber slipped down the ladder-way, causing a panic among the natives. Four natives were fatally injured and about twenty more were slightly injured.

The question of stabilizing the price of gold has been to the fore, here, recently. The *Rand Daily Mail* of Aug. 26 reported a statement by D. C. Greig, who was chairman of the Johannesburg Stock Exchange, to the effect that arrangements were likely to be concluded for the sale forward of gold produced in South Africa for a considerable period, say two years. There has been during the week a considerable rise in the selling price of leading gold stocks. However, the *Star* on the same day said that on making inquiries it had learned that a period as long as two years would involve many serious risks. A great many factors enter into the question of production and mines might be unable to supply that which they had contracted to deliver. Gold cannot be dealt in by the same methods as other commodities. It is sold by transactions in the international exchange market, and these operations are among the most risky and speculative that can be indulged in. The trend of gold prices is hard to determine and the workings of international exchange still more difficult to foresee. In the *South African Mining and Engineering Journal* of Aug. 27 an instructive diagram or graph shows the fluctuations in the gold premium from January to July of this year. It also shows that, when the price of gold falls to 99/ per fine ounce, sixteen gold mines now working in the Transvaal will be working at a loss and 5,800 European employees will be affected. When the price falls to 89/ the number of mines working at a loss will have increased to twenty-six and the number of Europeans affected will number 12,000. At 84/ per fine ounce, thirty-one gold mines will no longer pay and 14,400 white employees would be affected. The reduction in wages, recently made by mutual agreement, will help to a small extent.

KOREA

Unsankinko—The September cleanup of the Oriental Consolidated Mining Co. was $83,775.

CANADA

British Columbia

"Black Lead" at Franklin Camp Yields Platinum

Usk — On the Peerless group, Kleanza Creek, tunnels and stripping have revealed ore in the form of bornite, chalcocite, magnetite and manganese oxides. An adit was started to get under the largest body of ore, but was not completed. A camp is being constructed on the Silver Horde, at the head of Chiminess and Kleanza Creeks, where there are bodies of ore in which gray copper predominates and which contain high silver values. The provincial government is doing some road construction in this district that will materially aid in development.

Grand Forks — Interesting developments are reported at Franklin Camp. It is stated that on the "Black Lead" of this section there has opened up about 10 ft. of 4.3 per cent copper carrying 0.11 oz. in platinum. This so-called "Black Lead" is a pyroxenite formation extending about two miles in length and averaging about 1,000 ft. in width. It has long been maintained that it is the source of the platinum found in the placers of the Tulameen River.

Princeton — Repairs and improvements are being made on the Kettle Valley railroad to Copper Mountain.

Salmo — The Nugget Gold Mines, operating the Nugget and Mother Lode properties, has been earning a small profit each month of operation this season, and with a further reduction of mining and milling costs the outlook for a substantial increase is regarded as promising.

Trail—Ore shipments received at the Consolidated smelter during the week ended Sept. 31 totaled 7,983 tons from the following shippers:

Mine	Location	Wet Tons
Bell	Beaverdell, B.C.,	27
Josie,	Rossland, B.C.,	125
Knob Hill,	Republic, Wash.,	95
Paradise,	L. Windermere, B.C.	45
Ruth,	Cedar Creek, B.C.	41
Sally,	Beaverdell, B.C.	18
Freddy Lee,	Ainsworth, B. C.	2
Skyline,	Ainsworth, B.C.	1
Company Mines,		7,629

Ontario

Construction of Addition to McIntyre Mill Now Likely—Teck Hughes May Take Over Orr Property

Cobalt—It is understood that though the Vipont mines, in Utah, owned by the Kerr Lake, made a profit last year, no money was received from it by the Kerr Lake Mines, Ltd., the holding company. The Kerr Lake Mining Co., of

Cobalt, made profits of only $29,000 for the fiscal year, so that the dividends paid were from surplus, the Cobalt company transferring $590,000 to the holding company.

For the week ended Sept. 30, the shipments from Cobalt consisted of two cars, one from the Hudson Bay of 31.8 tons and a car of La Rose ore shipped by the Temiskaming Testing Laboratories.

Official announcement is made of the proposed sale of the properties of eighteen Cobalt companies for arrears of taxes, which, in practically every case, are less than $100. The names of these companies are remiscent of the early boom days in Cobalt, during which period they were formed.

The plant of the Trethewey property in Gowganda has been put in condition for work. It was burned down last spring, and no work has been done since. The company is short of funds and will have to be reorganized before work can be started.

Kirkland Lake—There is reason to believe that the Orr property will be taken over by the Teck Hughes when the reorganization plan of the latter company, with respect to its outstanding bond issue of $600,000, is completed.

The Sylvanite will soon begin the sinking of a new three-compartment shaft some distance west of the old shaft. The new power house is about completed, and repairs are being made to the plant. The old shaft was too small for the scale of work proposed.

Negotiations are under way for the purchase of the Townsite property by English interests. The property adjoins the Lake Shore and Wright Hargraves, and although the surface showings are comparatively unimportant, it is believed that deep development will be productive.

In November the Wright Hargraves mine will start sinking from the 400 to the 800 level. To handle the additional work, a new eight-drill compressor is being installed. The mill is treating 160 tons of $15 ore a day.

Development work on the 400 and 600 levels of the No. 2 vein of the Lake Shore has been so satisfactory that the company is considering the erection of a mill of larger capacity.

The Kirkland Lake Gold is now developing good ore on the 900 level. Mill heads are running $9 a ton.

Porcupine — Recent rains of almost tropical violence have apparently solved, for the present season at least, the power troubles in Porcupine, which were much more critical than the general public believed. It will not, however, solve the problems of the future, and if the camp is to expand as is anticipated, more power will have to be developed. Even now, with the question settled for the winter, only the three big mines, the Hollinger, the Dome, and the McIntyre, can get power, and if any of the other properties in the camp desired to start, they would not be able to contract for a supply.

The Hollinger is apparently serious in its intention to increase its milling capacity to 5,000 tons a day, which can be done with only minor changes. The preliminary crushing will be followed by rolls, and ball mills will be used in place of stamps. Additional ore-hoisting facilities are available in the main shaft. When this is done, all ore above a grade of $4 a ton will be included in the ore reserves, and this will bring the positive reserves up to $53,000,000. Milling 5,000 tons a day the company will require at least 10,000 hp.

The addition to the McIntyre milling equipment of a new 500-ton unit has been delayed only on account of the uncertainty of power, but it is probable that it will now be erected. Within the last few weeks the company has been considering the installation of a steam power unit, but this plan will probably be abandoned.

SURFACE PLANT AT ADARGAS MINES NEAR JIMENEZ, CHIHUAHUA

MEXICO

Coahuila

Torreon Smelter's Capacity Being Overhauled by Penoles Company

Torreon—Owing to the advance in the price of silver renewed animation is noted in this mining center and if the railroads can improve their service accordingly, a number of the mining companies and individuals will shortly resume operations.

Work is progressing rapidly on the general repairs of the Cia. Metalurgica de Torreon smelter, owned by the Cia. Minera de Peñoles. The capacity is to be considerably increased by dismantling the smelter at Mapimi, owned by the same company, and the equipment added to the plant at Torreon. It is not yet known just how soon the smelter will be blown in but it is generally expected that it will be about the first of the year.

It is reported that some new discoveries of large ore bodies have been found in the mines at Santa Eulalia, Chihuahua, which were recently acquired by the Cia. Minera de Peñoles from the Chihuahua Investment Co. At the present time they are shipping approximately 1,000 tons of silver-lead ore to the Chihuahua smelter. This ore assays about 17 oz. of silver and 20 per cent lead. As soon as the plant here is blown in these ores will probably be brought to Torreon for treatment.

Chihuahua

Old Adargas Properties Being Reopened and Electrically Equipped—Shipments To Start Soon

By Santiago Artwis

Chihuahua—The Adargas mines are situated in southern Chihuahua near Jimenez and are owned by the Cia. Minera San Pascual de las Adargas, S. A., an American corporation, with offices at El Paso, Tex. The property, which was an old Spanish mine, was rediscovered in 1880. Lead-silver-gold carbonate ore averaging about $[illegible] per ton was shipped by [illegible] over the flat country to Dolores station, twelve miles from the mine. These operations had reached a depth of about 240 ft. when water was struck. This circumstance, together with lack of sufficient pumping capital and poor management, led to abandonment in the late [illegible]. However, work has not been entirely [illegible].

The Adargas properties, with the [illegible] of San Pascual de las Adargas, are on the northern end of the Sierra de las Adargas, the latter consisting of [illegible] limestone. The range has been cut in several places by porphyry and andesite [illegible]. One of these, running along the southern side of the main Adargas hill, has proved to be highly mineralized. The dike widens from 100 ft. to over 400 ft. within a distance of

1,000 ft. The main orebodies occur either in the limestone or along the contact and even within the dike. They are found at varying depth and distance from each other, their limit as to the depth not having been acertained. The upper carbonate ores carried 15 to 30 per cent lead, 12 to 30 oz. silver, and 0.2 to 0.5 oz. gold. The lower ores run as high as 55 per cent lead, 60 oz. and more of silver, with good values in gold. Several cross veins, extending from the main dike into the limestone of the hill, have also been worked more or less extensively, producing siliceous ores with 55 per cent lead, 170 oz. silver, 2 per cent copper, and some gold. The main shaft of the principal property has been sunk to a depth of 450 ft.

Since May, 1920, when the present company started operations, considerable work has been done. Several new headframes, a new steam power plant, an office and staff houses, a warehouse, and many other buildings have been erected. Several additional shafts have been sunk and new levels opened, with the object of improving the ventilation in the lower, wet orebodies. A 50-hp. air compressor, several Novo gas-engine hoists, and a system of underground electric lighting have been installed.

The old steam pumps have been put in condition, and the boiler capacity has been increased on account of the bad quality of feed water. No difficulty has been experienced in draining a large area of the main dike. As unwatering has progressed, the flow has decreased gradually from 600 gal. per minute at the start to only 215 gal. per minute, when the bottom of the old working was reached. This can be easily handled by a No. 11.5-in. discharge Cameron sinking pump.

Development undertaken since unwatering has proved the existence of large commercial orebodies. It has been decided, however, to continue draining the mine from the bottom of the main shaft, and to install at the surface a new electrically driven pump, having a much greater capacity than required.

The plant is to be electrified soon, the power to be furnished by the Cia. Agricola y de Fuerza Electrica del Rio Conchos, S. A., which has its power plant at La Boquilla, near Camargo. The building of the forty-five miles of transmission line from San Juan to the mines will be started as soon as the material ordered arrives. The equipment to be installed includes electrically driven pumps, a compressor plant, one double-drum and five single-drum hoists, machine shops, and a crushing and sampling plant.

In the meantime, development work is being speeded up. The main shaft is being reconstructed to a two-compartment shaft. This is to be deepened to 550 ft., after which diamond drills will be used to explore thoroughly the as yet undeveloped parts of the property.

Ore is being mined steadily, and shipments will be made to the Jiménez and Dolores stations as soon as the wagon roads are sufficiently improved to permit the steady use of several modern Buffalo steam wagons or traction engines, each having a hauling capacity of ten to thirty tons.

ARIZONA

Plaintiffs in Smoke-Damage Case Against U. V. Extension Get $1 and Costs

Phoenix—Collusion, fraud, and coercion are charged by Stephen Lucas, in a suit locally filed against the Lucky Five Mining, Milling & Reducting Co., Grace White, Ira L. Horton, and the Copper Basin Six Mines Co., in connection with a suit for $100,000 filed by Mrs. White against the Lucky Five corporation in 1918. It is alleged that the proceedings were collusive, including transfer of the property on sheriff's sale to Mrs. White's father and its later transfer to herself.

Suit has been begun in Yavapai County by R. M. Garrett for foreclosure of a mortgage for $55,477 held by him on the Bannie mining property, in the Walker district. He states he will protect legitimate investors in the company's stock.

T. N. McCauley, who is interested especially in the Central-Mascot mines near Willcox, has had prepared for exhibition in the East a 3,000-ft. film showing Arizona scenes, inclusive of the capitol building and other views around Phoenix, Willcox, and the Central mines.

Prescott — The Biles-Wells smoke-damage case against the United Verde Extension Mining Co., after a trial of six weeks, resulted in a jury verdict for the plaintiffs in the sum of $1 and costs. The costs will approximate $3,000. An attempt was made to show that the plaintiffs' crops had been diminished and their lands injured by the volume sulphuric fumes from the defendant's smelting plant at Clemenceau, in the Verde Valley, below Clarkdale. The defendant offered testimony from many expert witnesses to the effect that the alfalfa and other crops alleged to have been injured by smoke had in reality suffered from a variety of plant diseases or from growth in shallow soil, with "hard pan" present. Local witnesses told they had raised gardens near the Clemenceau smelter and had failed to observe any injurious effect from the smoke. Claims were made that the plaintiffs had refused access to their land to investigators who sought to secure data for the defendants. Similar cases near Clarkdale a number of years ago were compromised by the United Verde Copper Co., which in a number of cases bought large farm acreages said to have been injuriously affected by the furnace fumes.

Morenci—F. O. Longcor, of Newark, N. J., and associates have contracted for the erection of a cyanide mill on the Stargo silver mine, near Morenci, and for provision of funds for deeper development work. The agreement includes purchase of a large block of the Stargo company's stock, understood to give a controlling interest to Mr. Longcor's syndicate. The mill plans are being prepared by the General Engineering Co. of Salt Lake City on the basis of mill tests already made. Profitable shipments of ore from the property were made until the closing of the Douglas smelters. The company's stock has been held by George J. Stoneman, of Los Angeles; P. A. Tharaldsen, of Phoenix; W. J. Graham, of Bisbee, and M. J. Hannon, the last named having been manager.

Johnson—The Arizona-United Mining Co. is reported to have perfected plans for a concentrating plant and new working shaft, involving expenditure of a large sum. The Keystone is building a new concentrator, with a power plant including a 150-hp. Corliss engine and two 100-hp. boilers.

Benson — Reports lately spread affirming discovery of a wonderfully rich gold field near Benson are declared to be utterly without foundation, unless on the basis of a piece of rich float for which no ledge can be found. A large number of miners and prospectors made their way to Benson from many points, only to learn that the rumors were false.

Tucson — Announcement has been made by the Southern Pacific of a new ore freight rate of $10.50 a ton from Cananea and southern Arizona points to San Pedro harbor.

Jerome—On its 960 level Dundee-Arizona has crosscut into diorite, said to be full of specks of chalcocite and native copper. The work is being pushed toward a known schist dike, in which it is expected commercial ore will be found. The property was recently examined by H. V. Winchell.

Verde Central has started sinking its main shaft at least 300 ft. deeper, this preliminary to exploration at depth of the low-grade sulphide cut in drifting along the United Verde fault.

NEW MEXICO

New Discovery of Silver Reported Thirty-five Miles Northeast of Silver City

Lordsburg—A meeting of the White Syndicate that control the Last Chance mine was held Oct. 3. It was decided to sink the main shaft another 200 ft., giving a depth of 500 ft. An assay office will be built at once. Arrangements are being made to begin work on a fifty-ton flotation mill. Work has been started on the Fairly-Smith ground recently acquired.

Ore shipments from the Lordsburg district for September amounted to 1,335 tons, the approximate value being $26,700.

Silver City—A new strike of silver ore is reported to have been made by Alexander Brothers, near Dry Creek, about thirty-five miles northeast of Silver City. There is some excitement, and a number of prospectors are in the field. The ores are said to run about 30 oz. silver.

UTAH

Work Resumed at Pittsburgh Mine at American Fork—I.X.L. Property Changes Hands

Eureka—Ore shipments from the Tintic district for the week ended Sept. 30 amounted to 136 cars. Shippers were: Chief Consolidated, 38 cars; Tintic Standard, 35; Victoria, 10; Iron King, 8; Eagle & Blue Bell, 8; Swansea, 5; Sunbeam, 4; Colorado, 2; Gemini, 2; Gold Chain, 1; Yankee, 1; Eureka Hill, 1; Alaska, 1. The Chief Consolidated is preparing to market limestone from its recently acquired quarry. Grading has been started preparatory to building a railroad spur to the property. The material will be shipped to the smelters and sugar factories.

American Fork—Work is to be resumed at the Pittsburgh mine, which in the early days is said to have produced high-grade ore carrying lead, silver, and gold from a tunnel about 200 ft. long. It is proposed to build an aërial tramway and to install modern machinery. Work will be started in the No. 3 tunnel, which will give a depth of 900 to 1,000 ft. on the vein.

Park City—Shipments for the week ended Sept. 30 amounted to 1805 tons as compared with 1,436 tons the week preceding. Shippers were: Silver King Coalition, 827 tons; Judge allied companies, 58 tons, and Ontario, 410 tons.

Marysvale — The I.X.L. silver-gold property, in the Mount Baldy mining district, adjoining the Deer Trail mine, has been taken over by the American Consolidated Mines, which is said to be controlled to a large extent by owners of the Deer Trail. The mill at the latter property is treating 100 tons of ore daily and producing eight tons of concentrates according to report. The company is a close corporation.

MONTANA

Butte & Superior To Seek Its Copper Orebody on 2,600 Level

Butte—The North Butte Mining Co. has opened more than 2 ft. of high-grade ore, in which considerable glance is to be seen on the 3,600 level of the Edith May vein. This orebody presumably is the extension of the shoot opened on the 3,400 level of the same fissure.

The Butte & Superior Mining Co. drift is continuing on its showing of copper ore on the 2,200 level of the Black Rock mine, and it has been decided to drive for this vein on the 2,600 level, the deepest in the property. A crosscut of more than 600 ft. will have to be driven to reach a point on the latter level where the operators expect to find the copper ore.

The East Butte Mining Co. is laying a foundation of slag for new ore bins at the site where the new working shaft now being raised will come through at the surface. The molten slag is being poured by means of traveling cranes into steel molds, a departure in the construction of ore bins in the Butte district. The East Butte has been quite successful in this style of construction in the matter of building tanks for use in its flotation concentrator. East Butte's treasury to date has $1,600,000 in cash and copper, principally copper.

Davis-Daly's crosscut on the 750 level of the Hibernia mine is expected to reach the south Hibernia vein within several weeks. Conditions at the Colorado mine are reported to remain unchanged.

The Tuolumne Copper Mining Co. in its west drift on the 1,600 level of the Spread Delight vein is showing ore of an improved grade, and it would not be surprising, according to those believed to be informed, were commercial rock to be had within a short time. The showing is regarded as the best thus far that has been opened on this level.

Elkhorn—Milling operations at the Elkhorn concentrator of the Boston & Montana Development Co. are awaiting only the completion of the building of the power line to start. Some delay has been experienced through lack of linemen to string the wires and do the necessary wiring at the mill. Plenty of help is available, but not of the skilled kind. However, the construction of the line is being pushed as rapidly as possible. The course of the east fork of the Wise River was changed recently to afford room for impounding tailings. Waste rock from development operations in the mine is being used for the building of the impounding dams.

WASHINGTON

Standard Silver-Lead Report Shows $366,275 in Cash and Security Assets

Colville—Development of the recent sensational strike of high-grade silver-lead ore on the Old Dominion mine is delayed pending installation of improved ventilation.

Spokane—The second quarterly report of the Standard Silver-Lead Mining Co., which has successfully operated a property at Silverton, B. C., for the last ten years, shows cash and security assets amounting to $366,275. The company recently disposed of its Silverton property under a bond and lease, but no substantial amount has yet been paid on this account.

Oroville—The State Supreme Court of Washington has just handed down a decision confirming title of [illegible] & Washington Mining Co. to the [illegible] mine, formerly known as **Lone Pine property**. The property is located along the international boundary and consists of [illegible] claims, upon which development has been fairly extensive. Values are silver, lead and copper, with some gold. It is believed plans for construction of a mill, which were held up pending settlement of litigation, will now be proceeded with.

NEVADA

All Available Ground Located in Argentite District—Work Resumed on Placers Near Johnnie

Winnemucca—The New Harmony Mines Co., operating four miles east of Winnemucca, has sunk the main shaft 150 ft. on the vein, and it is reported that the bottom of the shaft shows 5 ft. of $75 ore. The vein as exposed in the shaft has contained values across narrow widths directly from the surface. The shaft is to be sunk to the 300 level and the vein will then be developed by drifting.

Tonopah—It is reported that W. Hampton Williams, discoverer of the famous "Kelly" mine at Randsburg, Cal., has purchased the Eden Creek mine situated in the Kawich Range forty-five miles east of Tonopah. Small test shipments, which ran as high as $100 per ton, have been made from the property. Development is meager; a tunnel cuts the vein at a depth of 230 ft. and drifting is being done. Values are in silver and gold, with the former predominating.

Conditions and production in the Tonopah and Divide districts are normal and satisfactory. The Jim Butler and New California mines will resume ore shipments soon. No ore has been shipped from these mines since the strike and shutdown of last April. Ore shipments made by the Divide Extension during September averaged $64 per ton, and the gross value for the month is given as $48,000.

Argentite—In this district, which is twenty-four miles from Silver Peak, all available ground in the vicinity of the Sanger, or original strike, has been located. The Watterson interests, which control the Sanger property under option, are drifting both ways on the vein on the 100 level, as well as getting out a trial shipment to send to the mill at Silver Peak. A $60,000 payment is reported to be due in October and the confidence of [illegible] in the district will be greatly strengthened if this payment be made. The veins in the Argentite district are strong and well defined and contain some exceptionally rich ore, but the average grade is not shipping ore. Present conditions indicate the necessity for a mill on the ground, in order to be able to realize a profit on ore in sight.

Johnnie—The weather being cooler, operations on many dry placers have been resumed. [illegible] Harry [illegible], and [illegible] have obtained a lease on the [illegible] on the [illegible] placer adjoining the Eureka-Johnnie property. [illegible] has located several claims [illegible] and east of the [illegible] group. The locations [illegible] The values [illegible] are reported to be very good.

MICHIGAN

The Copper Country

September Shipments of Copper Heaviest of Season—C. & H. Still Has Large Surplus

Houghton—Copper shipments out of the Lake district in September totaled 7,028,000 lb., being the heaviest made in any month of the navigation season to date, comparing with 5,176,000 lb. for August, the smallest monthly total. Shipments of copper by water to date total 30,000,000 lb. Probably 10,000,000 lb. more have gone out by rail in the five months' period. In September, Calumet & Hecla shipped by boat 2,748,000 lb., Copper Range, Mohawk, and Wolverine, 2,764,000, and Quincy, 1,516 000.

There is no immediate prospect of a reopening of the Calumet & Hecla mines. These mines still have a large metal surplus, and the properties will continue in idleness until this surplus is nearly out. All mines are being kept in good physical condition. Timbering is done when it is needed, and there have been no serious caves. All openings are being kept free of water. A small force recently was put on at Ahmeek for the purpose of doing some repair work.

The Copper Range gained a net total of fifty men in September. Several hundred men have been added to the payroll during the summer. Champion shipped 42,000 tons of "rock" to the mill in September; Baltic, 19,000, and Trimountain, 10,000. Champion ground continues rich, with no change in yield. Ground in both the Baltic and the Trimountain is running better than the average for those mines, Baltic being in particularly good ground in September. A big program of drifting is under way at Trimountain, but drifting at Champion and Baltic is still below normal. Copper Range has a comparatively small copper surplus, estimated to be not more than 5,000,000 lb.

No distress is yet in evidence in the district, despite the long shutdown of the Calumet & Hecla mines. This is due to various summer activities, such as farming, road construction, and other outdoor work. It is believed organized relief will be necessary during the winter unless mining operations are resumed.

Gogebic Range

Oliver Mines Shipping at Present at Pre-War Year Rate—Contract Miners Averaging $4.06

Ironwood—Shipment of ore continues at about the same rate as for the last two months. The mines of the U. S. Steel Corporation are shipping about 78,000 tons per month, but nearly 30 per cent of this is coming from the Tilden mine, which normally furnishes less than 10 per cent of the total. If the present rate continues until the end of the season, these mines will have shipped about as much as in the average pre-war year, but one-third less than for the last four years. The Steel & Tube Co. of America, which last year exceeded the Steel Corporation in shipments, has this year shipped less than one-tenth as much. Of the other big producers on the range the Wakefield pit has shipped nothing, the Plymouth pit about half its usual amount, and the Ironton mine practically nothing up to the present.

The wage scale recently put in effect at the Steel Corporation's mines—and most other operators have adopted the same arrangement, gives $4.06 as the average for contract miners. All now pay contract miners a flat rate of $2.24 per shift, and then their contract price per ton or per foot of drift is supposed to bring their daily wage up to $4.06. Contract prices for stoping vary from 11c. to 30c. or more, depending on the amount of repairing, hardness of ground, and various other conditions.

COPPER AWAITING SHIPMENT, PORTAGE LAKE, NORTHERN MICHIGAN

Marquette Range

Accident Rate Much Lower in 1921 Than in 1920—Rolling Mill Pit Working

Ishpeming—The annual report of the mine inspector of Marquette County, which includes all of the operating mines on the Marquette Range, for the year which closed Sept. 30, shows that there were only four fatal accidents during the twelve months embraced by the report. This was a fatality rate of 1.09 per 1,000 men employed, as against eight accidents and a rate of 1.72 in 1920. During the year the Angeline, Lake, and American mines have been abandoned. In addition to the thirty active mines seven quarries are in operation. Most of the latter are producing crushed rock.

Negaunee—C. K. Quinn & Co. is now working its open pit at the Rolling Mill mine. All ore being taken out is shipped. More ore is now going forward from the Maas and Negaunee mines, and regular shipments are being made from the Mary Charlotte. The Richmond has suspended shipping for the season from its pit property.

Ishpeming—The Oliver Iron Mining Co. has finished shipping from its Section 16 mine for this year. Over 250,000 tons went forward, this property being the heaviest shipper on the range this season. The Oliver company has obtained permission to place two 8,000-gal. Layne-Bowler pumps in the Angeline mine, abandoned by the Cleveland-Cliffs Iron Co., to keep water from the Section 16 workings.

MINNESOTA

Mesabi Range

Stock Ore Being Shipped Before Cold Weather Sets In

Chisholm—Shipments have been resumed at the Dunwoody mine, the ore coming from stock.

The lease on the Palmer forties, which form a portion of the Hartley open pit, operated by the Oliver company, has been given up by the company.

The stockpile at the Chester mine has been shipped. The Oliver lease was surrendered several months ago.

Hibbing—The Crete Iron Mining Co., a subsidiary of Pickands, Mather & Co., is shipping 100,000 tons of ore from its stockpile at the Utica mine

THE MARKET REPORT

Daily Prices of Metals

Oct.	Copper N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
6	12.75	26.625	27.00	4.70	4.45@4.50	4.60
7	12.75	26.625	26.875	4.70	4.45@4.50	4.60
8	12.75	26.625	26.875	4.70	4.45@4.50	4.60@4.65
10	12.75	26.875	27.125	4.70	4.45@4.50	4.60@4.65
11	12.75	27.00	27.25	4.70	4.45@4.50	4.65
12						

*These prices correspond to the following quotations for copper delivered for the entire week: 13c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Oct.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
6	69	70	74	155½	157¾	23¼	23¼	26½	27¼
7	69½	70½	74½	155	157½	23¼	22¾	26⅝	27¼
8			...						...
10	69½	70¼	75	155¼	157¾	23	22⅞	26¾	27¼
11	69¾	70¾	75¼	155¼	158	23¼	23	26¼	27
12	69¼	70¼	75¼	155½	158¼	23¼	23¼	26½	27

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver			Oct.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
6	377	99¾	69¾	41¼	10	385	99¾	72¼	42¼
7	377¼	99¾	70¾	41¼	11	384	99¾	72½	42½
8	376	99¾	71½	42	12				42½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, Oct. 11, 1921

Copper and zinc remain the most active metals of the week, zinc advancing slightly and copper establishing itself firmly on a 13c. level. Although the trade is gratified over the recent betterment in the metal market, it is generally felt that a further rise in prices is likely. The London market has improved concurrently with the advance in New York, the betterment being due more to the increase in sterling exchange than to the higher quotations. The holiday tomorrow necessitates closing the market report today. London quotations, however, are given for the entire week ending Oct. 12.

Copper

No copper has been reported sold during the week below 13c. delivered. The market reached this price last Thursday, and is the price at which October copper has been sold. Copper is still available at this figure, both for October and November shipment, but several producers are quoting higher prices, [illegible] being asked for October copper and 13¼c. for November and December. The prompt market for copper has not been as active as that for forward delivery, the largest sales of the week being copper to be shipped in November and December. Large consumers were [illegible] in the market and were able to fill their requirements early in the week for 13c. The market is still strong, but has found a resting point at its present level. One copper manufacturer is of the opinion that the heavy purchases of the large copper consumers, which generally were forward copper, will tend to lighten the market in the next few months, as producers in the recent scramble anticipated their requirements several months ahead in order to obtain the metal at the lowest possible price. This presupposes that there will be no improvement in domestic consumption in the near future and that manufacturers will stop buying copper for future delivery, both of which assumptions are problematical.

The export business in copper has been good, with the demand distributed among various European countries, but trade with England has been lighter than usual. Recent advices from Germany report a feverish industrial activity. Export prices have risen with the advance in this market, and the metal has been sold during the week at prices ranging from 13c. to 13.25c. c.i.f. The advance in the price of London electrolytic has been the feature of the market, amounting to about 0.9c. for the week figured on a currency equivalent basis.

Lead

The American Smelting & Refining Co. continues its official contract price at 4.70c., at which level most of the New York trading has been done. The market has been more inactive than last week, and our quotations show no change. Several of the large producers report sales in fair volume. Inquiries are increasing in number. Lead is freely offered in St. Louis at 4.475c., and there is a possibility that this price can be shaded on a large order. Producers seem a little more anxious to sell their product, although the statistical position of lead continues to be good. Production is low, and stocks are not large enough to be disturbing. For future lead a premium of 5 points per month would have to be paid.

Zinc

The market has advanced [illegible] to 4.65c., [illegible] galvanizers. The steady advance of the past few weeks [illegible] of zinc [illegible] sant. [illegible] forward [illegible] was sold [illegible] per lb. [illegible] held steadily, the rise in sterling has raised the currency equivalent of the American price.

Tin

The market is reported as being better, and a good business has been done. The advance in sterling exchange has increased the price here, and has made the quotation of dealers and producers vary greatly during the day. Future tin is quoted about ¾c. higher than prompt. Dealers are not inclined to quote on large orders due to the exchange difficulties and in some instances are carefully co-ordinating operations in London and New York.

Arrivals of tin in long tons: Oct. 6th, Straits, 525; 7th, Straits, 30.

Gold

Gold in London: Oct. 6th, 108s. 6d.; 7th, 108s. 8d.; 10th, 107s. 5d.; 11th, 106s. 8d.; 12th, holiday.

Foreign Exchange

The spectacular advance in sterling exchange has been the feature of the week, the total advance in seven days being about 14c. Continental rates followed sterling. The rise is ascribed as chiefly due to speculation and manipulation. On Monday, Oct. 10th, francs were 7.345c.; lire, 4.055c.; and marks, .8275c. New York funds in Montreal, 9.75 per cent premium. Sterling cables continue to be quoted ½c. higher than the figures given on page 635.

Silver

Silver prices have advanced sharply the last week in both New York and London, New York reaching a new high for the year of 72¼c. Eastern rates have strengthened again, with China rather than India the principal buyer. This buying is apparently in anticipation of the Chinese New Year. The sudden rise in sterling exchange on the 10th was responsible for the higher New York price of silver on that date, as the London price has reacted slightly, due to small buying orders. The market closes steady, although quiet.

Mexican Dollars—Oct. 6th, 53½; 7th, 54¼; 8th, 55; 10th, 55⅝; 11th, 55⅝.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 18@20c. per lb.; 18½c. for imports, duty paid.

Antimony — Chinese and Japanese brands, 5@5¼c.; market very strong. W.C.C. brand, 5¼@5⅝c. per lb. Cookson's "C" grade, spot, 9c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb., black oxide, $2.35 per lb. in bbls.

Iridium—Nominal, $150@$170 per oz.

[1]**Molybdenum Metal** — In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominal, $55@$60 per oz.

Platinum—$80 per oz.

Quicksilver—$39@$41 per 75-lb flask. San Francisco wires $43.75. Dull.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium** — Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $24@$26; ground, $28; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—20@22c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 50c. per lb. of contained sulphide, New York. Quotation purely nominal.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

[1]**Titanium Ores**—Ilmenite, 52 per cent TiO_2, 1¼@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3, f.o.b. Atlantic ports.

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $2.25 and 75c. per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

Zircon—Zirconium silicate, f.o.b. Pablo, Fla., 4½@ 13c. per lb., according to grade.

[1]**Zirkite**—According to conditions, $70 @$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Oct. 8—Zinc blende, per ton high, $26.45; basis 60 per cent zinc, premium, $24; Prime Western, $23.50@$23; fines and slimes, $22@ $18; average settling price, all grades of blende, $22.12.

Lead, high, $64.40; basis 80 per cent lead, $60; average settling price, all grades of lead, $59.12 per ton.

Shipments for the week: Blende, 6,192; lead, 1,020 tons. Value, all ores the week, $197,290.

The highest authenticated blende basis price is given at $24. The purchase was 5,700 tons, a decrease of 600 tons from the previous week. Competition was particularly active on zinc ores carrying little or no lead content. Rumors of higher than $60 basis for lead ore continue in circulation week after week, with no verification.

Restarting of idle mines and mills to increase the output of lead has so far increased the output of zinc almost imperceptibly.

Platteville, Wis., Oct. 8 — Lead ore 80 per cent lead, $60 per ton. Shipments for the week: Lead ore, 122 tons. Shipments for the year: Blende, 8,461; lead ore, 1,405 tons. Shipped during week to separating plants, 440 tons blende, 50 tons sulphur ore

Non-Metallic Minerals

Asbestos — Crude, No. 1, $1,500@ $2,000; No. 2, $850@$1,250; spinning fibers, $350@$850; magnesia and compressed sheet fibers, $225@$350; shingle stock, $95@$150; paper stock, $55@ $70; cement stock, $16@$27.50; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada.

Barytes—Crude, 88 to 94 per cent barium sulphate, $10@$12 per net ton; ground (white) $23@$24 in bags, carload lots; (off-color) $21@$22 in bags carload lots; all f.o.b. South Carolina points. Foreign barytes, prime white material, $25 per net ton, f.o.b. Atlantic seaports. Western grades are $24.50. Crude quoted $7@$10 per long ton, f.o.b. Cartersville, Ga.

Bauxite — French bauxite, $8@$10 per metric ton, c.i.f. Atlantic ports. American bauxite, crushed and dried, $8@$10 per gross ton, f.o.b. shipping points; pulverized and dried, $12@$15 per gross ton, depending upon grade; calcined so as to remove most of the combined water, $20 per gross ton, f.o.b. shipping point.

Borax—Granulated, crystals, or powdered in bags, carloads, 5½c. per lb.; in bbls. 5⅝c.

Chalk—English, extra light, 5c. Domestic light, 4½c.; heavy, 4c. per lb., all f.o.b. New York.

---

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

China Clay (Kaolin)—Crude, $6.50@$8.50; washed, $9@$10; powdered, $12@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $25@$40, f.o.b., quoted at New York.

Emery—Turkish emery, 6c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b., from New England points.

Feldspar—No. 1 soap grade, $7@$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, $6@$6.50; No. 2, $5@$5.50. Market dull. For No. 1, Canadian, ground, $23, f.o.b. Ohio points.

Transactions are reported on a $5 basis for crude No. 1; prices are still nominal.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; gravel, $15; lump, $12.50, f.o.b. Lordsburg, N. M. Ground, acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, 1@2½c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $45@$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica — India block mica, slightly stained, per lb.: No. 6, 25c.; No. 5, $1.50; No. 4, $2.50@$3; No. 3, $2.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, [illegible]; No. 3, [illegible]; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50 extra large, $25; ground: [illegible] grade $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

¹Monazite — Minimum of 6 per cent thorium oxide, $30 per unit, duty paid.

¹Foote Mineral Co., Philadelphia, Pa.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $11.65; 75 per cent, $10.65; 75@74 per cent, $10.15; 70 per cent, $6.25; 68 per cent, $5.75; 68@66 per cent, $5.50.

Pumice Stone — Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 13c.; Spanish lump, 13@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic, f.o.b. Texas and Louisiana mines; $18@$20 for export, f.a.s. New York.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $7.50@$11 per ton; less than carload, $25, f.o.b. cars. Imported, $30@$40; Canadian, $18@$40 per ton.

Mineral Products

Arsenic—5@6c. per lb.

Sodium Nitrate—$2.25@$2.30 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $12.50 per ton, f.o.b. in bulk, Western mines, spot and six months' contract; $20@$22 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.20 per unit, basis 90 per cent, f.o.b. New York.

Ferro Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 11c. per lb. of chromium contained; 4 to 6 per cent carbon, 11@12c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $60@$65, f.o.b. furnace; resale, $90 delivered; English and German, $60@$63, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, [illegible] per gross ton, f.o.b. furnace.

Ferromolybdenum—Standard grades carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.25 per lb. of contained metal, f.o.b. works. Imported material, $1.50@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $38@$40; 50 per cent, $60@$65; 75 per cent, $130@$135.

Ferrotungsten—Domestic, 70 to 80 per cent W, 40@45c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$4.25@$4.50 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 20.50c. per lb.; wire 14.50c.

Lead Sheets—Full lead sheets, 7¾c.; cut lead sheets, 8c. in quantity, mill lots.

Nickel Silver—29.50c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets, 16.25c.; sheathing, 15.25c.; rods, ½ to 3 in., 13.25c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $50 per ton; 76 per cent, $90@$95 f.o.b. works.

Chrome Cement — 40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—$52@$55 per net ton.

Fire Brick—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35

Magnesite Brick—9-in. straights, $65@$70 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000; $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Oct. 11, 1921

Production of steel ingots in September was at the rate of 32 per cent of capacity, against a 30 per cent rate in August.

The Steel Corporation's unfilled obligations increased by 28,744 tons during September.

Independent steel mills have started advancing prices again, to a basis of 3.25c. for black sheets, while continuing to try to accumulate enough bar, shape and plate tonnage [illegible] advance prices, the schedule being 1.65c. for bars and 1.75c. for shapes and plates.

Pig Iron—[illegible] freights [illegible] them back to [illegible] 1920. [illegible] of iron [illegible] shipped [illegible]

Coke

Connellsville—Furnace, [illegible]; foundry, $4.[illegible]@$4.50.

The Copper Market Improves

Metal in Better Position Than for Many Months—Domestic Trade Lending Greater Support to the Market—1921 Production Will Be Lowest in Twenty-Four Years

EDITORIAL MARKET STUDY

WERE THE RECOVERY in the copper market the sole evidence of any fundamental change in business conditions, the improvement might be heralded as transitory, and as due chiefly to manipulation, and incapable of being sustained. However, copper is only one of the metals that has increased in price lately; zinc, lead, and silver have taken a prominent part in the upturn. This rise seems to be but one factor in the sentiment gaining headway in the country that business conditions have become better and that trade recovery is at hand.

As raw materials have long been abnormally depressed, they are ungrudgingly granted the advance in price. Copper has for months been below the cost of production and below the pre-war normal average price. The recent advance which carried it from a low of 11.625c. to present prices of 13c. indicates a partial return to a rational price level. The recovery is in large part due to the measures adopted by copper producers early this year after they had realized the seriousness of the situation, the huge excess copper stocks in the country, and the comparatively inactive state of the foreign and domestic market. The plans which were then executed, curtailing production, financing a goodly part of the copper surplus, and stimulating consumption, have produced results that could not help being beneficial. Domestic copper consumers are again buying in fair volume, and the large amounts of scrap copper which have been a depressant to the use of newly mined metal are becoming diminished. The recent scarcity of casting copper, which is manufactured from scrap, is a good indication that supplies of old metal are no longer over-plentiful.

Whether the advance in copper prices is merely affording the producers a breathing spell or is the beginning of a convalescent period is a subject upon which opinion is divided. Substantial betterment in the situation depends greatly on export trade in copper. Any foreign or domestic developments which tend to influence European buying will be of much concern to the American copper miner. The steady depreciation of the German mark and the general instability of foreign exchange have always profoundly affected export business. The accompanying uncertainty about Germany's financial affairs and ability to meet reparations is an element of first importance to the market.

The dependence of the American copper-mining industry upon German imports of copper is well known. The figures of monthly copper movements since the beginning of 1921 show that Germany has been the greatest foreign purchaser of American copper. Especially has this been true in the last few months. In June, July, and August the amount of copper consumed by Germany was over 43 per cent of the total amount exported from the United States, which approaches the pre-war rate of consumption. Figures of copper exported from the United States do not show whether the metal is intended for storage purposes in the warehouses of the Copper Export Association, or will be consumed immediately. The warehouses at such ports as Bremen, Hamburg, Liverpool, Havre, and other European cities are used to facilitate the quick and convenient shipment of American copper to interior European points.

The U. S. Geological Survey has announced that the surplus stocks of copper in the United States on Sept. 1 amounted to 405,051 tons of pig copper at smelters and refined metal ready for the market, a figure that does not include copper in transit and in process of refining. Although of large magnitude, this estimate was made for a date previous to which trading had been exceptionally quiet. During September, however, sales were heavy enough to make a deep dent in surplus stocks; brass, wire, power, and telegraph companies and electrical manufacturers all were in the market for larger amounts of metal than they had purchased earlier this year. Stocks in consumers hands are believed to be low, and this, with the desire of getting in at the bottom of the market, has likely been an impelling motive in the recent buying. Consumers have been anxious to cover future requirements, but have not met with great success from the producers, who are just as anxious to avoid making future sales. The bugbear of surplus stocks has caused many consumers, foreign and domestic, to believe that the copper market's future was virtually in their hands, and that a sustained rise was out of the question under present circumstances. This reasoning exaggerates the importance of surplus stocks and loses its force when the financial arrangements made to carry them are considered. The agreement between the bankers and the producers has proved highly satisfactory in operation, despite some foreign comments to the contrary, and has greatly eased the pressure which would have been exerted by individually held accumulations. Merchants who have worked through similar periods of excess stocks of raw materials, agriculture and mineral, have often affirmed that when once on the decline, such stocks have disappeared with surprising rapidity, and it would not be unusual if this experience were duplicated in copper.

The world is not suffering from over-production but from under-consumption. A great market exists for copper, whether new uses are discovered for it or not—a market that should be sufficiently broad to absorb the surplus more speedily than has been considered possible.

Production of copper in the United States for 1921 is estimated at 502,000,000 lb., assuming that production will continue for the remainder of the year at its curtailed rate. This production will be the lowest since 1897, before the days of the large porphyries, when domestic production amounted to 494,100,000 lb. From 1909 to 1913, a normal period of slight growth in the industry, copper production averaged 1,434,500,000 lb. The record for 1921 will thus leave a big hole in the statistical table of production.

Concurrently with the improvement in the market, the impression may grow that it is an opportune time for the mines to start operating again. The heavy expense to which most copper companies are put in keeping their properties idle will add weight to the argument. From the producers' standpoint it is undoubtedly preferable to take a small operating loss, with a possible chance of breaking even, rather than a heavy one from an unproductive plant. There is also the possibility that some companies will be over-eager to join the mines that have not stopped production, mines that will naturally be the first to feel the improved market. A premature resumption of operation would be unfortunate. Although the day seems much closer at hand to start the wheels of the industry turning again, the wisest policy is a continuation of the sacrifice the industry is making until there is no doubt that the statistical position of copper has improved and that the menace of surplus copper stocks and secondary metals is eliminated.

COPPER MOVEMENTS TO AND FROM THE UNITED STATES

In Pounds

EXPORTS

	Average Monthly Pre-war	Average Monthly 1920	Jan. 1921	Feb. 1921	March 1921	April. 1921	May 1921	June 1921	July. 1921	August. 1921
United Kingdom	5,583,000	[illegible]	[illegible]	18,970,100	7,407,000	7,976,600	6,765,000	[illegible]	1,597,100	1,234,400
France...	11,530,000	[illegible]	15,012,000	10,243,000	2,926,000	10,800,000	4,455,000	[illegible]	4,710,400	6,091,400
Germany	18,366,000	[illegible]	18,802,000	20,725,000	19,021,000	15,838,000	7,074,000	[illegible]	23,687,800	16,428,100
Total all countries	67,266,000	[illegible]	[illegible]	62,480,000	38,720,000	41,495,000	35,378,000	[illegible]	51,771,800	42,891,000
IMPORTS										
Total (a) all countries	28,750,000	[illegible]	31,136,000	30,066,000	12,808,000	22,562,000	12,689,000	20,967,100	32,095,800	23,126,000

COMPANY REPORTS

Chief Consolidated Mining Co.

Silver, Lead; Utah

The operations of the Chief Consolidated Mining Co. during the quarter ended June 30, 1921, showed a net profit of [illegible], a slight increase over the preceding quarter. The development footage and tonnage of ore shipped was greater also. The lower silver content of the ore (33.917 oz. per ton for the silver-lead ore, compared with 35.678 oz. in the first quarter) was balanced by an increase of lead (21.28 per cent instead of 17.24), and thus the average gross value of the ore remained about the same. Ore was produced from all the ore channels and all levels. Development progressed on the basis of about six miles per year. Work was begun in sinking the Water Lily shaft for the purpose of further developing the eastern portion of the property, which is considered promising. The speed made in this undertaking has recently been reported in the pages of the *Engineering and Mining Journal*.

The average gross value of all ores was, per ton, $40.02; smelting, freight and sampling was 60c. higher than for the first quarter, at $18.46, leaving a net value of $21.56 per ton.

Two Arizona Copper Co. Reports Show Losses in 1920 and 1921

The Arizona Copper Co. has issued two reports, one for the fiscal year ending Sept. 30, 1920, and another covering the period from Oct. 1, 1920, to May 31, 1921. The report of operations of the Arizona Copper Co. for the year ending Sept. 30, 1920, states that 17,486 tons of Bessemer copper was produced. Revenue statement follows:

	£	s.	d.	£	s.	d.
[illegible]				£	s.	d.
Loss on copper [illegible]				[illegible]	13	11
Add:						
Expenses of administration at Clifton	[illegible]	[illegible]	[illegible]			
Interest paid in the United States, less received	27,[illegible]	[illegible]	[illegible]			
Taxes in the United States paid and reserved	107,[illegible]	[illegible]	[illegible]			
	£160,[illegible]	[illegible]	[illegible]			
[illegible] Arizona	[illegible]	[illegible]	[illegible]			
	£162,4[illegible]	[illegible]	[illegible]			
Charges and expenses in Edinburgh, less received for transfer fees, [illegible] 17s. [illegible]	[illegible]	[illegible]	[illegible]			
				[illegible]	[illegible]	[illegible]
				[illegible]	[illegible]	[illegible]
Deduct:						
[illegible]				[illegible]	[illegible]	[illegible]
				[illegible]	[illegible]	[illegible]
Interest received [illegible]				[illegible]	[illegible]	[illegible]
				[illegible]	[illegible]	[illegible]
Add:						
[illegible]				[illegible]	[illegible]	[illegible]
[illegible]				20,000	[illegible]	[illegible]
[illegible]				[illegible]	[illegible]	[illegible]
[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]			
				[illegible]	[illegible]	[illegible]
[illegible]				[illegible]	[illegible]	[illegible]
[illegible]						
[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]			
				24,551	[illegible]	[illegible]
[illegible]				[illegible]	[illegible]	[illegible]
[illegible]				[illegible]	[illegible]	[illegible]
[illegible]				[illegible]	[illegible]	[illegible]

A report of operations of the Arizona Copper Co. for the period beginning Oct. 1, 1920, and ending May 31, 1921, states that 18,500,000 lb. of copper was produced in the interval. Profit and loss account follows:

	£	s.	d.	£	s.	d.
I. Six months to March 31, 1921						
[illegible]				[illegible]	[illegible]	[illegible]
[illegible]				[illegible]	[illegible]	[illegible]
Loss on copper and stores [illegible]				£164,347	11	[illegible]
Add:	£	s.	d.			
Expenses of administration at Clifton	11,458	17	[illegible]			
Interest paid in the United States, less received	26,098	5	[illegible]			
Taxes in the United States paid and reserved	[illegible]	[illegible]	[illegible]			
	[illegible]	[illegible]	[illegible]			
Public subscriptions in Arizona	[illegible]	[illegible]	[illegible]			
Charges and expenses in Edinburgh, less received for transfer fees, £177 12s. [illegible]	[illegible]	4	[illegible]			
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
				[illegible]	[illegible]	[illegible]
Deduct:						
Sums received in respect of [illegible]						
Interest and dividends [illegible]				12,089	11	9
				[illegible]	[illegible]	[illegible]
Interest received less paid				[illegible]	[illegible]	[illegible]
				[illegible]	[illegible]	[illegible]
Add:						
Amount carried to reserve for contingent [illegible]				[illegible]	[illegible]	[illegible]
Deficiency				£254,277	[illegible]	[illegible]
Dividend on "A" preference shares for six months to March 31, 1921	£1,187	[illegible]	[illegible]			
Dividend on preference stock for six months to March 31, 1921	11,[illegible]	11	[illegible]			
				[illegible]	[illegible]	[illegible]
Deficiency for six months to March 31, 1921, after paying preferential dividends				[illegible]	[illegible]	[illegible]
II. Two months to May 31, 1921						
Deficiency for the two months to May 31, 1921, [illegible] preferential dividends [illegible]				[illegible]	[illegible]	[illegible]
Deficiency for eight months to May 31, 1921 [illegible] preferential dividends				[illegible]	[illegible]	[illegible]
[illegible] 1920				[illegible]	[illegible]	[illegible]
Net deficiency at May 31, 1921				[illegible]	[illegible]	[illegible]

The Arizona Copper Co. has now been taken over by the Phelps Dodge Corporation. Details of the purchase and agreements made were published in the issue of *Engineering and Mining Journal* of Oct. 8.

Capitalization: "A" preference shares, £7,480 10s., in shares of 5s. each; £316,[illegible] [illegible]; £379,974 in ordinary shares of 5s. each.

Mining Dividends for September, 1921

The following dividends were paid by mining and metallurgical companies during September, 1921:

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

The [illegible] from these [illegible] made by these companies.

MINING STOCKS

Week Ended October 8, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Ahmeek	Boston	57	54½	55½	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*44	*38	*39		
Allouez	Boston	21	21	21	Mar. '19	1.00
Anaconda	New York	41½	40¼	40¾	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2	1¾	2		
Ariz. Com'l	Boston	9¼	8½	9¼	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*40	*28	*30		
Bingham Mines	Boston	14	13	13½	Sept. '19, Q	.25
Calumet & Arizona	Boston	..	..	45½	Sept. '21, Q	.50
Calumet & Hecla	Boston	245	238	240	June '20, Q	5.00
Canada Copper	N. Y. Curb	*39	*30	30		
Centennial	Boston	9½	8	8½	Dec. '18, SA	1.00
Cerro de Pasco	New York	30¼	29	30¼	Mar. '21, Q	.50
Chile Copper	New York	12	11½	11¾		
Chino	New York	26½	25¼	25¾	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*18	17¼	*17½		
Con. Arizona	N. Y. Curb	...		*1	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1¼	1⅛	1¼		
Copper Range	Boston	36½	36	36½	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*27	20	22		
Davis-Daly	Boston	7¾	6¾	7½	Mar. '20, Q	.25
East Butte	Boston	10	9½	9½	Dec. '19, A	.50
First National	Boston Curb	*95	*80	*90	Feb. '19, SA	.15
Franklin	Boston	3	2½	2½		
Gadsden Copper	Boston Curb	.		[illegible]		
Granby Consol.	New York	21½	21	21	May '19, Q	1.25
Greene-Cananea	New York	24¼	22¼	22¾	Nov. '20, Q	.50
Hancock	Boston	2½	2½	2½		
Howe Sound	N. Y. Curb	2¼	2¼	2½	Jan. '21, Q	.05
Inspiration Consol.	New York	36½	35¼	35½	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6¼	6	6¼	Sept. '20, K	.25
Isle Royale	Boston	21	20	21	Sept. '19, SA	.50
Kennecott	New York	22	20½	21¾	Dec. '20, Q	.50
Keweenaw	Boston	1¼	*99	*99		
Lake Copper	Boston	2½	2½	2½		
La Salle	Boston	2	1¾	1¾		
Magma Chief	N. Y. Curb	8	8	8		
Magma Copper	N. Y. Curb	*22½	*21½	*22¼	Jan. '19, Q	.50
Majestic	Boston Curb	*6	6	*6		
Mason Valley	Boston	1½	1½	1¾		
Mass Consolidated	Boston	2¼	2¼	2¼	Nov. '17, Q	1.00
Miami Copper	New York	22¼	21¾	22¾	Aug. '21, Q	.50
Michigan	Boston	2½	2¼	2½		
Mohawk	Boston	54	53	53¼	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	4½	3¾	4¼		
Nevada Consol.	New York	12	11½	11¾	Sept. '21, Q	.25
New Baltic	Boston Curb			3		
New Cornelia	Boston	15	14½	14¾	Aug. '20, K	.25
North Butte	Boston	11½	10½	11¼	Oct. '18, Q	.25
North Lake	Boston	*30	*30	*30		
Ohio Copper	N. Y. Curb			*6		
Old Dominion	Boston	25	24	24	Dec. '18, Q	1.00
Osceola	Boston	30	28	28½	June '20, Q	.50
Phelps Dodge	Open Mar.	†165	†155		Oct. '21, Q	1.00
Quincy	Boston	41	38	40	Mar. '20, Q	1.00
Ray Consolidated	New York	14¼	13½	13¾	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*25	*19	22		
St. Mary's Min. Ld.	Boston	40	38	38	June '20, K	2.00
Seneca Copper	Boston			13¼		
Shannon	Boston	1¼	1¼	1¼	Nov. '17, Q	.25
Shattuck Arizona	New York			7½	Jan. '20, Q	.25
South Lake	Boston	†1	†*50	1		
Superior & Boston	Boston	2	1½	2		
Tenn. C. & C. cfs.	New York	8	7¾	7	May '18, I	1.00
Tuolumne	Boston	*50	44	*44	May '13	.10
United Verde Ex.	Boston Curb	28	26	27	May '21, Q	.25
Utah Consol.	Boston	4	3	3	Sept. '18	.25
Utah Copper	New York	53¼	51½	52¼	June '21, Q	.50
Utah Metal & T.	Boston	1½	1½	1½	Dec. '17	.30
Victoria	Boston	1½	1¼	1¼		
Winona	Boston	*60	*45	*55		
Wolverine	Boston	12	11	11		
		NICKEL-COPPER				
Internat. Nickel	New York	14¾	13¾	14½	Mar. '19	.50
Internat. Nickel, pf.	New York	76	75	75	Aug. '21, Q	1.50
		LEAD				
National Lead	New York	76	74¼	74¾	Sept. '21, Q	1.50
National Lead, pfd.	New York			102	Sept. '21, Q	1.75
St. Joseph Lead	New York	12¾	11¾	11	Sept. '21, Q	.25
		QUICKSILVER				
New Idria	Boston	†*50		*50		
		ZINC				
Am. Z. L. & S.	New York	10¼	9½	9½	May '20	1.00
Am. Z. L. & S. pfd	New York	30	30	30	Nov. '20, Q	1.50
Butte C. & Z.	New York	4½	4¼	4	June '18	.50
Butte & Superior	New York	14½	13½	14	Sept. '20	1.25
Callahan Zn-Ld.	New York	4¾	4¼	4½	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	122½	119	121	Aug. '21, Q	2.00
Success	N. Y. Curb			2	Jan. '16	.03
Yellow Pine	Los Angeles	*45	*20	*55	Sept. '20, Q	.03

Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	⅜	⅛	⅝		
Alaska Juneau	New York	¾	¾	⅞		
Carson Hill	Boston	15½	14	14		
Cresson Consol. G.	N. Y. Curb	1 11/16	1½	1 9/16	June '20, Q	$0.10
Dome Extension	Toronto	*70				
Dome Mines	New York	19	18¼	18¼	July '21, Q	.25
Florence Goldfield	N.Y. Curb	*48	*44	*45		
Golden Cycle	Colo. Springs	*67	*67	*67	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*7	*3	*3	Dec. '19	.05
Hollinger Consol.	Toronto	7.50	7.35	7.45	Oct., '21, 4 wks.	.05
Homestake Mining	New York	57	56	56	Sept. '21, M	.25
Kirkland Lake	Toronto	*37	*30	37		
Lake Shore	Toronto	1.36	1.25	1.28	Aug. '21, K	.02
McIntyre-Porcupine	Toronto	1.97	1.93	1.95	Sept. '21, K	.05
Porcupine Crown	Toronto	*17	*14½	*16½	July '17	.03
Porcupine V. N. T.	Toronto	*19½	*18	*19½		
Portland	Colo. Springs	†*42	*35	*36½	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb			*4	May '19	.05
Schumacher	Toronto	*26	*24	*25		
Silver Pick	N. Y. Curb	*9	*9	*9		
Teck Hughes	Toronto	*17½	*15	16		
Tom Reed	Los Angeles	*70	*62	*63	Dec. '19	.02
United Eastern	N. Y. Curb	2½	2¼	2¼	July '21, Q	.15
Vindicator Consol.	Colo. Springs	*22	*22	22	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*3	*2	2		
Yukon Gold	N. Y. Curb	1¼	1¼	1⅛	June '18	.02½
		SILVER				
Arizona Silver	Boston Curb	*20	*17	20	Apr. '20, M	.03
Batopilas Mining	New York	⅝	½	⅝	Dec. '07, I	.12½
Beaver Consol.	Toronto	*26	*24	*25	May '20, K	.03
Coniagas	Toronto	1.65	1.55	1.65	May '21, Q	.12½
Crown Reserve	Toronto	*15	*11	*13½	Jan. '17	.05
Kerr Lake	N. Y. Curb	3½	3¼	3½	July '21, Q	.12½
La Rose	Toronto	*34	31	34	Apr. '18	.02
McKinley-Dar. Sav.	Toronto	*26	*22	*24	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.18	1.10	1.18	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	5½	5	5½	July '21, Q	.15
Ontario Silver	New York	4¾	4¾	4¾	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb			*11	Jan. '12	.10
Temiskaming	Toronto	*27	*21	*21	Jan. '20, K	.04
Trethewey	Toronto	*14	*12½	*12½	Jan. '19	.05
		GOLD AND SILVER				
Barnes-King	Butte			60	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	1¼	1	1¼		
Cash Boy	N. Y. Curb	*5	*5	5		
Consol. Virginia	San Francisco	*36	*31	36		
Dolores Esperanza	N. Y. Curb	1¼	1¼	1½		
El Salvador	N. Y. Curb	*21	16	*18		
Jim Butler	N. Y. Curb			7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*4	*3	*3	June '16	.05
Louisiana Con.	N. Y. Curb			½		
MacNamara M & M.	N. Y. Curb	*15	14	15	May '10	.02
N. Y. Hond. Rosar.	Open Mar.			4	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 3/16	1¼	1 3/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*81	68	[illegible]		
Tonopah-Extension	N. Y. Curb		1½	1½	Oct. '21, Q	.05
Tonopah Mining	N. Y. Curb	1¼	1¼	1¼	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	1	*87	1	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N. Y. Curb	*6	*6	6	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	†1.15	†1.00	1.07½	Dec. '20	.15
Chief Consol.	Boston Curb	†2½	†2½	2¾	Aug. '21, Q	.05
Consol. M. & S.	Montreal	16	16	16	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†3.00	†1.00		July '20, Q	.10
Daly-West	Boston	2½	2¼	2¾	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†2½	†2	2	Apr. '21, K	.05
Electric Point	Spokane	*6½	*6	*6½	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*49	*39	*40		
Federal M. & S.	New York	7	7	7½	Jan. '09	1.50
Federal M. & S. pfd	New York	24	23	24½	Sept. '21, Q	1.00
Florence Silver	Spokane			10	Apr. '19	.01½
Grand Central	Salt Lake		†*15	...	June '20, K	.03
Hecla Mining	N. Y. Curb	4¼	4 3/16	4¼	Sept. '21, Q	.10
Iron Blossom Con.	N. Y. Curb	*18	*18	*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†3.50	†1.50		Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*4	*4	4	June '21, I	.02
Prince Consol.	Salt Lake	*8	*6	*8	Nov. '17	.02½
Rambler-Cariboo	Spokane	*2	*1	1½	Feb. '19	.01
Rex Consol.	N. Y. Curb	*11	*9	*10		
South Hecla	Salt Lake	†*30			Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*12	*10	*12	Oct. '17	.05
Stewart Mining	N. Y. Curb	*4	*4	*4	Dec. '15	.05
Tamarack-Custer	Spokane	1.75	1.65	1.75	Jan. '21, K	.04
Tintic Standard	Salt Lake	2.05	1.82½	2.02½	July '21, Q	.05
Utah Apex	Boston	3½	2¾	3	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb			2	Nov. '17	.01
		VANADIUM				
Vanadium Corp.	New York	32¼	30½	31¾	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	48	47	47	July '21, Q	1.50
Asbestos Corp. pfd	Montreal	70¼	69¼	70¼	July '21, Q	1.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	39¼	37	38	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf.	New York	78½	75	75	Sept. '21, Q	1.75
Am. Sm. pf. A	New York	72	70	72¼	Oct. '21, Q	1.50
U. S. Sm. R. & M.	New York	34½	34	34	Jan. '21, Q	.50
U. S. Sm. R. & M. pf.	New York	40½	39	39	July, '21, Q	.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
[illegible] T. M. HAIG
J. VOLNEY LEWIS
[illegible]
Consulting Editors

Volume 112 New York, October 22, 1921 Number 17

The Merits and Demerits of the Mining Law Bill

THE BILL for a revised mining law, introduced by Representative Arentz, of Nevada, and which has been drafted by a committee of engineers selected by the Bureau of Mines, should be considered very carefully by our readers. It abolishes extralateral rights for all mining claims to be located in the future; it substitutes for the extralateral rights of such claims, vertical boundary lines; it removes the necessity of a real or faked discovery before filing a claim; it makes the form of the claim square, instead of oblong-rectangular, or oblong-rhomboid, as at present. There is nothing new about these proposals to experienced mining men. It is the old Spanish law, with which they are familiar, especially through experience in Mexico; it has been abundantly tested and found good. There is no use in arguing about that, to those whose experience has been broad. It is a better law than our existing mining law of the United States. Everybody agrees to that; and the propositions are, therefore, not only simple but tried.

There are some minor things in the bill that are not so evidently advisable: For example, the stipulation that the lines of claims be surveyed in conformity to the existing lines of public land surveys; and that on public lands the claims shall be a regular subdivision of the land-office divisions—that is, shall be a regular "forty" of a regularly surveyed section in a regularly surveyed township. So we interpret the proposed law; and it is certainly a mistaken provision. There is no adequate and natural reason why it should do so.

When a prospector makes a discovery of ore—there will always be in most cases a real discovery—he should be allowed to stake his claim, so that his forty acres will be advantageously selected with reference to his deposit, because he will not wish to hold any useless ground on which to pay the costs. He may, under the new law, find ore on the line between two "forties," in which case he will have to take up both forties, or eighty acres, equivalent to four claims of the present size, in order to hold his one find; or if he should find ore on or near a "quarter corner" he would have to take up four claims, or 160 acres, equal to eight present claims, to hold his find.

Moreover, the requirement of the proposed law involves this, that before legally staking a claim in a surveyed region, the prospector must ascertain the lines and monuments of the land survey. Those of us who are familiar with the mountains and desert know that as a practical matter these monuments and lines in many cases do not exist; they may be found only in the maps in the land office. It would require not only a surveyor, but a detective, and finally a research into the checkered annals of land surveying practice and dead-and-gone governmental graft, before the prospector could drive his stakes and establish a legal right.

Senator Pittman, we hear, has observed that the new law has been drafted "very carelessly"—an observation that strikes rather humorously those who know the years the committee has put upon it. But it is this unfortunate provision as to survey and location which is attracting the unfavorable attention of the prospectors and miners of the West, and which is giving, colloquially speaking, a "black eye" to the whole of this otherwise plainly meritorious and desirable piece of legislation. This feature must be eliminated. We cannot understand how it could have been allowed to slip in.

The membership of the Mining and Metallurgical Society of America, in which the present movement started, voted in 1916 in favor of the vertical boundary lines, the abolition of the necessity for a discovery, and the square claim, but voted distinctly against the proposition that the mining claim should be located to conform to a regular subdivision of the public land surveys. The committee would have done well to have heeded this referendum, as is now evident.

As for us, we hope the bill will be amended as to its objectionable features, and pass. It should be strongly supported, as to its main proposals. The law will not, of course, take away rights from any of the existing claims.

Conditions in Mexico

RECENT TRAVELERS in Mexico take a soberly optimistic view of the situation there. The country has been immensely impoverished and reduced as the result of the years of turmoil, but there is left a great distaste and weariness of war. The country is quiet. Villa tills his vast ranch, the reward of the wicked. Mining activity is increasing a little here and there. There is a growing tendency to gamble upon a long-continued period of peace and a return of government. Yet the country has far to go before being even as far along as was the old Mexico of Porfirio Diaz. The railroads are largely stripped of rolling stock. Many of the large companies have to purchase and bring in their own freight cars in order to move their ore. The government, which owns and operates the railways, furnishes the engines and the train crews, and the company the cars, which when dumped are returned empty to the owning company.

The Passing of Bolshevism in Mexico

THE MEXICAN CHARACTER has evidently been affected by the [illegible] of the past decade. Political doctrines, [illegible] down to Bolshevism, have [illegible] by the [illegible] servility of the peon [illegible]. There was a period when the [illegible] A [illegible] a Mexican stealing [illegible] before a judge.

At this period the judge was inclined to take the view of the peon, that, being a free citizen of Mexico, he had a right to help himself to ore in the mine in which he worked. Did not the mines belong to the miners, more than to anyone else? Whereupon the mine operator waxed wroth, indignant, and wordy; and the judge promptly fined him for contempt of court, with imprisonment as an alternative. So the ore thief went without punishment, and the mine operator was punished. But the pendulum has swung back from this extreme, and Bolshevism is a dead issue in Mexico, as it is all over the world.

How To Get Back to Hard Money

SOME WHO HAVE LIVED through the vicissitudes of Mexico during the last few years, and studied her economic and fiscal conditions, feel that they have some precedent for predicting what may happen to the currency of Austria and Germany and the countries of eastern Europe. In Mexico there was flood after flood of paper money, growing, as was inevitable, cheaper and cheaper, more and more worthless, as it became more and more hopelessly remote from any solid underlying security. Finally a revulsion seized the people, running more or less simultaneously throughout the nation. They would not bother further with the truck. There were severe legal penalties against refusing to receive the paper currency as legal tender; but the revulsion and the refusal to accept it were so widespread that the law was inoperative from the reason of the broad nature of the movement and the attitude of the population.

The paper dollars were repudiated, not by the government but by the people. They would take only hard money—silver or gold. So, with the swiftness of a revolutionary movement, and without any governmental action, the nation, almost overnight, speaking figuratively, changed from paper to gold and silver; and today in Mexico only gold and silver are used as money. Thus a new economic and monetary law, a sequel to the oft-quoted law of Gresham, was evidenced. Gresham's law, as we remember, was that in times of depreciated and varying currency, the cheap money drives out the good. In France, for example, the paper money has driven out the silver coins, which have disappeared—sold into Switzerland or England or hoarded. But the new law as displayed in Mexico (and not alone there) is that at a certain stage of cheapness, when the cheap money becomes practically worthless, the good money drives it out. So all the mining and other enterprises in Mexico now are compelled to pay their wages only in solid coin.

Such an event is accordingly predicted by these observers for certain countries in Europe. In Russia and in Austria the revulsion would appear to be overdue; and such a happening in Germany would provide an avenue back to sound money not contemplated by economists. The revaluation of the mark or the repudiation of paper currency by the government are the probabilities contemplated by many financiers; and either avenue is a repudiation. But, if the people should drop their paper rolls, as worthless, into the gutter, and trade only with something else, the government would be saved the trouble of solving the puzzle and the paper marks would have the same status as Confederate currency, now valued solely as a historic curiosity of our Civil War period, has with us.

Drill-Hole Results and Gold-Dredge Recovery

THE DIFFERENCE between expectation, as determined by preliminary examination, and recovery, as attained by a given plant and equipment, is a subject of considerable interest not alone to engineers but also to financiers and others who put their money into mining enterprises. There is a well-justified belief that in the great majority of examples, where the deposit in question is accessible at a sufficient number of places, a thorough preliminary examination by experienced engineers reduces the difference between expectation and actual recovery to a comparatively narrow margin. As the number of places examined in a single deposit becomes smaller, the element of uncertainty becomes greater. There thus can be placed a limit predicated on the degree of accessibility to the accuracy of the results obtained in the examination. This limit will vary with different types of deposits and with the vagaries of individual deposits.

Charles W. Gardner presents a review on pp. 646-649 of this issue of the differences that arise in gold-dredging practice between expectation and recovery. It is a valuable contribution in that it cites a number of examples where the recovery is less than anticipated, others where it is greater, and some where it is approximately the same. The method of examination of dredging ground is usually by bore holes of relatively small diameter, spaced at considerable intervals. In some instances shafts are sunk to bedrock to check the results of the bore holes.

It is impossible to escape the conclusion, after a study of Mr. Gardner's examples, that the method of depending upon bore holes is not universally applicable to such deposits, and with this conclusion most engineers will agree. Just where to draw the line is the hard question. What deposits can be safely drilled? What deposits must be examined by other methods?

Mr. Gardner does not analyze individual cases, nor is the accompanying information sufficient to enable a reader to analyze them for himself. He discusses the factor used in calculating the value per cubic yard and points out the importance of the personal equation. He leaves us with the idea that there is a large element of uncertainty, but does not definitely tell us why.

In the discussion which followed Mr. Gardner's paper at the California Gold Dredge Operators' meeting at Natoma, on Sept. 27, R. G. Smith, engineer with the Natoma Company of California, suggested that the gold dredge was not doing its work and that part of the difference should be laid to the failure of the dredge in some instances to secure a high recovery of the gold actually present. Thus a reduction factor, personal equation, and the dredge itself received the blame. All, no doubt, are concerned in the problem. We should like to see them discussed in the light of carefully studied examples.

At the Nevada meeting of the dredge operators, Gerald H. Hutton introduced this subject for discussion. He advocated the successive placing of groups of drill holes and the comparison of the results from the different groups. As soon as sufficiently close agreement was obtained, in his opinion, further drilling is unnecessary. In computing averages, he suggests that drill holes of extremely high values be cancelled with the same number of holes extremely low in value, and the value content of the ground be derived from the number of tests of average or mean value remaining. The first suggestion is in principle at least used by many engineers in making preliminary examinations. Usually, however, a different method rather than a repetition of the one used in the first testing is employed. The second suggestion might sometimes apply, but a more definite reason for such cancellations in specific instances should be found.

It appears to us that the nature of the deposit, whether river channel, terrace, or flood plain, would be of importance. The physical nature of the gravel, whether fine or coarse, loose, compact, or cemented, whether charged with water or not, enters into each investigation. The presence of clay beds and sand beds would also have a bearing. How fine or how coarse are the particles of gold, and what is their distribution? Is the gold relatively coarse in those instances where there is a wide spread between expectation and recovery? On the other hand, where the gold is in a finely divided state, and more or less distributed over a considerable depth of bore hole, is the spread between expectation and recovery negligible? Do compact gravels give close agreement between expectations and recovery and do loose gravels increase this? Does the sinking of a certain number of shafts in proportion to the number of drill holes guard against a wide discrepancy? These questions suggest themselves to us as important in reaching a decision as to the reliability of the bore-hole method of testing dredging ground.

Charles Janin, in his excellent treatise on "Gold Dredging in the United States," says: "To assure the success of a gold-dredging venture, experience and judgment are requisite to the conduct of every detail of the work and pre-eminently in prospecting and examining the ground." He further says: "The reliability of the tests and the accuracy of the average value indicated either by drilling or by sinking shafts depend on the care taken in prospecting, the number of samples procured, the location of the holes in relation to the deposit, and the experience and ability of the men in charge. If these factors are satisfactory, the estimate of the value of the property should require no discounting other than to recognize that the recovery of the dredge is always less than the gold content indicated by prospecting and that the returns on the investment should be enough to compensate for any risks that may be taken."

We agree with Mr. Janin, but we would like to see the discussion of this question extended on more specific lines than have as yet appeared.

Lead and Chewing Gum

ONE OF THE EVILS of the present period of readjustment in metal markets and prices is the necessary stimulation of new and the resurrection of old uses for the metals in an effort to increase their wider employment, and aiding consumption in what has been a sluggish market. Naturally, the high prices of the war period forced, and generally encouraged, the use of substitute materials whenever that was possible. The attempt of the copper producers, through an organization formed for the purpose, to delve into the use of copper and to popularize its employment is too well known to mining engineers to require emphasis here. Some of the old uses will return without much persuasion, aided by the low price of the metal. Others will necessitate the application of stronger methods.

The predicament of the copper producers is duplicated to a greater or smaller extent in the other metal markets. Occasionally, heartening reports come to us from producers that a manufacturer who reluctantly discarded the use of a non-ferrous metal during the war is gladly returning to it. A recent illustration is the problem that has confronted chewing-gum manufacturers—chewing-gum manufacturers also have their troubles—in adequately protecting the slabs of chicle from dryness and deterioration. Being considered relatively unimportant or subordinate to war industries, chewing-gum factories did not obtain their customary supply of lead for foil purposes during the war. Rather than allow the populace to go gumless, they generally, with one or two exceptions we believe, turned to the use of waxed paper in wrapping the individual and collective slices. Those of us who occasionally exercise our jaws on the rubbery product of *Mimusops globosa* will recall how hard and dry the gum became, despite the paraffined cover. We have no doubt that many a gum addict changed brands when he discovered that the quality of his pet licorice, mint, or wintergreen gum had changed in character. Fortunately, one or two manufacturers steadfastly adhered to the use of metallic foil, so that a comparison was constantly available and some relief given from the dry, crackling variety of covering so widely used as a substitute during the period of war scarcity.

Now, however, it appears that the gum people are again entering the lead market, the metal to be converted into foil, the superiority of which is generally admitted, and that the foil business is picking up. Lead and tin foils make unexcelled cheap protective coverings for a variety of products, from tea to tobacco, and although the consumers of foil were somewhat hard hit by their inability to secure all the lead they desired during the war, their return to it with relish is one good example of the failure of substitutes to measure up to expectations.

It probably is not the only example, for our readers may be personally familiar, through their own experience, with the inefficacy of substitutes for copper, lead, and zinc. The metals in general gained their pre-war positions in industry on merit, and are returning to them for similar reasons. It is an encouraging and hopeful sign for the non-ferrous mining that this transition is taking place.

Flotation Experiments

WALTER S. MORLEY'S paper on the "Flotation of Pyrite," prepared for the A. I. M. E., and recently mentioned elsewhere in this journal, represents an attempt to investigate the limitations of flotation by a series of simple synthetic experiments. This is a decided advance over the preliminary work that has been published on flotation. The number of variables which influence flotation is such that accurate conclusions are difficult to draw. Only by the laboratory method of controlled and known conditions in systematic experiments can definite improvement in the knowledge of the art be made.

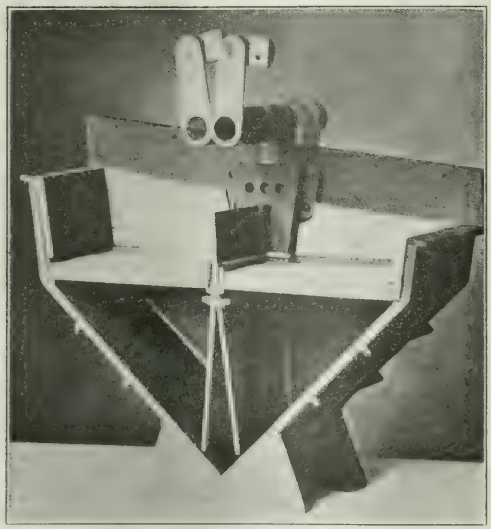
We hope that Mr. Morley will continue his experiments and investigate the physical and chemical conditions controlling flotation with such thoroughness as to permit of their statement in a form immediately useful to the practical mill superintendent and other workers.

WHAT OTHERS THINK

Obtaining Suction in Jigs

The interesting and timely article by Edward S. Wiard covering preliminary roughing by jigs and tables calls attention to a phase of the metallurgical treatment of low-grade ores which seems to have been overlooked too often. The desire for a simple flow sheet and "one easy step" in grinding has been the primary cause for the forgetting of old-time principles and the elimination of such important steps as Mr. Wiard describes.

In Mr. Wiard's diagram to illustrate the action of the grains of gangue and mineral in a jig bed, he has assumed that the grains are of equal size. Such is generally not the fact. The grains of metallic minerals usually are more friable than the gangue and are crushed finer, and hence they will be carried by the suction effect of the piston through the interstitial openings to the screen and then through into the hutch. This is particularly the tendency if the roughing jig is used for handling an unsized product, in which event the jig might discharge from its hutch a real concentrate, from its surface a real tailing, and from properly designed end or side discharges a real middling.



DOUBLE EXPOSURE, NEILL JIG, SHOWING SWING OF PADDLE

The loss of capacity due to suction, as mentioned by Mr. Wiard, must be considered as relative to perfect operation, the capacity of the jig being almost entirely dependent upon the quantity of transportive water fed to the machine.

In the system devised by Woodbury, and largely in use in the Lake Superior region, each compartment in one jig is followed by a dewatering compartment, and the surplus water is carried to the nearest jigging compartment, thus doing away with the objection noted by Mr. Wiard. For roughing and for unsized feed where the object is the simple removal of finely divided mineral particles, no such amount of water would be necessary. In a roughing jig handling an unscreened product the effect of suction aids the elimination, through the bed, of the particles which it is desired to save. Therefore, the jig which produces the greatest suction is the one to be preferred for this operation.

In the Neill jig, of which an illustration is herewith given, there is no plunger compartment. The space ordinarily used as a plunger compartment is available for jig work. Pulsion and suction in both compartments are obtained by the swing of a paddle in the hutch below the screens. This paddle does not touch either the bottom of the compartment or either side.

The cut is made from a double-exposed photograph (of a sectional model of the jig) made for the purpose of showing the extent of the swing of the paddle. The volume that is displaced by the swing of the paddle is equivalent to about a 1¾-in. stroke of a plunger the same size as one screen, and as the entire paddle is submerged at all times, it is evident that the suction must be equal to the pulsion. The weight of the paddle blade below the point of its suspension, on the outside of the jig, is balanced by the two arms and a cross piece by which it is connected to the eccentric, and there is, therefore, only so much power consumed as is required by the actual raising of the water plus sand upon the screen. These jigs have been manufactured in sizes up to 18 sq.ft. of screen area, and operated with 3 to 3½ hp.

The following figures were obtained in a testing plant using these jigs wherein cassiterite mixed with river gravel, the latter screened through ⅜-in. openings, was fed to two jigs set in series. The cassiterite all passed 20 mesh. Thirty per cent passed 60 mesh. Its specific gravity was 5.56. The jigs were bedded with one inch of cast iron shot. The mixture of gravel and tin-stone was fed to the jigs at a rate of 4, 6, and 8 cu.yd. per hour, an average of 5.82 cu.yd. per hour. The jigs each had 9 sq.ft. of screen area.

The concentration was at an average rate of 9¼ into 1, but varied from 17.3 to 1 down to 6 to 1. The material fed to the jigs carried from 0.27 up to 0.53 per cent of tin oxide. The concentrate produced carried from 4.27 up to 6.38 per cent. The average recovery of all the tests showed 85.49 per cent saving in the first jig, and 2.25 per cent saving in the second jig, a total of 87.74 per cent for the whole plant.

The conditions prevailing in these tests were similar to those usually obtaining upon gold dredges, where these jigs have been widely used for the removal of the "black sand" and the gold or other precious metals. These conditions are, of course, different from those prevailing in concentrating mills, owing to the fact that in dredge operations the minerals are free from the gangue and no middlings are made. It was, therefore, simply a question of supplying sufficient jig area to remove all the mineral particles through the screen into the hutch. The concentrate produced is always, and purposely, of low grade, and is always subjected to further treatment, either by concentration, regrinding, amalgamation, tabling, or other suitable metallurgical method.

Using an 8-mesh screen, these jigs deliver a practically perfect 20-mesh product.

It has been suggested that this jig might profitably be placed in the crushing circuit ahead of the ball mills, with the object of removing from the circuit at this point all mineral particles of sufficient fineness to pass through the bed and screen, and handling this concentrate directly in the finishing plant, thus giving to the smelter the much-desired coarser material. Whether it would be advisable also to attempt to make a clean tailing in this same operation would depend entirely upon the character of the ore, but I believe that in many cases a tailing could be discarded and a further saving in crushing costs thereby attained.

San Francisco, Cal. JAS. W. NEILL.

Fundamentals of Exploration

The dictionary says "explore" means "to search or examine thoroughly." That being the correct definition of the term, present-day exploration companies are properly named and are logically doing their duty; but are they finding anything? It has been a long time since any new mineral discoveries of importance have been made in North America. It would be hard to name any notable strike in recent years, excepting the Premier mine, in British Columbia.

This condition, in view of the great sums that have been and are being spent by the exploration departments of many of our larger mining concerns, is becoming a matter of frequent comment, especially among Western mining engineers. These same Westerners are the witnesses of great *duplication of effort*, in that they are the nearest observers of the successive examinations of the same property, of the same district, by a dozen or more different engineers, representing as many different exploration companies, presumably in search of new mines, and profitable ones.

An engineer's diagnosis of a newly discovered mineral outcrop, or of an abandoned mine, or of a partially developed "prospect," is influenced by three fundamental factors:

First, the extent and *variety* of his mining, metallurgical, and geological experience.

Second, the requirements of his clients or backers.

Third, his courage.

In considering the first factor, we submit that many of the field engineers of these large exploration companies are able men who have made a notable success in the exploration and management of some particular mine and have been closely associated therewith over a considerable period of years without the valuable background of variety and diversity of employment in many fields at many mines.

A successful finder of mines must have in the back of his head the record of multitudinous past experiences (both successes and failures) to draw upon and bring into play as soon as he comes out to a new piece of ground.

If he has been merely a successful operator of one or two mines he has not the requisite background to make him a safe diagnostician of all prospects and rebellious mines. By *safe* I do not mean conservatism alone, but also I refer to an elimination of the danger of condemning something because it is unfamiliar.

In a consideration of the second factor, i.e. the requirements of an engineer's clients and backers, it would seem to me that in three-fourths of the cases under my observation these requirements were impossible because they either called for an elimination of chance altogether by demanding an assemblage of all essentials before spending a dollar in actual digging, or else their desire for something fashionably big in the way of tonnage obscured the real issue of finding something profitable. Although the element of *chance* is omnipresent and is what makes metals of commercial value in ordinary times, it can be reduced to a rational minimum in the hands of a field engineer possessed of a background of diversified successes and failures.

The third element—courage—has to do entirely with the ability of the field engineer to recommend to his employers something he absolutely believes in, the possible subsequent failure of which might endanger the tenure of his job. *Conservatism* in this field of endeavor means to decide for or against any enterprise accordingly as the preponderating evidence, comprising statistics and data and judgment (based on background of past experiences), is favorable or unfavorable. Any other form of conservatism is simply cowardice—a fear of risking one's personal future by indorsing something that "might not pan out all right."

If my analysis of these fundamentals is as sound as I believe it to be, would a little retrospection upon the part of our great exploration companies do any harm? For instance, how would it do to send an engineer (equipped with the requisite background) into the field, and instead of telling him we want this or that kind of an orebody in this or that stage of development, tell him: "John, we want to make some money in mining. Now go out and dig up something."

At the same time make sure that "John" heretofore has been something more than the successful superintendent or manager of some particular mine.

I venture the prediction that the successful field man and ore finder of the near future will be possessed of a long record of divers successes and failures in many fields and will have authority to spend ten or twenty thousand dollars in demonstrative preliminary digging at any place his judgment dictates. In the long run such a policy would result in finding more mines, and its cost would be no greater than the ultra-meticulous circumscribed procedure that is now usually followed without finding new mines or rejuvenating old ones.

The North American mining districts *have been* liberally scratched and the more self-evident mines have been discovered. New discoveries will be made at more obscure locations by widely experienced field engineers with a digging account to draw upon when necessary to penetrate the veil of obscurity that has caused other engineers to become conservative.

Silverbell, Ariz. PERCY WILLIAMS.

Transportation of Diamonds by Aircraft

To establish a quick way of transportation for the diamonds mined in the Province of Kasai, in the Congo State, the company [illegible] and operating these fields has acquired a number of airplanes, by means of which the [illegible] are now being sent to their [illegible] destination from the town of [illegible].

Drilling Results and Dredging Returns—I

Accuracy of Churn Drilling of Placer Deposits Limited by the Irregular Distribution of the Gold, the Relatively Small Samples Taken, the Skill Of the Operator, and Many Other Factors—Work Difficult To Check

BY CHARLES W. GARDNER

Published exclusively in *Engineering and Mining Journal**

IT IS ASSUMED by many that prospecting with a churn drill has become an exact procedure, and that from the results obtained the gold content in the tract of ground drilled can be determined accurately. An exact comparison between drilling results and dredge returns cannot be made until the area originally drilled and estimated has been completely mined, and it is the purpose of this article to show comparative results obtained from different fields and to demonstrate that drilling is not an exact procedure and that the results obtained cannot by any mathematical process be used to estimate absolutely the gold content in the prospected area. The churn drill is, however, the best device known for prospecting ground having the necessary qualifications for gold dredging, and the facts concerning its first use for that purpose may be of interest.

CHURN DRILL USED IN PLACER WORK ABOUT TWENTY-THREE YEARS

In 1897, C. H. Souther, of Boston, then president of the New England Dredging Co., became interested in the future possibilities of gold dredging and obtained an option on a tract of ground in Boise Basin, adjacent to Idaho City, Idaho. This property was later transferred to the Boston & Idaho Gold Dredging Co. and profitably mined. I went to Idaho in November, 1897, to take charge of prospecting this ground. After successfully sinking one shaft to bedrock, a second shaft was started, but owing to the equipment being inadequate to handle the large volume of water encountered, the shaft was abandoned and the difficulties and conditions were described to Mr. Souther. He had just seen a Keystone drill at work on a site for a proposed dam in Massachusetts, and he conceived the idea that it might perhaps be successfully used in prospecting for gold.

Mr. Souther at once communicated with the Keystone Drill Co., and Mr. Downie, its general manager, went to Boston and obtained an order from Mr. Souther for a No. 2 traction drill and guaranteed that it would do the required work, and as necessary to this accomplishment designed the vacuum sand pump now in common use. This drill was shipped on Jan. 1, 1898, and placed in use near Idaho City the first of February of that year. In March Mr. Souther ordered a second drill for shipment to Yreka, Cal. About a month later Messrs. R. G. Hanford and R. H. Postelwaite visited Beaver Falls, Pa., and, after seeing a demonstration of the drill, ordered one. A little later W. P. Hammon used the same type of drills in his extensive operations, and now they are in use all over the world.

Later, the Empire hand drill was placed on the market, and it has met a satisfactory acceptation and application, principally in places where the conditions and its light weight make it adaptable. Still later, the Union Construction Co., of San Francisco, designed a light, portable power drill which has been extensively adopted.

IRREGULAR DISTRIBUTION OF GOLD INFLUENCES DRILLING RESULTS

As these various types of churn drills are now in common use for prospecting, I shall consider the various conditions and causes affecting the accuracy of the results obtained. The first and most important of these is the uneven distribution of gold and the smallness of the sample taken. If the gold content in placer ground existed in the form of a sheet of uniform thickness covering a certain defined area, a sample from this sheet at one point would enable one to determine accurately its value as a whole. The distribution of gold, however, in the larger dredging fields of California, such as those on the Feather, Yuba, and American rivers, is very uneven, owing to its deposition and distribution by devious and changing currents of water and to its being changed and shifted by the action of later currents before finding its final resting place.

In smaller streams, narrowly confined between elevated boundaries, the gold is often deposited in a well-defined channel, and such conditions are frequent in Alaska and sometimes in the small deposits of the Pacific slope. It is the common experience of dredge operators that the amount of gold recovered by any one dredge varies noticeably from day to day and from week to week. Gold recovered from one cut will often vary by a large amount from that taken from an adjoining cut, and well-defined pay channels are comparatively limited in area.

Some interesting tests were made by J. J. Martin, while superintendent of the Chicksan Mines, in Korea, to determine the gold content in a tract of dredging ground, and these tests show both the uneven distribution of gold within limited areas and also the misleading deductions which may be made from the results obtained from any one drill hole.

MARTIN'S TEST SHOWED WIDELY VARYING RESULTS

An Empire drill with a 4-in. casing was used to drill a hole to bedrock, and results obtained indicated ground having an average value per cubic yard of 17.59c. Around this hole was then sunk a steel casing having a diameter of 3 ft. 3 in. The gravel content was taken out and washed, and the returns indicated a value per cubic yard of 37.33c. Around this casing the ground was laid off in a square 30 x 30 ft. This area was then subdivided into sections 10 x 10 ft., and at a corner of each section a drill hole was put down, making sixteen holes in all, which is proportionate to a little over twenty-seven holes per acre. The average of the assay results obtained from these holes was 15.22c. per cubic yard. The whole area was then excavated by hand to bedrock, the gravel was washed in a sluice box, and the content of the whole pit found to average 29c. per cubic yard.

---

*Read at the Meeting of California Dredge Operators, Natoma, Sept. 27, 1921.

The value per cubic yard as indicated by the first drill hole was 47.2 per cent of the casing value, 60.6 per cent of the pit value and 115.6 per cent of the average value indicated by the sixteen holes. The average from all of the holes was 52.5 per cent of the pit value. This disparity was due in some measure to the existence of small nuggets, because the gold was not uniform in size.

Five other 30-ft. squares were laid out in other places on the property, and in each sixteen holes were drilled at the same relative points as in the first square. The difference in results obtained from separate holes in each of the squares is startling. The range obtained was as follows:

DRILL RESULTS FROM SIXTEEN DRILL HOLES IN EACH PIT

Range of Values Indicated by Separate Holes

Pit No.	Highest Value, Cents	Lowest Value, Cents	Average Value, Cents	[illegible]
1	[illegible] 4	0.19	18.22	[illegible]
2	4.[illegible]	0.45	[illegible]	[illegible]
3	44.36	[illegible]	[illegible]	[illegible]
4	[illegible] 72	0.[illegible]	[illegible]	[illegible]
5	[illegible]	2.20	7.[illegible]	[illegible]
6	[illegible]	0.72	[illegible]	20.0

In common practice any of these drill holes in any one of the squares would, with the possible exception of some of those highest in value, have been accepted as fairly representing not only the square in which it was placed but also an additional area of from one to three acres. Further tests were made by Mr. Martin in an endeavor to test the values obtained from certain drill holes by sinking casings 3 ft. 3 in. in diameter around them, and the comparative results obtained were as follows:

Test No.	Value from Drill, Cents per Cu. Yd.	Value from Casing, Cents per Cu. Yd.	Per Cent of Casing Value Shown by Drill	[illegible]
A	4.[illegible]	[illegible] 42	[illegible]	[illegible]
B	36.87	97.83	[illegible]	[illegible]
C	4.[illegible]	15.12	[illegible]	4
D	[illegible] 42	[illegible]	22.7	[illegible]
E	17.59	[illegible] 33	[illegible]	[illegible]

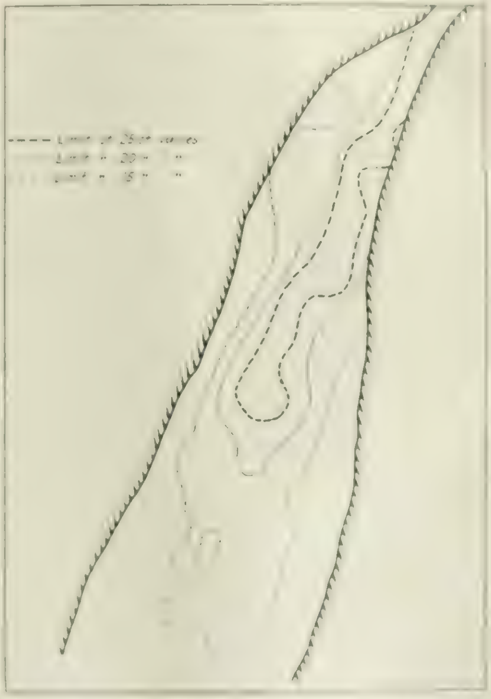
All of the drill holes were put down with an Empire drill, using 4-in. pipe, and the calculations were based on 289 ft. in depth as representing one cubic yard of material.

About a year ago a test was made on another placer property in Korea by dividing an area 20 ft. square into four 10-ft. square sections and drilling a hole at the corner of each, making nine drill holes in all. The range indicated by the separate holes was from 0.2c. to 34.1c. per cubic yard, and the average indicated by the nine holes was 11.33c. The whole square was then excavated to bedrock (about 23 ft.), the contents were washed, and the recovery was 12.9c. per cubic yard, the drill returns indicating 87.8 per cent of those actually obtained from the pit. The grains of gold in this ground were fine, without nuggets.

OTHER EXAMPLES ILLUSTRATE INACCURACY OF RETURNS

On a property in Colombia, tests were made at several places to determine the results indicated by single drill holes, and this was done, first, by drilling check holes, and then by sinking a shaft around them. The values found in cents per cubic yard were as follows: At the first point two drill holes gave 17.7c. and 22.6c.; shaft, 25.0c. Second point, one drill hole, 12.2c.; shaft, 20.0c. Third point, two drill holes, 17.0c. and 68.2c; shaft, 151.5c. Fourth point, three drill holes, 25.7c., 30.6c., and 34.4c.; shaft, 56.7c.

On a California property a drill hole was put down which gave a return per cubic yard of $1.56. To check this a hole was put down on each side of it and 15 ft. distant. These holes showed 46c. and 25c. respectively. In the same line two more holes were put down, each being 50 ft. from the center hole. These holes returned 30c. and 14c. respectively. When the ground was mined, the dredge cut across this line of holes and included them all. The dredge return for two weeks' operation in an area having these drill holes about in its center was 5c. per cubic yard. There was a great deal of clay, and the washing devices on the dredge were very inefficient, which accounts for some of the discrepancies.



SKETCH SHOWING DISTRIBUTION OF GOLD CONTENTS OF A PLACER DEPOSIT

On the same property, a drill hole which indicated a value of 2.7c. per yard, was checked by means of a shaft sunk around it, which gave [illegible] per yard. At another point a similar test was made, and the results indicated were [illegible] per cubic yard from the drill and 5.8c. from the shaft.

One dredging company operating in California checked the results obtained from a number of drill holes by sinking shafts around them. The ground contained no water and was so firm that the shafts required no timbering. The comparative results obtained in cents per cubic yard are as follows, in which A shows the value per cubic yard indicated by drill; B shows the value per cubic yard obtained from shaft, and C shows the percentage of drill values obtained from shaft:

Test No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	4.8	3.6	4.7	5.4	5.2	12.3	14.6	11.6	6.8	5.7	6.1	7.4	10.3	20.5	20.6
B	4.6	4.0	7.5	10.3	7.4	16.6	16.6	21.2	8.0	6.7	8.0	10.5	15.7	27.8	25.0
C	96	111	160	191	142	135	114	182	118	118	131	142	152	136	121

The average of all the drill values is 8.63c., of all the the shaft values 12.03c., the drill values being 71.7 per cent of those obtained from the shafts. The constant used in the drill calculations was 0.30.

An Alaska property was prospected by means of a hand drill using 6-in. casing. Holes were put down in pairs one and one-half to two feet apart. As the gold was deposited on or near bedrock, returns were figured on the square-foot basis. The results follow:

TESTS OF BEDROCK DEPOSITS

Holes	1–2	3–4	5–6	7–8	9–10	11–12	
Depth in feet	6.0	5.00	8.0	8.0	4.0	5.00	..
	6.5	5.00	9.0	7.0	4.0	5.00	..
Value per square foot, cents	2.5	2.9	Tr.	5.5	18.2	5.5	.
	Tr.	Tr.	49.3	1.8	2.9	1.8	..
Average value per square foot, cents	1.3	1.5	24.7	3.7	10.5	3.0	7.5

Holes assaying highest of each pair averaged 14.0c. or 187 per cent of the average value. Holes assaying lowest of each pair averaged 1.1c. or 15 per cent of the average value.

LINE 300 FEET ABOVE THE FIRST LINE

Holes	1–2	3–4	5–6	7–8	9–10	
Depth in feet	6.3	7.5	9.8	8.0	9.5	.
	7.5	9.0	9.5	8.0	9.0	..
Value per square foot, cents	6.2	1.8	100.0	2.2	7.0	..
	25.0	2.9	49.4	4.7	8.0	....
Average value per square foot, cents	15.6	2.3	74.7	3.5	7.5	20.7

Holes assaying highest in each pair averaged 28.1c. or 136 per cent of average value. Holes assaying lowest in each pair averaged 13.7c., or 66 per cent of average value.

It is the common belief that in a gravel deposit the gold found in a small section of any one distinct horizontal stratum is fairly representative of that stratum for some distance from the point where the sample was taken. To disprove this I am further indebted to Mr. Martin for information concerning the results which he obtained in a recent examination of a placer property in Oregon.

A part of the property had been mined, leaving a bank, with an exposed and almost perpendicular face, having a height from bedrock to surface of 123 ft. The overburden had a depth of 54 ft. and the gravel a depth of 69 ft. This face was prospected by first removing all loose and weathered material, and a channel, 2 ft. wide and 6 in. deep, was then cut down the face of the solid and undisturbed gravel. Cutting was made from stratum to stratum and the gravel from each separately washed. To test the evenness of the values in each stratum, check samples were taken by cutting the channel 6 in. deeper, and the comparative results obtained are as follows:

VALUES IN CENTS PER CUBIC YARD AS INDICATED BY SAMPLES FROM DIFFERENT STRATA

Test No.	A	B	C	D	E	F	G	H
First cut	0.24	5.5	13.8	5.4	16.6	10.2	75.3	74.2
Check cut	0.31	10.9	48.0	[illegible]	[illegible]	18.3	77.0	82.1

This indicates that it would have been necessary to have sampled a much larger area to obtain an average value and also indicates why two drill holes, if put down only a foot apart, would give entirely different results. Under some conditions placer gravels may be laid down so as to give a fairly uniform distribution of the gold when the deposit is considered as a whole, but with gold content so varying within short distances that it is impossible to outline areas carrying definite average values by the use of a drill.

A good illustration of this is found in a property which has now been dredged. The deposit is the result of stream action having a direct flow. The portion of it under consideration was originally crosscut with six lines of drill holes, some holes being spaced 100 ft. and others 200 ft. apart. The natural conditions indicated the existence of a well-defined pay channel, but the results obtained from adjacent drill holes on the same line were so variable and had such a wide divergence that it was impossible to define an area carrying any specific average value. After the property was dredged it was easy to outline the deposition of the gold and to define the limit of any certain average value, and this is illustrated in the accompanying sketch.

RELATIVELY SMALL AMOUNTS OF PLACER GROUND ACTUALLY TESTED

The above examples are sufficient to prove the uneven distribution of gold in placer fields having average conditions, and when it is considered that some dredging properties have been prospected with one drill hole to every ten acres, and that it is common to assume one drill hole to every one to four acres sufficient to enable close estimates to be made of the gold content, it is remarkable that drill results can so often be interpreted as closely approximating the dredging returns. A few properties have been prospected with an average of one hole to an acre, but this is unusual, and even on such a basis the proportion of the sample taken to the area represented is extremely small.

The external diameter of the cutting shoe used on the end of a 6-in. Keystone drill pipe is 7½ in., and its area 0.3068 sq.ft., which is $\frac{1}{141.982}$ of an acre.

In a quartz mine where the vein has been exposed by a drift, it is common practice to cut a sample at right angles to the strike of the vein the width of the ore exposed, and to repeat this at frequent intervals. If one imagines an orebody having an exposed width of 9.86 ft. and a length of 100 ft., as developed by a drift, and an attempt made to sample the whole by taking from some random place on the exposed back a piece of ore one inch square, it would be considered the extreme of absurdity, but such a sample would be in exact proportion in area, but not in volume, to that taken from one drill hole in an acre of ground.

If an Empire drill is used with a cutting shoe having an area of 0.1134 sq.ft., the portion of an acre sampled is $\frac{1}{384,093}$.

The second cause, which may be considered as having an important bearing on the accuracy of the results obtained by the use of a drill, is that of the personal equation. The average operator of a drill used in prospecting is a man of some experience in that line of work, one who can keep his machine in repair, successfully cope with such mishaps and accidents as frequently occur, and who is familiar with the common method of procedure. It is essential that he make such measurements as will enable him to know at all times the length of the pipe driven, the distance drilled below the cutting shoe, and the amount of core left in the pipe after pumping. Laxity on his part concerning any of these details will produce serious errors.

The panner must be skillful in the use of a pan and a rocker. It devolves upon him to keep a record of the details of the work as it progresses, to count the colors found in each pumping, measure the volume of tailing pumped, and collect by amalgamation all of the gold coming from the hole. Lack of skill, inattention or inefficiency on his part will be fatal to accuracy.

On some properties where dredging operations are being conducted, and where further prospecting by a drill is a necessity, the drill operations are frequently left entirely to a crew of inexperienced men, as the general conditions are well known and no close supervision is given to the work. The record of each hole, together with the gold recovered, is turned in by the panner to the office of the company. The amalgam is then cut by acid and weighed, and the value per cubic yard of the ground drilled is figured by the use of a standard formula. I question if the results thus obtained are not as fairly representative of the gold content of the ground as if an engineer were employed to give to the work his entire attention and to estimate results by more elaborate and theoretical methods.

In the examination and prospecting of new fields it is customary to employ an engineer to take full charge, and it is usual for him to find conditions different from those he has encountered in any previous examinations. He relies on the services of an experienced drill crew, and, if all of the mechanical operations are performed by the most approved method, the responsibility then devolves upon him intelligently to interpret the results obtained. In doing this he has to rely upon preconceived and imaginative ideas as to the effects produced by certain causes. He must consider the nature of the material, the amount of water found, the effect upon the result if boulders are encountered, make due allowance for any excessive flow of material into the pipe at any depth, and take into consideration the measured tailing when it is in excess or materially less than the theoretical volume displaced by the cutting shoe. In solving his problems he has no recourse to printed formulas and no established precedents. He may have made deductions from similar conditions in other fields without knowing to what extent they were verified by subsequent dredging returns.

Even if possessed of such information he realizes that conditions in the present field vary materially from those in the others, and that he has new problems. His position is like that of one called upon to estimate the distance between two points. His estimate is placed on record, but if he is not informed as to the actual distance, his first guess is no guide or help to him when called upon to estimate the distance between two other points. It is unfortunate that so few engineers are conversant with the dredging returns from ground which they have previously prospected, and in the absence of such information they adhere to their theoretical conceptions and ideas, with no concrete facts to either prove or disprove them. The uncertainty as to the results obtained is fully recognized by Mr. Prichard in his report to the Oroville Dredging Co. and published in *Engineering and Mining Journal* of Jan. 30, 1915, and expressed by him as follows:

> "Where gravel deposits extend several feet below the permanent water level, as those of the dredging areas of [illegible] there is no method commercially available for accurately determining their gold content. Drilling, which under these circumstances is the most accurate, gives only approximate results that are subject to wide variations owing to the personal variation of method, carelessness in drilling and panning, varying physical properties of the deposit, and to the economic impracticability of drilling holes sufficiently close together.
>
> "Having driven a tube and pumped the gravel out of it foot by foot to bedrock, and panned the gravel so extracted, and weighed its gold contents, we desire to know just what proportion of the displaced gravel and gold entered the tube and subsequently the pump, and what proportion was pushed aside by the tube in entering the ground and how much was pushed out of the flow in pumping. This proportion varies in different sections of the hole and also in the different holes, more especially where the physical character of the deposit is different. Many other variable quantities common to all types of drills enter into the process, but suffice it to say that we can only assume an average factor or proportion which is reliable to within perhaps 50 per cent of the true average figure on any individual drill hole."

It is with these facts in mind that I state that estimates of the gold content in placer ground are dependent to a great extent upon the personal factor, both as applying to the care and skill employed in the actual drilling operations as well as to the interpretation of the results on which the final estimate is based.

As indicating the difference in results which may be obtained, I may cite as an example work done on a certain property where an engineer crosscut the gravel deposit with five drill holes spaced 200 ft. apart. The average value per cubic yard of the section between the end drill holes was estimated to be 10.29c. Another engineer, working independently of the first, at a different time, drilled four holes midway between those originally put down, and the results from these holes applied to the whole section, as first estimated, gave a value of 18.20c. per yard, or an increase of 71 per cent.

It is an established fact that the same engineer with the same drill crew cannot redrill a piece of ground, even with holes placed a few feet from the original ones, and get the same results, and there will be a material difference should the holes in redrilling be laid out on different lines. The best illustration which we have of this is that given by James W. Neill and published in *Mining & Scientific Press* of Aug. 8, 1914.

In the property of the Yosemite Dredging & Mining Co. there was a tract thirty acres in area which was drilled with holes 400 ft. apart up and down stream, by 200 ft. across the flow, making twenty holes in all. The average value of all of these holes figured with a constant of 0.27 was 5.29c. per cubic yard. Three of the drill holes were high in value—25c., 14c., and 20c. If the value of these was cut in half, the average value of all the holes would then be 3.63c.

This tract was then redrilled by lines of holes across the flow and between the lines as first drilled. Twenty-five holes were put down, which gave an average value of 4c. per cubic yard. Two of these holes, having a value of 33c. and 13c. respectively, were considered high and were cut in two, giving an average value for all the holes of 3.27c.

Comparing the results of the two operations it appears that, if the full value of the holes be taken, the second drilling shows an average value per cubic yard of 75.6 per cent of the first. If the averaged values, obtained by an allowance for the high holes, are used, the results from the second drilling are 90.1 per cent of the first.

This example also brings up the interesting question as to how other engineers would have considered the high holes and what allowance they would have made for them, as each allowance has a material effect upon the average result.

(To be concluded.)

Cobalt in Jackson County, Ore.

Found Associated With Gold-Copper Ore in Gold Hill District—30,000 Tons of Ore Blocked Out In Chisholm Property Estimated to Run 4 1-2 Per Cent

BY A. E. KELLOGG

Written for Engineering and Mining Journal

ABOUT twenty years ago cobalt was discovered in Jackson County, Ore., by Dr. W. P. Chisholm, of Gold Hill, Ore., the pioneer of the quicksilver industry in that district, while he was developing his gold-copper mine in the "Meadows," twelve miles north of Gold Hill. This property, known as the Chisholm group, is still owned and under development by the doctor. It is situated not far from Chisholm's quicksilver properties, also in the "Meadows." Early in the development of the gold-copper property, large orebodies were opened up, which, besides producing gold and copper, also carried from 4 to 4½ per cent of cobalt. This work extended over a period of several years and it is estimated that at least 30,000 tons of this ore will produce not less than 4¼ per cent cobalt.

The discovery attracted considerable attention at the time among those seeking new deposits of cobalt. But owing to the low price and less extensive use of the metal at that time, investors were seeking deposits that would produce at least 6 per cent cobalt. Recently, however, operators have been urged to search for new deposits of cobalt, and the deposits of this region have been investigated. Development of the quicksilver properties shows that the cinnabar ore, besides producing gold, silver, nickel, zinc, and arsenic as byproducts, also gives evidence of cobalt values. Other localities in this region are believed to contain cobalt in commercial quantities, but the Chisholm mine is the only property in the district which has been reliably and systematically tested for cobalt.

The Chisholm mine is in a heavily timbered district, at an elevation of 1,760 ft. About $45,000 has been spent in its development. In part, the ore is a primary constituent of the norite country rock, and the vein deposits were probably derived from the same source. That is, magmatic waters, after concentration through crystallization of the main magma, probably carried the ores, simultaneously concentrated, into fissures and there deposited them with other vein-forming matter. At this mine there is no evidence that surface waters have produced any important effects; the veins are not leached nor oxidized, and there is no indication of secondary enrichment by meteoric waters.

A crosscut entry extends S 45 deg E about 30 ft. and is being driven thence S 63 deg. E about 300 ft. through quartzitic rock, but has not yet struck the main body of ore at the fault. About 150 ft. from the portal a fault strikes N 31 deg. W and dips 55 deg. northeast. It has a maximum thickness of 18 in. and contains fragments of quartzite. Near the fault the country rock changes from a micaceous to an ordinary quartzite There are two other older adits which show large bodies of ore. The lower and southern entry is in micaceous quartzite banded and locally contorted. The upper adit is about 100 ft. higher. It disclosed ore which consists of chalcopyrite and arsenopyrite. Surface waters have formed some gypsum and melanterite by oxidation of the sulphides.

The ore at this mine is very interesting, as it occurs in part as a primary constituent of a basic igneous rock, and in part as a vein filling. The rock is a norite containing abundant hypersthene partly poikilitically inclosed by plagioclase, both minerals intergrown with pyrrhotite and chalcopyrite as well as a little brown biotite, hornblende, and magnetite. Some secondary chlorite and calcite are also present. As a vein filling the sulphides occur intergrown with quartz, which may fill fissures or serve as a cement of broken material consisting of pegmatitic andesite with some quartz. The vein filling has been sheared since formation. It seems clear that the ore was derived from the norite magma.

The Gold Hill district is a mountainous region cut by one narrow east-west valley and its tributaries from the north and south. The elevation varies from less than 1,000 to 4,000 ft. The district is occupied chiefly by old Paleozoic sediments interbedded with stills or flows of andesite and greenstone. Everywhere the sedimentary rocks strike northerly, usually about N 15 deg. E and dip eastward at angles ranging from 65 deg. to nearly 90 deg. Diller has shown that Jurassic beds west of the district have been overturned so that the oldest strata now overlie the younger formations. It is probable that the Paleozoic sediments are also overturned, and that limestone found in the district is probably of early Paleozoic age, and fossils found in limestone lenses indicate that they are not Devonian; Diller would suggest that they are Silurian rather than Carboniferous in age.

Long after the formation of these Paleozoic sedimentary rocks, the region was intruded from below by a mass of molten igneous rock; at about the time and perhaps by the same agency the bedded rocks were closely folded and overthrusted to the westward. The intrusive rock solidified beneath a considerable thickness of sediments or other rocks, which has since been removed in some places. Thus the igneous mass is now exposed to view in the south part of the district, and extends thence northeastward past the Chisholm mine, and it seems probable to Diller that it underlies at considerable depth a large part of the Gold Hill district.

This igneous intrusion and intense folding seem to have elevated the region enough to cause a new erosion and the formation of coarse sediments which could not be transported far by ordinary agencies. Therefore conglomerates were produced, and these were succeeded by feldspathic sandstones during part of Cretaceous times. Rocks produced in this way are now found in the south part of the "Meadows." Along Evans Creek from the "Meadows" northward these Cretaceous sandstones are overlain by a considerable thickness of Tertiary sandstones which contain some thin beds of coal.

The latest rock formation in the district consists of stream deposits, some of which are valuable on account of the gold and platinum they contain. They are formed along all the streams of the district, but are not abundant along Rogue River in this region because the latter is here in a narrow rock-cut portion of its course to the sea.

War Minerals Problems

III—The War Minerals Investigations of the Bureau of Mines

BY J. E. SPURR

IT IS NOT GENERALLY KNOWN, but it deserves to be known, that the program of restriction of mineral importation which was worked out by the Committee on Mineral Imports in collaboration with other branches of the Government and through conference with the industries involved would have turned out to be unusually close had it not been interfered with. The one way to reduce shipping use in transoceanic ore-haulage was to reduce the maximum tonnage allowed to be imported; and at once it became necessary to provide for a program for increasing the domestic supply sufficiently to make up the tonnage barred. The advice and support of domestic producers was asked in carrying out this program. I refer, of course, to high-grade manganese ore, chrome, and pyrites; and it was pointed out to them that, with the restricted imports and surely far larger consumption, a certain large tonnage of domestic ore could be marketed promptly if produced.

The committee was justified in making these statements and in assuming its ability to carry its program through. It was so organized that it had behind it the administrative powers of the Shipping Board, the War Trade Board, and the War Industries Board; and its program had been accepted by all the boards. But it realized from the first that any laxity in restricting importations to the agreed figure would tend to overstock the market, and thereby leave the domestic producer of what was on the whole less desirable ore with some of his stock hanging on his hands. It, therefore, pointed out at the start that no infringement of the program restriction should be allowed on any excuse, especially on the specious "ballast and back haul" basis. This was a form of exception which always looked good to the shipping men, who, indeed, always fought for it. Some ship turned up with the plea that she had taken a cargo from the United States to New Caledonia, and unless she were allowed chrome ore as a back haul, or ballast, she would not be fit to put to sea.

There were a number of reasons, which the committee had fully investigated, which made it deaf to these emergency pleas. They were without exception the pressing devices of importers, and were promptly refused as fast as they came up. But our citizens have found that there are many departments to our Government; and their excellent story found sympathetic hearers elsewhere. One of these was in the office of the branch of the Shipping Board in New York, which controlled actual sailings and cargoes of ships—subject, of course, to the importation restriction schedules such as those which we had drawn up. This department assumed that "ballast and back haul" exceptions were not infringements of the restrictions; in fact, that the shipping efficiency would be thereby increased. A real conflict of authority grew up between the two departments of the Shipping Board, our committee (through Mr. E. F. Gay, member of the War Trade and Shipping Boards, our immediate chief) insisting on a literal interpretation of the restrictions, and the New York department insisting on its interpretation of shipping efficiency. For a ship to clear, however, the approval of both branches of the Shipping Board was necessary. Therefore, it happened at that time that a ship might be released and stopped again by the same board; and in one pivotal case, that of the "Betsy Ross," her clearance orders were granted and countermanded many times over a period of several weeks.

Of course, this situation could not last indefinitely. The importers found an additional backer in the powerful person of B. M. Baruch, chairman of the War Industries Board. It was Mr. Baruch's job to see that the war industries got all the raw materials they needed. He felt that these restrictions on the ore importations threatened the abundance of these supplies, and believed that the whole matter should have been and should be under his own control. He undertook promptly to aid those importers who were trying to import chrome ore as "ballast and back haul." He took part in the "Betsy Ross" controversy, which precipitated the show-down, in which he finally carried his point.

Mr. Baruch's sources of advice were opportunistic rather than scientific. At any rate, the hotly fought-over chrome-laden ships sailed for the United States; and the Committee on Mineral Imports, consisting of Messrs. Leith and Spurr, promptly resigned, for it was at once evident to them that the importations plus the domestic production would mean a congestion of the market which would be bitterly resented by the American producer, who had been told the settled program would be adhered to. The War Industries Board member of the committee, Mr. Pope Yeatman, had already withdrawn from it on Mr. Baruch's request. The organization of the committee continued to function as before, as a part of Mr. Gay's organization, and under the efficient direction of Mr. F. W. Paine, who had been active in its work nearly from the first.

In making war it is better to have too much in the way of supplies than too little; far better than either is it to have the right amount. In this war, we had too much of many things; almost nothing of many essentials; often, apparently, no calculations were made in giving orders for material. A certain ornamental button was used on a part of the regular army overcoat. Enough orders were placed so that there were several dozen extras on hand for every overcoat in existence. Saddles were ordered out of all proportion to the horses in the army. It was not scientific or economical: and, therefore, it was fortunate for us that our participation in the war was not long. In the case of the necessary war minerals, however, a careful program had been worked out; and when it was in full operation, it was scrapped in favor of opportunism.

Mr. Baruch was a good provider. What he provided for in the way of copper still hangs over the world's copper markets as the surplus stock. From the time he broke the Mineral Imports Committee's stand as to chrome importations we had plenty of chrome also, for importers crowded the ore in, and domestic producers on either side were already accomplishing wonders even before the barriers were let down. It was this breach of the stated program that caused the domestic producers to believe (properly) that they had been misled, and was the basis of reasons for the passage of the War Minerals Relief Act later. Except in the case of chromite, however, there was no very serious breach in the enforcement of the importation and production programs covering the numerous war minerals.

We must remember, as an excuse for all errors of judgment in the war—none were of the heart—the vast confusion of feverish action into which we were hurled through President Wilson's refusal to prepare before the war. When the War Minerals problem was presented as a serious one by the War Minerals Committee, headed by Mr. Westervelt, the Director of the Bureau of Mines saw his opportunity to assist in the regulation of the domestic supply, and was granted by Congress a special appropriation of $150,000 for the purpose. This became available just before the time of the sudden resignation of Dr. Leith and myself as members of the Committee on Mineral Importation, and I accepted the invitation of Director Manning and Assistant Director Bain, and took charge of this work on June 6. Dr. Leith believed he could be most useful in representing the Shipping Board restrictions in the War Industries Board.

The War Minerals Investigation of the Bureau of Mines covered war minerals, their production and utilization. Its field touched that of the Geological Survey on the one hand and that of the War Industries Board on the other; the Geological Survey covering the field of the geologist, the War Minerals Investigation that of the mining and metallurgical engineer, the War Industries Board that of the manufacturer and merchant. The program covered all the "war minerals."

To handle each of the war minerals adequately, an organization of specialists was developed in Washington, and each mineral or metal was placed in special hands. The patriotism of the period had made available in some cases at little or no cost some of the best mining engineering talent of the country. The first draft of organization showed on the section of the staff covering mineral groups in Washington F. W. Paine, J. H. Mackenzie, D. A. Lyon, H. Foster Bain, Harvey S. Mudd, A. G. White, Hennen Jennings, Henry C. Morris, A. W. Stockett, Oliver Bowles, R. W. Gannett, and D. A. Hall. Another group handled general mining, transportation, and marketing problems: H. H. Porter, a volunteer, serving as railway transportation expert for both the Shipping Board group and the Bureau of Mines; and Mr. Paine handling the shipping problems when they became a factor of the mining problems, and so on.

A number of mining engineers were in the field, studying the mineral production. For manganese, these included Messrs. Newton, Van Barneveld, Eaton, Crane, Louderback, and Jones, and also, as volunteer experts, E. G. Spillsbury, H. W. Hardinge, and C. W. Van Law; for chrome, Albert Burch, J. E. McGuire, Frank C. Probert, and others; for tungsten, J. H. Mackenzie and J. H. Means; for pyrite, H. A. Buehler and C. E. Julihn; for sulphur, Otto Lindberg; for sulphuric acid, A. E. Wells; for mercury, L. H. Duschak; for graphite, George D. Dub and others. Some of these were regular Bureau of Mines men, but most were engineers who enlisted especially in the Bureau of Mines work for the war.

An executive staff in Washington was developed, ready to handle expeditiously and promptly any matter which arose or was referred to the Bureau of Mines for decision. C. M. Weld was appointed assistant executive, and A. G. White administrative assistant. Mr. Weld was also in special charge of manganese, both in the field and at headquarters; metallurgical problems relating to conservation being handled through a committee consisting of Dr. H. M. Howe, J. E. Johnson, Jr., Bradley Stoughton, and himself, with a special staff including P. H. Royster, S. L. Hoyt, and others. J. E. McGuire had charge of chrome, H. C. Morris of tungsten, W. C. Phalen of magnesite, A. W. Stockett of potash, and so on through the list. Upon each subject there was a representative or a committee. Corresponding committees having been appointed on the Geological Survey, there were frequent consultations, and also numerous joint committees formed on each subject, so that the knowledge and judgment of the mining bureaus of the Interior Department as a whole was constantly ready on all current problems.

The necessity for interlocking this organization with that of the War Industries Board, to insure full advice on every problem and a consistent program, soon became apparent. After some delay, closer co-ordination was effected by arranging to have certain members of the War Minerals Investigations sit upon committees of the War Industries Board in a consulting and advisory capacity. Unfortunately, the smooth and effective working of this plan came too late to accomplish much toward adjustment of supply and demand. In accordance with this plan, Mr. Weld served on the manganese and chrome committees of the War Industries Board, which were in charge of Hugh Sanford, and the unanimous approval of the most vitally interested Government organizations was thus facilitated on any important decision. J. H. Mackenzie, of the Bureau of Mines, took charge of the War Industries Board tungsten problems when emergencies arose, and A. E. Wells, of the Bureau, co-operated with the War Industries Board on matters regarding the sulphuric-acid supply, and served on the committee of the board appointed for that purpose. Hennen Jennings, of the Bureau of Mines, in charge of platinum for the Bureau, served on the platinum committee of the War Industries Board also, and so on.

Co-operation was effected with the Department of Labor, in regard to the allocation of unskilled labor, and with regard to exemption of skilled men essential for the operation of approved and necessary war mines. The Director of the Bureau of Mines was given charge of this matter, and local volunteer representatives were appointed in the different mining fields, to take up these matters with the local draft boards. Even the mining section of the Capital Issues Committee, which controlled the issue of securities during the war, was entirely referred to a special section of the War Minerals Investigations, and in some cases the decisions required field examinations. Matters pertaining to the War Finance Corporation that involved mineral problems were also referred from all quarters to us for final report. Everything was produced or moved during the period, under the War Industries Board, on a "priority" basis, and priority lists were given out to railroads and others for their guidance.

To show the unorganized nature of war board work, the War Industries Board got out in September a new priority list, which failed to include smelters, mills, or mines of the non-metallic minerals; and it became our duty to see that this omission was promptly remedied. Questions of priorities for fuel for mines were referred to the War Minerals Investigations by the Priorities Committee of the War Industries Board. Indeed, the regulation of production of necessary war minerals was taken into consideration in all its phases by this organization, both in regard to matters initiated by the Bureau of Mines, and those referred to it by other branches of the Government, in the numerous cases where office or field reports of mining or metallurgical engineers was necessary. I am sorry (and glad) to say also that from time to time it was our duty and pleasure to circumvent the plans of promoters who, in the confusion of our war troubles, sought to put over some mineral-producing scheme for their own financial betterment. It sometimes happened that they sought to use the Government as their tool, and had secured political backing in high places.

Another activity in which the War Minerals Investigations was active was the completion of the series of summaries of the situation in regard to the political and commercial control of the different important war minerals. For the first time the Government awoke to the necessity of knowing what capital controlled key mineral industries, both in this country and abroad, and what political control lay back of this capital. These papers, each written by a specialist who contributed his work as a patriotic offering, were the first systematic efforts to state the problem; and they were got out one by one in mineograph form and furnished confidentially to the interested officials of the Government only. They were highly appreciated. Among others, I was told that Secretary Lansing took a full set in his trunk when he went to Paris. At the close of the war, the remaining mimeograph copies were distributed to the public. Unwilling that this work should be lost, I suggested that they be published by the Interior Department, but not receiving approval of this, I received permission to publish the papers outside, which, after drastic editing, I did, in one volume, the royalties being devoted to further work along the same line.

The problem of increasing the domestic and near-by foreign production of high-grade manganese, of chrome, and of pyrite, near the Atlantic seaboard, enlisted the special efforts of the field force during the early weeks of the War Minerals Investigations. This work had been initiated before the decision against the Mineral Importation Committee's stand on importing minerals as ballast in excess of the amount allowed in its program, which led to the committee's resignation as a protest against possible consequences; and though this situation led to anxious uncertainty, it was some little time before it was demonstrated to be the case that the domestic supply of war minerals would reach the necessary figures; and in the meantime it was necessary to continue the production stimulation program already entered upon. By the first of August, 1918, however, less than two months after I had undertaken the War Minerals Investigations work, I was able to report to the Director that the situation in the chief war minerals was "very easy"; that both the domestic production campaign, and the efforts put forth for conservation and economy in the use of these materials, had been effective past all anticipation and prophecy; so that the restricted import program which had been laid down by the Committee on Mineral Imports, and which had been condemned as too drastic by many, was already proved to be sufficient and even superfluous.

There began to be, at this period, an oversupplied market for chromite, thanks largely to the "ballast and back haul" importations. By the first of September, it was still more plain that there was a superabundance of this mineral. Those best acquainted with the situation, when we canvassed it before determining upon a program, were of the opinion that the maximum production which could be secured for the United States in 1918 would be 60,000 tons; but by Sept. 1 it was estimated that the actual production would be 75,000 tons. In the meantime, the result of the programs of conservation and economy in the use of chromite had been so effective that, whereas in 1917 the domestic consumption amounted to 150,000 tons, of the equivalent of 50 per cent chromic oxide, in 1918 the consumption promised to be less than 100,000 tons. To meet this domestic oversupply question, conferences were held with the Shipping Board, the Geological Survey, and the War Industries Board. In these conferences, the Interior Department made firm representations as to the rights of producers who had been stimulated by the Government program.

On Nov. 9 I wrote the Director concerning the chromite industry:

"It is true that this industry was advised by the consumers and by the Government that all the ore which they could produce would be accepted, but this encouragement was based upon the almost universal testimony of the California chrome producers themselves that the Pacific Coast production could not be stimulated beyond a production of about 60,000 tons for 1918, so that the moral responsibility really does not go beyond that figure. In the conference which was summoned by the War Industries Board and the Shipping Board and at which I presided, we had a score or more of representatives of the California chromite industry, and the above was practically their universal testimony. The tonnage which we estimated as the possible maximum has already been produced and marketed, so that in one way it might be considered that there is no moral obligation on the part of the Government to further sustain the domestic chromite industry. On the other hand, it is true that actual importations of chromite in 1918 were largely in excess of those recommended by the Committee on Mineral Imports and approved by the War Trade Board, the Shipping Board, and the War Industries Board, and that producers had been advised of the limitations which had been placed by these boards, and which as I have said have been greatly exceeded. This was due to the fact that an exception was made by the War Trade Board to import restrictions on the basis of 'ballast and back haul,' although the Committee on Imports had definitely recommended that no such exceptions be allowed, and the decision over this exception was placed in the hands of the Ship Control Committee in New York, which allowed such large amounts of chromite (as well as manganese) to come in that the entire program and calculations of the Committee on Mineral Imports were upset and the present oversupply of chromite is the result. If the Government is morally liable, therefore, it is not on account of its program, but on account of the lack of coordination of the various branches of the Government and the lack of a strong central control."

The oversupply of chromite continued, and a plan was adopted by the War Industries Board, after conference with the Bureau of Mines and the Geological Survey, to cut off all importations for 1919. Had the war lasted, of course, this plan would probably have prevented the absorption of the domestic supply; also, the program of conservation and economy of the use of chromite was complete.

The manganese situation was somewhat similar. As set forth above, it was found as early as August to be "very easy." By late September there was a threatened possible oversupply. Even before that time the War Minerals Investigations had begun to discourage all new domestic manganese undertakings except such as might give promise of being able to withstand drastic competiton. An effort was also made to promptly reduce importations from Brazil to the rate of 250,000 tons annually, a figure which promised ample supplies for the continuation of the full war program, even though domestic output should show no increase over the already established 1918 rate and our conservation program should effect no marked reduction in consumption. This effort was delayed, however, on account of considerations involving State Department policies relating to Brazil.

By the middle of October, conditions of supply of war minerals were such that I advised the Director:

"As regards the general situation, the condition previously reported as to sufficiency of prospective supply of chromite, manganese, pyrite, and sulphur continues, and it is unlikely that we shall be pressed for supplies of these materials during the remainder of the war."

In the early part of November, the near prospect of peace led to a backing up of markets in general, and the situation in chromite and manganese became acute. The following general notice was sent out on Nov. 9, under the signature of the Director:

"From the Government standpoint there is no longer any need of encouraging increased production of manganese, chromite, and pyrite. Intending investors should investigate very carefully before embarking in mining ventures involving these ores. After the war, domestic mines will have to compete with foreign ores, which are situated where labor is more plentiful and cheaper."

On Nov. 9, I advised the Director as follows:

"The near prospect of peace has led to a backing up of markets in general and of these the chrome and manganese markets have been brought very specifically to our attention. The War Industries Board, which had handled the matter all through, has become subject to very sharp criticism, and it is largely for this reason that the War Industries Board has turned over the entire problem to the Interior Department. Unfortunately, however, it is, in my opinion, too late to correct any errors in judgment which may have been made. The great trouble has been in the lack of co-ordination of Government departments. They have attained our major object, namely, the procuring of abundant manganese, chromite, and other war minerals, for the carrying on of the war, but have failed utterly in the accurate adjustment of supply and demand."

During all this period, there had been pending tardy legislation in Congress to pass a bill creating a Minerals Administration, similar in authoritative scope to the Fuel and Food Administrations. This had been recommended by the War Minerals Committee, of which Mr. Westervelt was chairman, as told in his article, which precedes this. The matter had dragged on in Congress while the war was being fought and decided, and we had no time to pay much attention to this deliberation in the necessity for action, which fortunately was secured in some fashion by the working together of various boards and bureaus and the formation of our own interdepartmental committees to decide and handle emergency questions.

The bill was passed by both houses of Congress late in September and went to the President for signature. It put the responsibility of selecting the Administration on the President, and the President's signature was delayed while he conferred with Mr. Baruch on the subject. In the latter part of October, it was agreed between Mr. Baruch and Secretary Lane that Mr. Baruch was to designate to the Secretary any war mineral of which there was a shortage (the bill restricted the authority of the act to minerals of which there was a shortage for war purposes), and in this case, the Interior Department would become responsible for its production. Mr. Baruch further specified that at that time, Oct. 28, the only articles of which there was a shortage were potash, zircon, and arsenic. He held that other minerals mentioned in the bill, of which there had once been a shortage, were no longer within the field of the bill, since the shortage had been relieved. Under this category, he placed the chief "war minerals," like chromite, manganese, and pyrite.

Acting on these instructions, I appointed A. E. Wells in charge of the arsenic situation, which was the only one which required immediate action, the zircon problem being really inactive; and I appointed a special new committee to supplement the former committee in a more vigorous handling of the potash situation. A first allotment of $100,000 out of the administration fund of the Mineral Control Act was made to the War Minerals Investigations, subject to my expenditure. This money was subsequently turned back into the fund.

On Nov. 1, however, Mr. Baruch advised Secretary Lane that the chromite situation was in a precarious condition, and asked him to *keep up the production* under the Mineral Act, thereby "passing the buck" of the oversupply problem, after having tenaciously held the mineral control up to that period.

It so happened, however, that the powers of the Minerals Administration were destined not to extend further than the arsenic question, and did not go far in that. A contract with the Government to supply arsenic was being sought for a mine in New England. This contract was sought by an officer who was in the Chemical Service of the War Department, but on investigation it was found that the enterprise did not warrant making any contract; it was also found that the reported shortage of arsenic was not threatening, and that it was very likely to disappear, which it shortly did.

The pressing mineral problems at the time were, however, not shortage, but overproduction, so did not come under the terms of the Minerals Control Act, which, moreover, was not signed by the President till about the time of the Armistice. Nevertheless, as soon as the news was wired by the American Mining Congress to the mining world that Secretary Lane had been appointed administrator under the act, telegrams and letters began to come in to the Bureau and to Secretary Lane, the President and members of Congress, urging that the Government relieve the chromite and manganese situation by purchasing producers' ore at the market price and supporting the market. Representatives of the industry also arrived in Washington to press the matter. Possible remedies were drawn up by the chromite, manganese, and pyrite committees, which I had appointed for the War Minerals Investigations.

The Chromite Committee submitted a plan for the alteration of the situation under the War Minerals Control Act. I stated, however, at this time in my report to the Director (on Nov. 23), "I do not think it possible to secure proper and adequate relief for the chromite, manganese, and pyrite situations under the Minerals Control Act, and I recommend that these problems be investigated by special commissions who shall report to Congress." And on Nov. 19 I wrote:

"I am of the opinion that we shall find on mature reflection that the present situation regarding manganese, chromite, and pyrite cannot properly or safely be dealt with under the Mineral Act, and that it would be a great mistake for the Bureau to undertake them under this act, and one which would bring finally much criticism upon it. Aside from the propriety, the logical methods for carrying out a plan of reparation for producers of chromite, manganese, and pyrite, including the establishment of a protective tariff in each case, and the control of vast and complex industries for the sake of supporting single minor industries, would lead the Bureau into an impossible position and one which would bring upon it an immense amount of criticism and would be foredoomed to failure. The recommendation is that a commission be appointed by the President, at the suggestion of the Secretary of the Interior, outside of the Bureau of Mines, or including a representation from the Bureau, to determine the moral obligations incurred by the Government during the war to the domestic producers of chromite and manganese, and that this commission or commissions report their findings to the President and recommend that he ask Congress to appropriate the necessary amount determined upon as damages, and reimburse the producers by a flat cash payment."

The plan of the Chromite Committee was transmitted for his opinion to Secretary Lane, who called a conference to consider the action of the Government and the consumers in the event of his taking action according to the Minerals Control Act. To this conference he invited representatives of the principal Government departments and of the Mining Committees of Congress, one representative of the producers, and about twenty-three representatives of the consumers. It was the Secretary's plan to see whether the chrome consumers could not be induced to buy sufficient chromite so that the domestic chrome industry should be enabled to avoid the losses with which it was threatened. The plan was not successful. Only about four of the twenty-three consumers invited responded, and these refused to admit a responsibility. The steel industry was not represented at all. Except that the Secretary indicated his sympathy with the producers of chrome in their difficulty, the conference was without result.

Subsequent to the conference, a tentative plan was suggested for the Bureau of Mines to proceed with the further investigation of the mooted problems of oversupply and failing markets for war minerals, such as chromite, manganese, tungsten, and pyrite, and that the administration funds carried in the Mineral Control Act should be used for that purpose; and I was asked by the Director to formulate plans for undertaking this investigation.

I reported on Dec. 7 that, in the opinion of the War Minerals Investigations Staff, we could not properly undertake investigation of the existing war minerals situation with the administration funds of the Mineral Control Act, since the Secretary had decided not to act under this authority, for the double reason that the war was virtually over, as President Wilson had announced, and that there was no shortage. In fact, it was not war problems, but post-war problems, that must be dealt with. However, a conference of producers about the middle of December secured the statement from Secretary Lane that he would exercise the powers of the Mineral Control Act, if he were authorized to do so by Congress. Concerning this conference, I reported:

> "A plan was therefore formulated to have Congress authorize the application of this act to cover the present emergency. Although this plan was approved by the senators present, personally I do not think there is any chance whatever of its succeeding, and, therefore, I am not counting on funds from that source."

What Congress actually decided to do was the obvious course of meeting the situation by new legislation, affording relief by the payment of claims; and the administration of this relief fund of $8,000,000 was turned over to the Interior Department. I was asked by the Director to handle this work, but I advised him that, the war being over, I desired to be relieved as soon as possible; and that I should advise in any case putting the adjudication of the claims into the hands of a commission of three men of recognized standing who had not been connected, as I had been, with the war minerals problem and the events which led up to the existing situation. This suggestion was adopted by the Director and the Secretary, and a commission, consisting of former Senator John Shafroth, of Colorado, chairman; Dr. Martin Foster, former chairman of the Committee on Mines and Mining in the House of Representatives, and Philip N. Moore, former president of the American Institute of Mining and Metallurgical Engineers, was appointed. On the urgent request of the Director, however, I undertook to organize, with the title of chief engineer, the investigating force of the Bureau, which it was planned by the Director to conduct separately from the commission.

Accordingly, a competent staff of engineers and auditors was assembled. C. B. Holmes, formerly with the Chile Copper Co., was engaged as chief accountant, and the selection proved a wise one. On July 8, 1919, nineteen engineers were at work—Messrs. Cameron, Toll, Shonts, Sheafe, Locklin, Williams, Sears, Eddingfield, Wormser, Van Siclen, Tucker, Harrison, Dub, Means, Henry, Hyder, Harder, Crane and Battle; and eight auditors—Messrs. Holmes, Trelawney, Langton, Hay, Evans, Dunn, Roosa, and Fleming. The staff being ready, I had all claims analyzed, abstracted, and classified, and annotated with whatever knowledge there existed in the Government departments concerning the particular enterprise in question.

The War Minerals Relief Bill as passed by Congress was not a skilful piece of legislation; after being trimmed here and compromised there, it required a lawyer to determine what it really provided for. Therefore, the decision as to its meaning was secured from the Attorney General and from the Solicitor of the Interior Department. The most perplexing and unsatisfactory provision was for the payment only of those losses made in the production of minerals "at request or demand" of the Government. Congress had, of course, no very clear idea what it meant by this. It was a cloudy and inequitable piece of legislation, giving awards to some who did not merit them, and withholding, by its provisions, awards from some better entitled, but it did not lie within the function of the Interior Department to make awards or disburse moneys from the $8,000,000 set aside by Congress for that purpose, except as directed by the law. So our job was simply to have that law interpreted by the highest authority, and act promptly in accordance.

Subsequently, in order to facilitate and expedite handling and disposing of the claims, and at the special request of the Director and the Secretary, I devised a plan of having the claims, after having been reported on by engineer and auditor, go to "examiners" (whom I selected and started out) who would go over the evidence, make additional necessary researches, and submit the whole case, with recommendations, to the commission, for their approval, disapproval, or further investigation. After the commission's finding the only final formality was the Secretary's approval. That the entire plan devised, of a commission, force of auditors and engineers, and intermediary examiners, has worked smoothly, is shown by the handling of 1,400 claims in about two years.

This sketchy record of the activities of the War Minerals Investigations has been prepared with the same object with which I have secured the other papers of this series—namely, the presenting of a true, unvarnished report as to how the mineral problems of the war were handled in Washington. It is not that we can point to the record with pride: we cannot. But we need the record to preserve an event in the history of American mineral production which otherwise would be unrecorded, and its lesson lost.

The striking feature to the reader will be the total unpreparedness: the swiftness of events which swept past a tardy and confused Government, and found us at the end of the war with knowledge and methods just emerging from something very near bewilderment, but still hopelessly hampered by internal politics and jockeying for power and for preferment within the Government.

The lesson to be learned and acted on is preparedness at leisure. There is no question more important than the supply of raw materials during crises: it should be taken up now, in the light of our war-time experience, and a careful survey made of the field, and detailed plans made for the effective putting into action of those plans in case of emergency. Our Navy at least, and some of our Army, is maintained ready for any surprise. What a lack of foresight if we do not have the other details for any eventuality planned and ready to put into smooth and effective action at a day's notice!

In the case of breaking out of a sudden war again, how would the mineral supply problem be handled? Nobody knows—there would be the same "doubt, hesitation, and pain." The agency would be squabbled over, and dallied over; and, if ever decided on, the necessary surveys and plans would still be lacking. So far as possible, the lesson teaches us, this should be remedied. The matter should be taken up by the War Department, co-operating with the mineral bureaus of our Government. At any rate, a conscious, intelligent, and far-sighted mineral policy, both foreign and domestic, should be reached as soon as may be by our Government.

We have certain reserves of certain ores: shall we mine haphazard; shall we exhaust at unnatural speed by the forced pressure of tariffs or other devices; shall we conserve? The country needs a wise business policy for its natural resources; and for its mineral supplies an intelligent program for the future, for peace or for possible war, is quite necessary. Tariffs should not be based on present-day individual desire for profit, but on a sane national policy of using its resources most efficiently and to the best advantage.

Mills in Tri-State Field Inspected

An inspection of the mills in the Missouri-Kansas-Oklahoma lead and zinc district is being made by engineers of the U. S. Bureau of Mines, with a view to determining their general procedure and gathering data as to different phases of the milling practice that may be most amenable to improvement.

Manganese Ore in the Western States Described in Survey Bulletin

In 1917 and 1918 there was a shortage of manganese ore in the United States owing to the impossibility of obtaining shipments from abroad. Because of the necessity of discovering further domestic supplies, a group of ten geologists of the U. S. Geological Survey made a rather careful examination of districts throughout the country in which manganese ore was known or supposed to be present. The results of these examinations have now been published, including reports that describe the deposits in most of Virginia, Tennessee, Georgia, Arkansas, Oklahoma, Colorado, Wyoming, New Mexico, Arizona, Nevada, and Southern California. One of the last of these reports, which describes the deposits of Montana, Utah, Oregon, and Washington, has just been issued as Bulletin 725-C, "Deposits of Manganese Ore in Montana, Utah, Oregon, and Washington," by J. T. Pardee.

The deposits in Montana include those near Philipsburg, where twenty-one mines have been operated; those near Butte, where a number of mines have been operated but only five have been productive; and those of eleven other districts. The most productive deposits in Utah are in the Little Grande district, Grand County, where twenty mines were operated, although those in the Tintic and Erickson districts also produced some ore. Many deposits in Oregon and Washington were explored during the war, but only a few were brought to the shipping stage. In Oregon twelve groups of deposits in the Lake Creek, Gold Hill, and Greenback districts, Jackson County, as well as scattered small deposits in three districts in Baker County, were explored. The principal deposits of Washington lie along the east side of the Olympic Mountains, in Mason and Jefferson counties, but small deposits are found in four other districts that have been under investigation and consideration.

Finland Iron-Ore Deposits

According to expert opinions obtained by the Geological Commission of Finland, the deposits of iron ore in the Porkonen-Pahtavaara region of Kittilä, in Finnish Lapland, estimated to contain 100,000,000 tons of ore, cannot be utilized for the next ten years, because of the high percentage of phosphorus and the difficulty of separating it from the ore, and owing to the inaccessibility of the mines, reports Leslie A. Davis, consul at Helsingfors. It is thought that these ore fields can be worked profitably if the proposed railroad to the Arctic Ocean is constructed within convenient access to them.

During the last three years the O/Y Pitkaranta Bruks A/B has been engaged in making preparations for the mining of iron ore and has been completing its foundry. Considerable money has been expended for this purpose, and conferences have been held with both native and foreign experts. Smelting experiments in electrical ovens have proved that a good cast steel and also a first-class steel for making tools and implements can be produced. Forests have been purchased to insure fuel for the coming smelting operations. Other improvements and extensions of the plant are said to be under consideration, and investigation warrants the conclusion that development will probably be initiated soon.

Government Officials Prominent in Mining

Albert H. Fay

BY PAUL WOOTON

Washington Correspondent Engineering and Mining Journal

A. H. FAY has been made chief of the Natural Resources Division of the Income Tax Unit of the Bureau of Internal Revenue. Mr. Fay is a widely known mining engineer. It is this subdivision of the Bureau of Internal Revenue with which the mining industry has largely to deal on taxation matters. The appointment of a mining engineer to that place follows many urgent appeals from the industry, as the valuation of mines is a highly technical procedure and one which best can be directed by an engineer, it is believed. For several months Mr. Fay has been the acting head of the division and has already undertaken to reorganize the units handling matters pertaining to natural resources. This is being done with the purpose of speeding up the work on valuations. A revised manual on oil and gas will soon be issued, which will be of great assistance in the valuation of oil properties. In his new position Mr. Fay is at the head of an organization comprising a large technical personnel. His staff includes fifty engineers and seventy-five auditors, besides clerks and other assistants. More than $250,000,000 in taxes are based on valuations made in the Natural Resources Division.

ALBERT H. FAY

Complaints have been frequent that it requires too long a time for tax collectors of this division to handle the data furnished them. It is admitted by Mr. Fay that the work has been handicapped by lack of funds with which to hire a sufficient number of engineers. He is not willing, however, to allow the Government to take all the blame as his records show that many taxpayers are slow in filing valuation data. He has figured out a plan which he believes will make possible a gain of from two to six months in the readjustment of taxes when the taxpayer proves his case.

Valuations of natural resources were necessarily slow at first, Mr. Fay points out, because the division was called upon to pioneer the entire field. During the period of organization and of preliminary work delays were unavoidable. This has had the effect of bringing the work of the division into some disrepute. It has been hard to live down that reputation, but Mr. Fay believes that there will be little cause for such complaints in the future. One thing is certain, he says—every taxpayer is going to be given every consideration that it is possible to extend. Mr. Fay is a native of Missouri. He was graduated from the Missouri School of Mines in 1902. He took post-graduate work at Columbia in geology, mineralogy, and ore dressing. Early in his career he became acquainted with a large number of mining engineers through his service as assistant to the secretary of the A. I. M. E. He resigned this position in 1903 to enter the employ of the Cananea Consolidated Copper Co. in Mexico. After more than two years with the Cananea company Mr. Fay became superintendent for the Bartels Tin Mining Co., which was operating in the Cape Prince of Wales district of Alaska. Two years later he accepted a position as mining engineer for the John T. Williams Co. at Bristol, Tenn., where he was in charge of the barytes operations of that company. From December, 1908, to August, 1911, Mr. Fay was a member of the editorial staff of the *Engineering and Mining Journal*. He edited the 1910 volume of *Mineral Industry*. In connection with his work for the *Journal*, he traveled widely, gathering data on numerous mining districts.

In August, 1911, Mr. Fay accepted the position of mining engineer in direct charge of statistics for the U. S. Bureau of Mines, in which position he continued for nine years. During that time, in addition to maintaining the statistical records of the Bureau, he prepared thirty-five technical papers, aggregating 1,500 pages in all, of statistical data on mine accidents. He is the author of a special bulletin describing coal mine fatalities in the United States between 1870 and 1914, the preparation of which [illegible] fatalities.

Mr. Fay is perhaps best known by his last publication, which bears the title "A Glossary of the Mining and Mineral Industry." Soon after leaving the service of the Bureau of Mines he accepted the position with the Bureau of Internal Revenue.

CONSULTATION

The Uses and Associations of Monazite Sand

"I am interested in monazite sand, and desire the following information regarding it: Where is it found? What are the minerals or metals usually associated with it? For what purpose is it used? Is there a considerable demand for it? What is it worth? I presume the sand is concentrated."

Monazite is a phosphate of the cerium metals (cerium, didymium, and lanthanum) and other rare-earth metals such as neodymium, and praseodymium, including thorium, the metal for which it is chiefly mined. The thorium content varies widely, and commercially ranges from 2½ to 6 per cent, but some monazite carries as much as 18 per cent thorium oxide. The best Brazilian concentrates carry about 6 per cent thorium oxide, or thoria, whereas those of India and Ceylon have about 9 per cent. The mineral is commonly associated with magnetite, zircon, gold, chromite, ilmenite, garnet and occasionally the diamond. Monazite sand consists of well-rounded grains of a resinous lustre which may be brownish, gray, yellow, or reddish in color. It is weakly magnetic but of high specific gravity. It gives a phosphate reaction.

Monazite, being heavier than ordinary minerals, has made many a prospector attach undue importance to the value of his find. The value of monazite depends upon its content of thorium oxide, and if this be too low the mineral is worthless. The domestic monazite-sand industry flourished at the beginning of the present century, but after 1910 production ceased entirely, owing to the development of strong competition by foreign producers.

Monazite is widespread in occurrence, but forms only a small fraction of 1 per cent of the rock contained in the earth's crust, according to W. T. Schaller. On decomposition of the rock, the monazite and other resistant minerals are not attacked chemically, remaining behind unaltered, and, being much heavier than the products of decomposition, are gradually but slowly concentrated in the residue from the broken-down rock. Locally, river waters will effect a concentration of the heavy minerals into monazite-bearing sands and gravels. If the ocean encroaches on an area of such decomposed rock, the selective action of the sea waves will still further concentrate the heavier minerals. Sea-coast deposits of sand, therefore, contain monazite in higher natural concentration and cover larger areas than river-bed deposits. Even if the percentage of thoria in monazite were constant, sea-coast monazite sand would contain more thoria than river-bed sands, on account of their greater content of monazite.

The world's monazite supplies are obtained principally from deposits in Brazil and India, although it has been found and mined in other countries. In the United States, it has been produced in the Carolinas and in Idaho. The counties of Cleveland, Burke, Alexander, Catawba, Caldwell, Rutherford, Gaston, Iredell, McDowell, Polk, and Lincoln of North Carolina, and Cherokee, Anderson, Laurens, Oconee, Pickens, Spartanburg, and Greenville counties in South Carolina, contain the most productive localities. The monazite is found in stream and bottom lands, and the mineral-bearing gravels are reported to range between 1½ ft. and 2½ ft. thick. In Idaho, the deposits are in Centerville and Idaho City, and are associated with gold-bearing gravels. Monazite is also reported to have been found in Colorado, in the Newland Gulch district.

Monazite was found in the Carolinas in 1879, and the placer deposits there, according to the U. S. Geological Survey, were first worked about 1886. The next year the mineral was shipped, and more or less has been mined and shipped ever since.

The quantity produced in the United States reached its maximum in 1895. In that year Brazilian monazite entered the market and caused the domestic production to fall to almost negligible proportions. Increased demand soon created a revival in the domestic output, which in 1905 again approached the maximum. From 1893 to 1910, inclusive, there was a large production of monazite in this country, but from 1911 to date the output has varied from nothing to 38,000 lb. annually.

The world's production of monazite is small, and fluctuates widely, averaging about 2,500 tons annually. Although Brazil formerly was the most important producing country, Indian monazite is now produced in greater quantities, and it is reported by the Imperial Mineral Resources Bureau to be richer in thoria than the Brazilian grades.

Monazite is used as a source or thorium salts and byproduct rare earths, such as cerium and lanthanum. Thorium oxide glows intensely when heated, and is therefore used in making incandescent mantles for gas lights (the Welsbach mantle). It is obtained by heating nitrate of thorium. According to the U. S. Geological Survey, from 250 to 500 mantles are produced from one pound of thorium nitrate. The world's annual consumption of incandescent gas mantles is about one-third of a billion. Thorium compounds are also used in magnesium flashlight powders, and the metal thorium, with other rare-earth metals, is alloyed with tungsten, making very ductile filaments for electric lamps. Only a slight use has been found for the rare-earth salts byproducts obtained from monazite sand.

Cerium residues may be used in the manufacture of ferrocerium, an alloy used in sparking devices, and cerium salts are used in the flaming arc. Mesothorium, a radio-active element found in thorium minerals, is recovered and used as a substitute for radium in luminous paint. Although the percentage of mesothorium in monazite is exceedingly small, its great value makes it one of the most desirable byproducts of the mineral. A ton of monazite containing 5 per cent of thoria has been estimated to yield about 2.5 mg. of mesothorium.

Monazite is quoted by *Engineering and Mining Journal* as being worth $30 per unit for material containing at least 6 per cent thorium oxide.

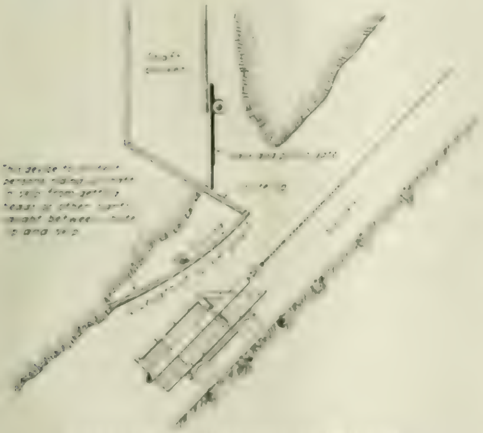
The sand is usually concentrated before being shipped. The deposits in the United States especially require concentration.

HANDY KNOWLEDGE

Guarding Chute Lips of Shaft Pockets

Written for Engineering and Mining Journal

The main shaft at the French Creek Mines of the E. & G. Brooke Iron Co., at St. Peters, Pa., is a 43-deg. incline to the 7th level, below which point it flattens to 33 deg. Shaft pockets or ore bins are provided at every level, the chute lips of which project into the shaft, clearing the skip by only about 2 in. to avoid spillage. If left unguarded, these lips would be a source of danger to men riding in the skip. Full protection is afforded, however, at each chute by nailing 12-ft. lengths of ½ x 4-in. pine lengthwise in the shaft over the full width of the skipway, one end of each length meeting; the lip and the other end being nailed to a timber across the hanging wall of the shaft. This makes it impossible for a person riding in the skip to let his head be caught between skip and chute lip. Any part of the body projecting outside of the skip is slowly pushed back without injury so as to clear the lip. This arrangement was devised at the mine and has been approved by the state mine inspector. The same device is used at the collar of the shaft. M. T Hoster is superintendent in charge.

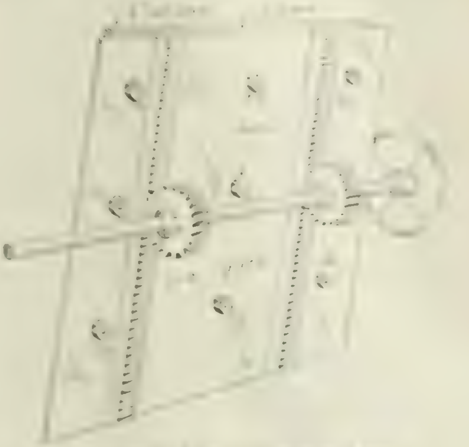

This device to protect persons riding in the skip from getting heads or other parts caught between chute lip and skip

METHOD OF GUARDING CHUTE LIP

A Reinforced Gate for Ore Bins

Written for Engineering and Mining Journal

The rack and pinion gate commonly used on ore bins is often required to withstand severe battering. The impact of the heavy pieces of ore frequently breaks the racks, which are of cast iron, bends the pinion shaft as well as the plate of which the gate is made, and springs the plate out of the groove in which it runs. This difficulty is avoided at the French Creek mines of the E. & G. Brooke Iron Co. at St. Peters, Pa., by reinforcing the gate, as shown in the sketch, with 2-in. planks of soft wood backed by a ½-in. iron plate. This extra plate and the planks are bolted to the gate. Gates thus reinforced have lasted three years without breakage at the mines mentioned, and are still in good condition.



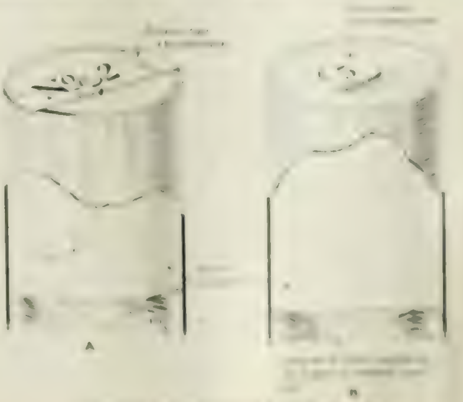
REINFORCED RACK AND PINION GATE

Tagging Diamond-Drill Holes

By Roy H. Poston

Written for Engineering and Mining Journal

Every diamond-drill hole should be tagged—that is, designated—by some number or symbol in a permanent way, to establish its identity beyond question at any time. Different ways of doing this are in use, such as center punching the number on the sleeve, bradding the number plate on the sleeve or filling the top of the sleeve with cement and embedding the number tag in it. The method depicted in *B* in the accompanying sketch seems better than others. That illustrated by A was



[illegible]

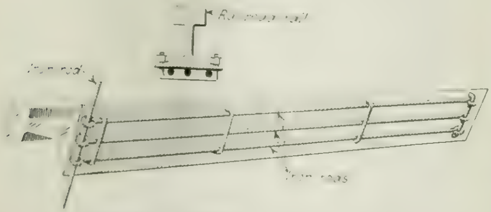
used for several years at one Missouri mine, but small boys pulled off the tags as fast as they were put in place.

To obviate this annoyance and difficulty, discarded railroad spikes, with the number punched in the top of the head, were substituted for the tags, and the trouble ceased. A coat of waterproof paint was applied to the top of the spike after it was placed in position in the drill hole. The top of the spike was faced on an emery wheel before punching the number.

Ore-Chute Device

Written for *Engineering and Mining Journal*

It may be desirable to lessen the impact of the feed flowing to a coarse crusher. At one plant chains were hung in the feed chute and, these failing, 3-ft. lengths of rail were suspended by one end. Both of these were unsatisfactory, as the breaking of either chain or rail permitted iron to enter the crusher, with consequent damage to the latter. Finally three rods were attached to each section of rail, as shown in the sketch. The device will hold the rail together, in case it breaks, thus protecting the crusher.



CRUSHER PROTECTOR FOR ORE CHUTE

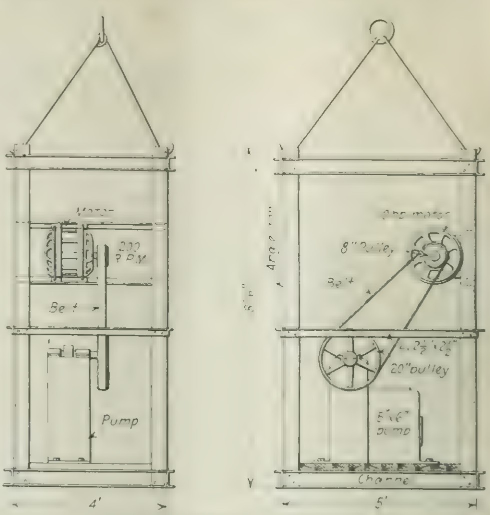
Substitute for Sinking Pump

Written for *Engineering and Mining Journal*

The necessity of purchasing an electric sinking pump to unwater an old shaft for preliminary examination, at the French Creek mines of the E. & G. Brooke Iron Co., at St. Peters, Pa., was avoided by mounting a small Dean triplex pump of a capacity of 130 gal. per minute and a belt-connected 15-hp. motor on a cage built for the purpose. The cage was lowered by a block and tackle as unwatering progressed. A standard 4-in. suction 20 ft. long was used, which permitted the cage to be lowered 20 ft. at a time. The horizontal members of the cage were of 3-in. channel iron and the vertical members of 3 x ¼ in. angle iron. The platform of the cage on which the pump sat was 5 x 4 ft. A sketch of the cage is shown herewith.

A 20-ft. length was added to the 3-in. column pipe each time the pump was lowered to a new position. To reduce to a minimum the time required to connect the pump to the column pipe, a flexible connection of fire hose was employed. Here a slight difficulty was encountered. The pump discharge and the column pipe were both of 3-in. diameter, but it was impossible to buy fire hose larger than 2½ in. in diameter. This was overcome by fitting both the pump discharge and the column pipe with a standard 3 x 2½-in. Y and connecting the two Y's with two 5-ft. lengths of 2½-in. fire hose. The fire hose was fitted with standard pipe-thread couplings.

An electric sinking pump was preferred to one operated by air for the reason that it was much cheaper and because, had the mine closed down, it would have been very inefficient practice to operate a large compressor for one or two small pumps.



CAGE FOR ELECTRIC SINKING PUMP

Suggested Changes in Low's Methods Of Analysis

By Albert H. Low

Written for *Engineering and Mining Journal*

The above caption appears in the Sept. 3, 1921, issue of *Engineering and Mining Journal*. I am glad to note the changes suggested. The first relates to the necessity of a provision being made for the presence of arsenic in the nickel and cobalt determinations. Unless arsenic is present in large amount relatively to the iron, it does no harm, and my inadvertence in the matter was due to the fact that I had not happened to encounter such ores. The decomposition in the zinc assay is similar, and arsenic has sometimes given trouble from the cause indicated. Reference to my "Methods" will show that provision was made for this contingency in a simple manner, which can easily be adapted to the nickel determination.

The suggestion relative to the determination of chromium in chromite does not impress me, as my personal experience with the method has failed to show the loss indicated. I am glad of the suggestion, however, and will as soon as practicable investigate the matter further.

The figure 4.74 in the molybdate method for lead is evidently a misprint for 4.24, the figure being qualified by the word "about." A more nearly correct figure is 4.26.

Investigating Use of Gunite

The U. S. Bureau of Mines is conducting an investigation in the Nevada gold-mining fields of the use of gunite in metal mines. The possibility of the cement gun being used in the preventing or minimizing of rock burst in deep metal mines is being given especial attention.

THE PETROLEUM INDUSTRY

Oil Prospects in Mackenzie River District

Special Correspondence

A. H. Low, geologist for the Mackenzie River Oil Co., has returned from field operations in the Northwest. He states that the results of the summer's work at and around Fort Norman are disappointing, no additional strikes having been made and the original discovery well not having yet been proved a commercial producer. Several years, in his opinion, may be necessary to locate the oil supply in the Mackenzie region, and Mr. Low is inclined to think that the greatest possibilities will be inland at a distance of perhaps fifteen miles from the river. This will increase the difficulties of operation, but the indications at several points at that distance inland are more favorable than along the shore.

It is also Mr. Low's opinion that the potential oil field does not extend far north of Fort Norman and that strikes are more likely to be made south than north. He considers that the Hay River field and some of the inland areas around Great Slave Lake are among the most probable prospects. His investigations showed many possibilities, but only a well could prove them and the only way was to keep on drilling until oil would be struck. No machinery having been taken in for the Mackenzie River Co., its operations were confined to the geological field work conducted by Mr. Low and his party.

When Mr. Low left Fort Norman on Sept. 13 the Imperial Oil Co.'s well on Bear Island was understood to be just beginning to drill, and the other rigs at Bluefish Creek, and the opposite side of the river, were getting under way. It will be possible to continue drilling at these points well into the winter, and the crews left at each of the camps will probably keep at work for some time.

Petroleum Conference Proposed

Washington Correspondence

A conference of men representing the various branches of the petroleum industry may be held in Washington in December. The matter is being discussed, and it is believed that the plan will be carried out. A gathering of oil men in Washington last winter was productive of much constructive work. Conditions have changed materially since that conference, and it is believed that mutual good will come from a discussion of the present-day problems which the industry faces. The Government officials who have been approached in this connection have expressed the desire that the conference be held.

Montana Oil Developments

Special Correspondence

Montana has sixty-[illegible] wells producing and sixty-four more drilling or rigged up to drill. Of this latter number forty-eight are on wildcat structures.

The West Dome Oil Co., which is controlled by officials of the Anaconda Copper Mining Co., has brought in its sixth producing well in the Cat Creek district. Besides this it has another well close to producing sands and will drill its Ten Spot well to the quadrant sands. It is rumored that West Dome officials have been negotiating to sell out to the Midwest Refining Co.

The Ohio Oil Co., a Standard subsidiary, has announced that it would build a seventy-two-mile pipe line to convey gas from the Elk Basin, Wyoming, fields to Billings, Mont. This will supply gas for light, heat, and fuel to Billings and points along the way. It will take ninety days to build the line, and during the construction period the company will employ 500 men and have a payroll of about $120,000 per month, including superintendence and incidental charges and expense. Cheap gas should make Billings a center for manufacturing and possibly for refineries and smelters.

Rumanian Oil Production

By Reuter's Service

The production of oil in Rumania during August amounted to about 105,000 tons, compared with 80,000 in July. There was a general increase in the output of the companies, the Steaua Romana producing 22,846 tons, against 18,892 tons in July; the Astra Romana 27,013, against 22,834; the Romana Americana, 23,187, against 20,449; and nearly all the smaller concerns showing proportionate, in some cases much larger, inshow proportionate increases.

San Joaquin Strike Unchanged

Special Correspondence

The strike situation in the southern San Joaquin oil district continues without apparent change. Acts of violence have been reported and threats have been made of extending the strike to other oil fields in California. Operators and workers have made no changes in their relative positions, and it appears that a settlement of the strike is a long way off.

The Alberta Oil Fields

Special Correspondence

Vice-president A. M. McQueen, of the Imperial Oil Co., confirms the report that a strike of 2,000,000 ft. of gas has been made at Pouce Coupe at a depth of 1,650 ft. He stated that drilling operations would be carried on throughout the winter as far as weather conditions would permit at all of the company's thirteen wells in Alberta.

Benzine Consumption in Japan Increasing

The output of oil in Japan and the import of foreign oil are alike increasing in proportion to the steady increase in consumption. [illegible] the annual domestic consumption of benzine in 1920 amounted to [illegible] cases, against [illegible] cases for the preceding year, and the output amounted to [illegible] cases, an increase of [illegible] cases compared with the output of 1919

Technical Papers

Washington Mineral Resources—Two bulletins have recently been issued by the Washington Geological Survey, Olympia, Wash., on the mineral resources of the state. Bulletin No. 21, 155 pages, presents not only bare statistical figures for each product, but makes interpretations and discusses the factors influencing changes in production. Descriptions of many mineral deposits are given, and a large map of the state, with mineral occurrences indicated in red, is a feature. Bulletin 23, 366 pages, is devoted to the metal mines of the state, the first seventy pages covering general information on the geography, geology, and commercial development of the deposits and the remainder being a description of the mining districts and individual ore deposits, arranged by counties. A directory is appended. Either bulletin may be obtained on request to the Survey at Olympia.

Mineral Tariffs—The October issue of *The Mining Congress Journal* (American Mining Congress, Washington, D. C.; price, 30c.) is devoted to the Chicago convention and appears in greatly enlarged form. An interesting feature is an insert, in tabular form, which is a digest of information on mineral tariffs compiled by the tariff division of the American Mining Congress. The chart covers twenty-seven minerals and mineral products and gives briefly conditions of production in the United States contrasted with those of foreign countries; present and pre-war prices and costs of production; and present, proposed and desired tariffs.

Alunite—"Alunite Deposits in the United States" are discussed in a four-page illustrated article in the *Compressed Air Magazine* for October (New York, N. Y.; price, 35c.). Economic conditions in alunite production are given equal prominence with a brief sketch of the developed deposits.

Silver—The Imperial Institute has issued a 152-page monograph on "Silver Ores," obtainable for 6s. from John Murray, 50A Albemarle St., London, W. 1. The book contains a short chapter on the occurrence, character, and uses of silver ores, followed by a résumé of information regarding the principal deposits of the world. The information given is largely either geological or statistical.

Mineral Resources—Recent publications of the U. S. Geological Survey in the "Mineral Resources" series include: "Lime in 1919," thirteen pages; "Sodium Compounds in 1920," eleven pages; "Carbon Black Produced From Natural Gas in 1920," four pages; "Gold, Silver, Copper, and Lead in South Dakota and Wyoming in 1919," five pages; "Silica in 1920," two pages; "Potash in 1920," twenty-four pages; and "Lead in 1919," seventeen pages. They may be obtained on request to the Survey at Washington, D. C.

Mine Gases—U. S. Bureau of Mines *Reports of Investigations* No. 2275 three pages, obtainable on request to the Bureau at Washington, D. C., is entitled "Rock Strata Gases in Mines of the East Tintic Mining District, Utah." Heavy irrespirable gases at times flood the lowest workings in this district. Dilution of the inflow with large volumes of air by mechanical ventilation was found to be the best means of surmounting the difficulty.

New Uses for Copper—The leading article in the *Arizona Mining Journal* for Oct. 1 (Phoenix, Ariz.; price 20c., four pages) is an interesting paper on the discussion on broadening the copper market. Some purposes for which copper is suitable as well as some for which copper is not so suitable as other metals are mentioned, and an address recently made by the president of the National Brass Co. before the Copper and Brass Research Association is reprinted. The movement to extend the uses of copper seems to be earnestly pushed in the Southwest.

Mine Ventilation Doors—Ventilation doors which can be opened and shut mechanically by the motorman without leaving his seat or stopping his train are described in U. S. Bureau of Mines *Reports of Investigations* No. 2273, three pages, obtainable on request to the Bureau at Washington, D. C. Such doors have been widely adopted in Arizona.

Diamond Digging—"Alluvial Diamond Diggers in South Africa" is the title of an eleven-page article in the September issue of the *South African Journal of Industries* (Pretoria; price 6d.) The stones are mined by methods and by a class of workers unknown in America. Among the topics discussed are classes of diggers; storekeepers and credit; cost and method of digging; factors affecting earnings; profits of the diggers, and how the discovery of new pipes would affect them; and the question of nationalization of diamond mining.

Oil in Montana—The State School of Mines, at Butte, Mont., has issued University of Montana Bulletin, Bureau of Mines and Metallurgy, Series No. 4, entitled "Geology and Oil and Gas Prospects of Central and Eastern Montana," by C. H. Clapp, Arthur Bevan, and G. L. Lambert. The report is a compilation of reports already published, together with information obtained from field work done by the State Bureau. Geologic maps and sections are included.

How Land Grows—*The Mining Magazine* for August (Salisbury House, London Wall, London, E. C. 2; price 1s. 6d.) contains an illustrated article of thirteen pages entitled "Land Growth," which should be of interest to geophysicists and geochemists.

Lead Poisoning in Utah—U. S. Bureau of Mines *Reports of Investigations* No. 2274, six pages, obtainable from the Bureau at Washington, D. C., is a statistical study of the relation of lead poisoning in Utah to mining.

Book Reviews

Textbook of Geology. By Amadeus W. Grabau. In two volumes. Cloth; 5½ x 8½; pp. 921; 1,980 illustrations; 1921. D. C. Heath & Co. Price, $6 each volume.

This most excellent and valuable work is a real addition to our existing list of textbooks of geology. Outstanding characteristics are detail, accuracy, a facile, lucid, and pleasant style of instruction, and every evidence of profound research, experience, and consultation of the literature. Elucidation by example is freely used to supplement the statement of principles, and the whole result is to make unusually easy reading for a work that is not intended in any way for popular use. Even the layman may look over these volumes with far less difficulty than with the usual geologic work; and the books are, therefore, well fitted for the guidance of students; they are also very valuable for the trained geologist, containing, as they do, the most modern discoveries and views of many phases of geology.

We know that the individuality of the author enters even into a textbook of geology. Thus, Dana was quite different from Le Conte; the facts were seen and presented through glasses of different tints. The work of Chamberlain and Salisbury is far different in point of view and in general individuality from that of Pirson and Schuchert. The latter work has the unusual advantage of being the result of collaboration between a petrographer and a paleontologist and stratigrapher. The work of Grabau, which we are here reviewing, shows unavoidably the perspective of the paleontologist, stratigrapher, and student of the geology of the eastern United States. To that extent it is not perfectly balanced; to ore deposits, for example, are devoted three pages and five illustrations out of the total—less than is given, for example, to lime deposits from springs and in caves, or to foraminiferal ooze. Therefore, the student of mining geology will find nothing to interest him, as to his chosen field, except to wonder that what is so vast and complex to him is so nearly invisible to the type of geologist represented by the author. The lesson for the student is that this work should be studied along with other textbooks, which present more fully and in different proportion varying perspectives of geological science; and this is a good plan in any event.

The number of illustrations is extraordinary, and they lighten the text continuously. In the vast presentation it it perhaps not surprising that some of them have slipped in twice: for example, Numbers, 423, 425, and 521 reappear in the second volume as Numbers, 1,923, 1,924 and 1,460. The area of glacial till on Warner St., Gloucester, is not without interest, but not sufficient to warrant a second printing.

J. E. S.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Electrolytic Zinc—Present and Future Possibilities

Anaconda Interested in Finding New Uses for Copper and Zinc

Dr. Frederick W. Laist, general superintendent of smelters of the Anaconda Mining Co., recently delivered an interesting address before the American Zinc Institute in which he praised the value of copper for roofing purposes, told of the success of experiments conducted at the Washoe plant and stated that the zinc producers need not consider copper producers as their competitors.

Dr. Laist does not believe that the zinc producers need fear the competition of the copper people, inasmuch as copper must necessarily command a higher price on the market than zinc. The cost of producing copper, says Dr. Laist, is seldom less than 15c. per lb., and in many cases the production cost is considerably more than this. Under ordinary conditions, copper will cost more than twice as much to produce as zinc.

COPPER ROOFING DURABLE

The converter building at the Anaconda reduction works afforded a difficult roofing problem, and experiments were made with many kinds of roofing. Corrugated iron was first used and had to be replaced about every eight months. About ten years ago it was decided to replace part of the roof with copper, which is still in fairly good condition, although some sheets have had to be replaced, owing chiefly to lack of physical strength rather than chemical corrosion. Thicker sheets should have been used. Later some corrugated zinc sheets were tried out on the roof of the converter building. These sheets, though they have stood up remarkably well, are not as good as copper and show the corrosive action of the sulphur gases. However, they stood the test better than might be supposed, considering the extremely severe conditions, and Dr. Laist is convinced that zinc roofing for ordinary purposes would last so long that the question of life would not be of importance as determining the choice between copper and zinc.

Last April the Anaconda company actually produced more zinc than copper in Montana. Though this is an exceptional condition, it is obvious that they are just as much interested in finding new uses for zinc as for copper.

At the present time, said Dr. Laist, the potential aggregate production of electrolytic zinc for the world amounts to approximately 125,000 tons, or 250,000,000 lb. per year. This is divided about as follows:

	Tons
Anaconda Copper Mining Co., Great Falls	55,000 to 60,000
Consolidated Mining & Smelting Co., Trail, B. C.	20,000 to 25,000
Electrolytic Zinc Co. of Australia	30,000 to 40,000
Judge Mining & Smelting Co., Park City	2,500
Brunner, Monde & Co., England	1,700

The experimental work upon which the modern electrolytic zinc process is based was started about the same time in 1914 by the Anaconda Copper Mining Co., at Anaconda, Mont., and the Consolidated Mining & Smelting Co., at Trail. Owing to the extraordinary high prices then prevailing for high-grade zinc, developments were unusually rapid, and in a surprisingly short space of time both Trail and Anaconda had commercial plants in successful operation.

ELECTROLYTIC PROCESS APPLICABLE TO ALL ZINC ORES

It may be stated that the electrolytic zinc process is applicable to a great variety of ores and concentrates. Almost any ore containing zinc can be treated, although, of course, it does not necessarily follow that the operation of extracting the zinc will be profitable.

The electrolytic zinc plant and the technique of the process at Great Falls is described fully in the *Transactions* of the American Institute of Mining and Metallurgical Engineers, and is also briefly described in a well-illustrated article in a pamphlet published for distribution by the Anaconda company. This plant represents the culmination of the experimental work and is probably the largest existing zinc plant of any kind in the world today.

JULY PRODUCTION RECORD

The record production for the plant was made last July, when a total of 11,801,662 lb. of cathodes were drawn. For Great Falls conditions this does not all represent marketable zinc, inasmuch as about 8 per cent of the cathode production must be blown into zinc dust for removal of copper and cadmium from the solutions. It should be borne in mind, however, that if the Great Falls plant had a copper-free concentrate to treat this would have very nearly represented net production, as on such concentrate probably not over 15 per cent as much zinc dust would have been required for purification. Though the Great Falls plant is rated at only about 110,000,000 lb. per annum, this means production from the relatively impure and expensive concentrates on which it operates. The maximum output of the tank house has been demonstrated to be at the rate of 140,000,000 lb. per year, or 193 tons per day, and it is probable that under favorable conditions, operating on concentrates such as are produced in the Joplin districts, the equipment at Great Falls could roast, leach and electrolyze sufficient concentrates for a production of 200 tons of zinc per day. This is quite an important point from the standpoint of plant investment in making comparison between the electrolytic and the retort process as applied to high-grade concentrates.

When the development of the electrolytic process at Anaconda for the beneficiation of complex zinc-lead-copper-silver ores and the utilization of surplus water power was undertaken there was little idea that such a process could be applied commercially except when the concentrates were low grade and water power was obtainable at low cost. Later high-grade concentrates, originating in the West in competition with retort plants, were purchased. In fact, it is probably not too much to say that the future of the zinc business in the West is going to depend to a considerable extent on the development of electrolytic zinc.

ELECTROLYTIC ZINC SHOWS STEADY INCREASE

With the development of the process and the extension of the Anaconda operations, optimism as to the future of electrolytic zinc has steadily grown, until now electrolytic plants operating on high-grade concentrates, and actually producing their power by the combustion of coal or oil or gas, are not an impossibility.

This statement may seem somewhat extreme, but it is based on the following general reasons:

First. The fuel required for distillation and retorting of a ton of zinc in a modern retort plant will, when burned in an efficient steam-power plant, generate sufficient electric energy to deposit a ton of zinc from sulphate solution.

Second. The labor required for producing a ton of zinc electrolytically from a given concentrate will be [illegible] than [illegible] the labor required in the former method.

Third. The total investment required to produce a ton of zinc electrolytically will, in general, be little if any greater than by distillation, it being assumed of course that both plants are constructed with a view to permanence.

Fourth. The great purity of electrolytic zinc and the desirable qualities which it possesses by reason of its purity, will, as they become better known, give electrolytic zinc a distinct advantage in the market.

An important advantage of the electrolytic zinc process over the retort process is better recovery. There has been a good deal of misunderstanding as to the recovery realized in existing electrolytic plants and a certain amount of disappointment has been manifested at the apparently low recovery being made. At Great Falls, for example, the recovery is approximately 80 per cent; at Trail it is lower than this. This 80 per cent recovery is, however, made up of recoveries of about 75 per cent on low-grade concentrates containing 30 per cent to 35 per cent zinc, on the one hand, and 85 per cent to 90 per cent on high-grade concentrates containing 50 to 55 per cent zinc, on the other. In other words, the possible recovery depends entirely on the grade and composition of the concentrates undergoing treatment, and the actual recovery depends as well on the design of the leaching equipment and the facilities for washing.

On pure, high-grade Joplin concentrates a well-designed roasting and leaching plant can make a recovery of 92 per cent to 95 per cent of the zinc content, and in general on any given grade a better recovery is commercially possible by distillation.

It goes without saying that a lower grade concentrate can be successfully treated, as the operating costs of the electrolytic process are more nearly proportional to zinc content than those of the distillation process and the presence of lead and iron is much less detrimental.

The recovery of zinc from low-grade and to a lesser extent from high-grade concentrates is one of the things which is receiving considerable attention at the present time, and the future will see great improvement in this direction. Experimental work is being carried on along two lines:

First. To cut down losses of insoluble zinc by more careful control of roasting, and to improve extraction and washing by better design of leaching plant equipment and flow sheet.

Second. By subjecting residues to additional treatment for recovery of both soluble and insoluble zinc.

The latter development is particularly important where the residues are to go to the lead smelter, as the presence of zinc in such residues, apart from representing an economic loss in itself, is highly detrimental to the subsequent smelting operation. Its removal and recovery would, therefore, be a very decided step in advance. Experimental work at Anaconda and Great Falls indicates that a recovery of 75 per cent of the zinc in the residue may be expected, which would bring the over-all recovery on even a low-grade (30 to 35) concentrate between 92 per cent and 94 per cent.

TREATMENT OF FINES ADVANTAGEOUS

Another important advantage of the electrolytic process is its ability to treat fines. The flotation process is used to be resorted to more and more for the production of zinc concentrates, and these are necessarily very fine. So far from being a detriment as in the firing process, this condition is a positive advantage to the new process, so that at Great Falls the company has in the past actually limited purchasers of outside material to flotation concentrates.

Where acid is to be manufactured, less complete roast required for the wet process may present certain advantages and might under favorable conditions make unnecessary the use of muffle furnaces. Obviously, from the standpoint of recovery the presence of sulphur in the form of SO_4 is not detrimental. The only possible disadvantage from too much sulphate in the calcine is the building up of acid in the solution system to the point where a discard of cell acid must be made. This actually happens at Great Falls and results in the loss of a small percentage of zinc. Both the acid and the zinc could be saved by evaporation of a small portion of the cell solution each day, and this will probably be done.

Technically, both metallurgically and mechanically, the existing plants are far from perfect, and much remains to be done. In all departments improvements can be made which will result in better recovery, better current efficiency and lower operating and plant costs. Such improvements are not problematical, but certain, and in many instances already have been roughly mapped out.

Hot Mine Gases at the Tintic Standard Mine, Utah*

Troublesome gases encountered in the Tintic Standard mine, at Eureka, Utah, are nitrogen, sulphur dioxide, and carbon dioxide, which interfere with the conduct of operation in the order named, nitrogen causing the most difficulty and carbon dioxide the least. According to the report of the Bureau of Mines, the origin of these gases is in the oxidation of sulphides in the ore. Carbon dioxide is generated through the action of the sulphuric acid on the limestone. These reactions are accompanied by the production of heat, which interferes with operations as much as or more than the gases themselves.

Separation of the different gases because of differences in specific gravity causes the ventilation problem. The nitrogen, being lighter than the atmosphere, tends to rise to the backs, and collects in such quantity in the high points of a stope or in a raise as to prohibit work in a very short time unless mechanical ventilation is provided. In the dead end of a drift which has not been worked for some time, it is possible to see where the line of demarcation is between the upper nitrogen layer and the purer air, containing more oxygen, by observing the sulphides in the wall rock, those particles below the line being considerably more oxidized than those above.

The sulphur dioxide has approximately the same specific gravity as the atmosphere and seems to mingle quite uniformly with the air currents. It is gradually eliminated through reaction with water and carbonates, forming sulphates and carbon dioxide, and therefore is not troublesome, unless near the point of origin.

Carbon dioxide is found in objectionable quantity in the Tintic Standard only during the periods of low barometric pressure, or when a drift in the quartzite encounters open fissures, which are usually filled with it.

Both nitrogen and carbon dioxide have a suffocating effect when breathed, even when considerably diluted with air. They are often present in the Standard in sufficient quantity to extinguish an acetylene light.

The rapidity of the oxidation in the Tintic Standard is a difficult phenomenon to explain. Mr. McIlroy, of the Bureau of Mines, attributes it to the fineness of the sulphide particles. The fact that oxidation does not seem to take place so rapidly where the sulphides occur in larger crystals would appear to confirm this conclusion. However, at no place in the Standard are the sulphides so fine grained as, for instance, in the Tintic district, in the Gemini and Ridge & Valley mines, where little if any oxidation takes place. One is, therefore, a little reluctant to accept the fineness of grain of the sulphides as being the prime factor in the rapidity of oxidation. Probably the access of air through more extensive fracturing of the rock and the more porous nature of some of the Standard ores, combined with the greater temperature of the wall rocks, accounts partly for the more rapid reaction in this section of Tintic; but the real reason is still unknown.

Formation of gas would seem to depend largely upon the iron sulphide content of the ores, as the galena, with the exception of a thin coat at the surface, remains practically unaltered. The oxidized material in exposed faces extends into the walls from one-half to three-quarters of an inch, beyond which little change is apparent. The amount of surface exposed is, therefore, an important factor in the formation of gas, which has a direct bearing on methods of ore handling.

If the muck from a round of holes in heavy sulphide is not removed, the beginning of oxidation is apparent within a few hours. Within a few days, the black sulphide is coated with white oxidized material, and the muck becomes recemented and difficult to handle. The storage of broken sulphide is prohibited by reason of the amount of gas and heat generated. The storage of any great quantity would doubtless pollute the whole mine so as to render it unfit for workmen, in addition to causing great danger of fire.

With reference to the temperatures of the gases, it is interesting to note that, though the carbon dioxide approximates the temperature of the wall rock, the nitrogen will run from 60 to 90 deg. F. more. Depending on locality, the rock temperature will vary from 80 to 110 deg. F. in the quartzite, much less in the limestone, and a few degrees more in the sulphide zones. The carbon dioxide varies from 85 to 110 deg., and the nitrogen averages 175 deg. where close to the point of origin.

---

*From a paper presented by A. J. May at [illegible] of the Utah Metal Mine Operators' Institute, Oct. 7 and 8, 1921, Salt Lake [illegible]

Oxidation in the wall rocks can be stopped or greatly diminished by guniting, which, though economical, has its limitation in that it is practicable only in drifts and crosscuts, leaving the much larger exposed surfaces in the stopes untreated. The temperature in one drift was lowered 40 or 50 deg. by this method. In a quartzite drift now being driven guniting is being postponed until the heading is far enough advanced to prevent heavy shooting from breaking the cement, but it is confidently expected that the gunite will not only reduce the oppressive temperature in this drift, but will also dam off an objectionable seepage of carbon dioxide from the numerous fissures.

The most satisfactory method that has been found in the Tintic Standard mine to handle the nitrogen problem is to maintain raises from the stope backs to the level above and to direct the ventilating currents downward through these rather than upward. This seems to clear out the gas better and leaves fewer dead ends and gas pockets, and, in fact, gives better working conditions at all faces.

Some idea of the activity of the oxidation which is causing the Tintic Standard's gas problem may be had from the fact that sills laid in the heavy sulphides are charred from the heat of the reaction. Though such phenomena are somewhat alarming, and the resulting gases are a disturbing factor in operation, some slight consolation is to be found in the non-poisonous nature of both the nitrogen and the carbonic-acid gas, as well as in their quality of not supporting combustion, thereby having a tendency to lower the fire hazard.

American Mining Engineers Honored

Nearly two hundred engineers attended the dinner to the delegation from the American Engineering Societies to Great Britain and France at the Hotel Pennsylvania, New York, on Oct. 10. Representatives of the British and French governments and of foreign engineering societies were present. Medals struck by the French government were presented to the [illegible] of the [illegible], to the chairman of each individual delegation, [illegible]

Honors conferred upon the visiting American engineers included the election of C. F. Rand to honorary membership in the Iron and Steel Institute, the Institution of Mining and Metallurgy, and the Institution of Mining Engineers. Arthur S. Dwight and William Kelly were elected to honorary membership in the Institution of Mining Engineers.

Bain Outlines Function of Bureau in Petroleum Industry

H. Foster Bain, director of the U. S. Bureau of Mines, recently addressed petroleum engineers and operators at the Engineers' Club of San Francisco. He discussed the relation of the Bureau to the oil industry. The initial work was undertaken by Dr. Holmes, who sent Bureau men into what was then the Indian Territory to control the waste of gas accompanying oil-drilling operations by applying muddling-off methods. This early work was successful, and since then the petroleum division has grown into an important and well-recognized relation to the petroleum industry of the country. Dr. Bain said that California was in advance of many other oil-producing districts and first developed engineering as applied to the problems arising in oil production. The methods developed in this state had been spread in part by the efforts of the petroleum division of the Bureau, to other producing districts of the United States.

Dr. Bain outlined the Bureau's organization for experimental work and stated that the real problem of the Bureau was to effect the translation of the laboratory processes to commercial-scale industrial processes. Instead of securing appropriations for large scale experimentation, the Bureau was cooperating with companies and preferably with associations and thus securing sufficient funds to test out promising research results instead of allowing dust to accumulate upon the reports already available.

Dr. Bain commented upon the Bureau's administrative difficulty caused by a large turnover in its technical staff, particularly in the petroleum division. The average time of service was two years and one month in this division. He stated that the Bureau was almost a school of instruction in advanced petroleum technology and research work.

In closing his address, Dr. Bain commented upon the position of the Bureau in relation to oil-land leasing. He stated that the Bureau had nothing to do with the making of the lease, but was charged with the responsibility of administering it after it was signed. It had no police power and simply represented the land owner, the Government. Its function is to check the company and help people in handling the wells.

At the conclusion of the address, the chairman asked David M. Folsom to speak upon the relation of the petroleum industry to the Bureau. Mr. Folsom said: "The relation of the industry to the Bureau of Mines is extremely cordial and extremely friendly. It is welcomed in the industry because it comes to the industry [illegible] trying to help it."

The Requirements of Hoist Signaling in Metal Mines*

The simplest form of electric system comparable with the bell rope system comprises a pull switch at each station for each hoisting compartment, a pair of insulated wires (a common return may be used), a source of current at top, and single-stroke gongs.

An addition to the simple electric system can be made to guard against "illicit" signals. It comprises locked signaling switches at each station that can be operated only by a man who carries the proper key or operating device. The protection is not quite perfect because it does not prevent the mistake of signaling the wrong side.

The complete signaling system must provide means for non-executive signals as well as for the purely executive signals. By an executive signal is meant a signal giving direct orders to the hoisting engineer, such a signal being given only by a properly authorized person. Non-executive signals comprise requests from any one for the cage, and certain emergency signals. All such non-executive signals should be provided for by a telephone or flashlight equipment entirely separate from the executive signal system.

The classification of the types of signaling equipment can be made in many different ways, but perhaps the following is as good as any other:

First. All sending equipment located on stations with nothing on the cages.

Second. All sending equipment located on cages, nothing on stations.

Third. Part of sending equipment located on stations and part on cages.

In each classification there may be a sub-classification:

A. Signaling current the same as the gong current. This eliminates relays and permits the use of alternating current throughout.

B. Signaling current separate from gong current, the joint operation being effected by relays. This reduces the current and voltage of the signaling circuit to very small values and makes possible the use of dry cells as a source of the signaling current.

Mining Institute of Scotland Meets

A general meeting of the Mining Institute of Scotland was held in the Heriot Watt College, Chambers St., Edinburgh, on Oct. [illegible] The following papers were presented and discussed: [illegible] "Electric Head Lamp," by [illegible]

---

*[illegible]

MEN YOU SHOULD KNOW ABOUT

Bulkeley Wells was recently in San Francisco.

Frank W. Royer has returned to Los Angeles from Virginia City, Nev.

Robert E. Palmer, consulting engineer for the Rio Tinto Co., is in New York.

John C. Ralston, of Spokane, is visiting New York and other Eastern cities.

W. J. Quigley and **E. J. Donohue,** of the Britannia Mining Co., were recently in San Francisco.

A. D. Chisholm left for South America on Oct. 12 to examine properties in Brazil for the Steel & Tube Co. of America.

Henry H. Armstead, president of Armstead Mines, Inc., has returned to Talache, Idaho, from a recent trip to New York.

William F. Ward sailed for Colombia last week, where he will be engaged in the examination of mining properties for several months.

E. P. Mathewson has been appointed consulting engineer to the Burma Mines, Ltd., and is on his way to the company's properties via London and Marseilles.

William Sloan, Minister of Mines for the Province of British Columbia, has been able to resume his work at Victoria after several months' absence on account of ill health.

Samuel Jewell, until recently assistant superintendent of the Marquette Ore Co.'s mines at Negaunee, Mich., has gone to Wharton, N. J., to assume charge of the Thomas Iron Co.'s mines.

R. A. Angst, former superintendent of the Woodbridge mine, Buhl, Minn., has moved to the Gogebic range in Michigan, where he has assumed his new duties as general superintendent of the Montreal Mining Co.

B. B. Thayer, vice-president of the Anaconda Copper Mining Co., was a visitor last week in Butte inspecting the company's properties. He also visited the phosphate deposits of the Anaconda at Soda Springs, Idaho.

J. L. Bruce, formerly manager of the Butte & Superior mine, and now manager of the Davis-Daly Copper Co., was in Spokane early in October, having been called there as a witness in the litigation arising from the Star-Bunker Hill-Hecla agreement.

M. J. Lorraine, of Alhambra, Cal., has completed a 2,000-mile trip by rowboat from the headwaters of the Columbia River to its mouth. Mr. Lorraine left Lake Windermere, in British Columbia, on June 13. He studied geological formations on the way and secured numerous photographs.

E. F. Burchard, of the U. S. Geological Survey, accompanied a party of state geologists on their recent visit to the mines at Cranberry, N. C. He is returning to Tennessee to take up co-operative work with the Tennessee Geological Survey on the brown iron ores of western Tennessee.

S. R. Elliott, general superintendent of the Cleveland-Cliffs Iron Co., Ishpeming, Mich., was a recent visitor to the Mesabi iron range, where he inspected the properties of his company. He was accompanied on his tour of inspection by **Max H. Barber,** district superintendent on the Mesabi range.

William Wearne, general superintendent of mines for the Inland Steel Co., has been given six months' leave of absence to recuperate from serious illness; and **R. L. Wahl** has been made acting general superintendent. Mr. Wahl, a graduate of the Michigan College of Mines, has been chief engineer for the company for the last six years.

Mining and metallurgical engineers visiting New York City last week included: **E. H. MacDonald,** Spokane, Wash.; **E. J. Carlyle,** Sudbury, Ont.; **C. H. Palmer, Jr.,** Los Angeles, Cal.; **E. W. Shaw,** Tulsa, Okla.; **William Kelly,** Vulcan, Mich.; **W. D. McMillan,** Tchikapa, Belgian Congo; **Paul W. Myers,** Philadelphia; **W. J. Priestly,** Charleston, W. Va.; **C. B. Murray,** Cleveland, Ohio, and **H. M. Boylston,** Cleveland, Ohio.

SOCIETY MEETINGS ANNOUNCED

The American Petroleum Institute will hold its annual meeting at the Congress Hotel, Chicago, Dec. 6, 7, and 8. The tentative plans to hold the meeting at Kansas City have been canceled.

The Petroleum and Gas Committee of the A. I. M. E. will hold a symposium on foreign oil possibilities at the Engineering Societies Building on Dec. 10. Ralph Arnold is chairman.

OBITUARY

James Kane Murphy, assistant superintendent of the Washoe Smelters of the Anaconda Copper Mining Co., died suddenly of heart disease at his home in Anaconda on Oct. 9.

Dr. Joseph Winthrop Spencer died in Toronto on Oct. 9 after a month's illness at the age of sixty-nine. He was born at Dundas, Ont., and was graduated from McGill University. He became professor of geology at King's College, Windsor, N. S., and occupied the same position at the University of Missouri, afterward being appointed state geologist of Georgia.

JOSEPH W. RICHARDS

Dr. Joseph W. Richards, professor of metallurgy at Lehigh University, died suddenly at his home at Bethlehem, Pa., on Oct. 12. Dr. Richards was fifty-seven years old, and was born in Oldbury, England. He was a graduate of Central High University, and taught at that institution for more than thirty years. He was a member of many engineering clubs and the author of several books. He was a member of the United States Assay Commission in 1897; representative of the Franklin Institute to the International Geological Congress held in Russia in 1897; a member of the jury of awards, department of chemistry, of the National Export Exhibition at Philadelphia in 1899; a member of the jury of awards and chairman of the metallurgical sub-jury, Panama-Pacific International Exposition, 1915, and a member of the United States Navy Consulting Board, 1915-1918. He was a charter member of the American Electrochemical Society.

Professor Richards was also a member of the following: The Farady Society, Deutsche Bunsen Gesellschaft, American Chemical Society, American Institute of Mining & Metallurgical Engineers, former vice-president of the Institute, and chairman of the iron and steel committee since 1914; Iron and Steel Institute of Great Britain, American Iron and Steel Institute; Société de la Chimie (France); American Institute of Chemical Engineers, and an honorary member of the American Electroplaters' Association. He was a member of the Board of Engineering Foundations and of the National Research Council. On the Joint Conference Committee of the Federated Engineering Societies he was the representative of the American Institute of Mining and Metallurgical Engineers.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

The power supply of the Witwatersrand is described in a special article dealing with the largest power undertaking in the British Empire, the Victoria Falls & Transvaal Power Co., which will furnish the large South African gold mines with electrical power.

Railroads are to petition the Interstate Commerce Commission to reduce fright rates upon iron ore in an effort to encourage shipments and the lowering of finished material prices.

The State of Arizona is investigating the back payment of corporate fees of 33,000 mining companies and intends to dissolve delinquent corporations, of which there are many. The Consolidated Arizona Smelting Co. is to be sold and reorganized.

Secretary Mellon, in a reply to the resolutions of twenty-two Western Senators, says that gold bonus legislation is unnecessary, as relief is gradually coming to the gold-mining industry and as the United States has more than enough gold to supply its needs.

A large contract has been signed by German potash producers and American fertilizer manufacturers. The price is believed to be below the possibility of American competition.

Reports from various sections of the country indicate that greater activity is noticeable in silver mining in Arizona, Nevada and British Columbia. Gold mining in California is on the increase. The advance in prices has stimulated Missouri and Oklahoma mining.

The experimental sulphur dioxide treatment of copper ores is giving encouraging results in the Southwest.

Railroads to Request Freight Reduction on Iron Ore

As an incentive and to encourage the shipment of more iron ore, the Eastern railroads have announced their intention of applying soon to the Interstate Commerce Commission for permission to lower the freight rate on iron ore shipments from lake ports to the furnaces. This reduction will amount to 28 per cent, and it was welcome news to iron and steel interests. Even though all mine operators and furnace men will not be able to take advantage of the new rate if it is established, it might have a bearing on the rate for next season. This reduction, should it be allowed by the commission, will be in effect until Dec. 31, 1921. It should be recalled that the rate on iron ore was raised 40 per cent on Aug. 26, 1920, so this reduction will greatly assist all companies that are in a position to take advantage of the same, as it will mean a reduction of 36c. per ton to Pittsburgh and 60c. to Schuylkill Valley points, which would mean approximately [illegible] cheaper pig iron per ton in Pittsburgh.

Since the slump in the iron and steel business has been attributed partly to high freight rates, it is hoped that the present reduction has not come too late in the season to cheapen the cost of iron and steel products to the public, and it will also strengthen the arguments of those who have been advocating a reduction in freight rates to reduce the cost of living. If the lower rate on iron ore is absorbed by the manufacturers so that the public does not get the benefit, it would mean merely that the revenue which the railroads are willing to forego in the experiment will go into the pockets of the manufacturers.

The Power Supply of the Witwatersrand

Victoria Falls & Transvaal Power Co. Largest Undertaking of the Kind in British Empire — Subsidiary Furnishes Current and Compressed Air to Central Mining Corporation's Mines

By M. EDWARD

Written for Engineering and Mining Journal

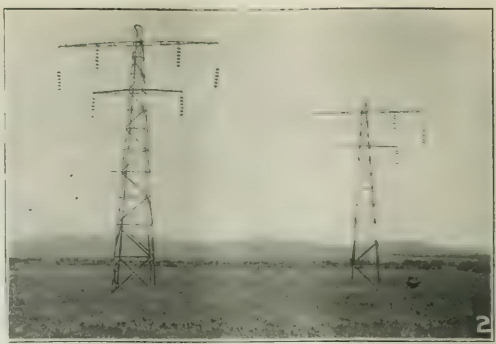
THE Victoria Falls & Transvaal Power Co., Ltd., in South Africa, is the largest power undertaking in the British Empire, and ranks as one of the largest in the world. The company was first formed in 1906 with the object of supplying electrical energy to the gold mines along the Witwatersrand. In 1908, the Central Mining & Investment Corporation decided to electrify its mines and agreed to purchase all its power from the Rand Mines Power Supply Co., Ltd., a subsidiary of the Victoria Falls company. It also stipulated that the company was to supply it with compressed air for its mines. At present there are two companies working under separate licenses granted by the government in terms of the Power Act passed in 1910, but both are managed by the same office and controlled by the same staff.

The capital of the V. F. P. (as it is most generally called) was as follows: Ordinary shares, [illegible] (issued as fully paid); preference shares, [illegible] (6 per cent cumulative and participating); debentures, 3,000,000 (5 per cent first debentures), and [illegible] (6 per cent second debentures), making a total capital of [illegible].

The bigness of the undertaking [illegible] all the larger because in a far-away country like South Africa may be gauged from the power stations which were immediately erected. At Rosherville, six miles or so from Johannesburg, the largest station has been erected with 64,000 hp. electric generators and 50,000 hp. air compressors. These air compressors and the electrically driven ones are all of the high-speed rotary type, and at Robinson station, mentioned later, are the most noteworthy of their kind, as regards capacity, in the world. The four [illegible]-hp. steam-driven and the five 4,000-hp. electrically driven air compressors that were first installed were at the time the largest in the world. The three 10,000-hp. compressors which were added in 1914 remain today the largest units by far of such kind in existence, and are likely to remain so for many years, for what other country will require so much compressed air as the chain of mines along the Witwatersrand?

Besides the Rosherville station, four other large stations were erected. These are at [illegible] ([illegible]-hp. electric generators), about ten miles east of Johannesburg; Brakpan ([illegible]-hp. electric generators, [illegible]-hp. air compressors), about twenty-five miles east; Robinson ([illegible] hp. electrically driven compressors), about [illegible] west of the town; and Vereeniging, thirty-five miles south of Johannesburg, [illegible]-hp. electric generators. Vereeniging is situated on the Vaal River and is the well-known Orange Free State border town where the Peace Treaty was signed at the termination of the Boer War [illegible].

The boiler plant at these power sta-



1—GENERAL VIEW OF SIMMER PAN POWER STATION. 56,000 HP. ELECTRIC GENERATORS

2—HIGH-TENSION TRANSMISSION LINE ON THE VELD IN SOUTH AFRICA.

3—BRAKPAN POWER STATION, SHOWING COOLING DAM, 40,000 HP. ELECTRIC GENERATORS, AND 10,000 HP. AIR-COMPRESSORS

4—ENGINE (TURBINE) ROOMS AT ROSHERVILLE POWER STATION. 64,000 HP. ELECTRIC GENERATORS AND 50,000 HP. AIR-COMPRESSORS

tions are of the marine water-tube type. Forty of these are installed at Rosherville, each capable of evaporating 40,000 to 50 000 lb. of water per hour into steam. The normal steam pressure is 220 lb. per sq.in. and the steam is superheated to a total temperature of about 340 deg. C. The special form of induced draft used is known as the Pratt ejector draft system.

At the time the plants were erected it was realized that one of the factors which has contributed in greatest measure to the successful evolution of large power schemes was the development of the steam turbine. The electric generating and steam compressor plants are all steam-turbine driven. The steam turbines driving the electric generators are of the Curtis-Rateau type and revolve at 1,000 r.p.m. in the larger electric generators and 3,000 r.p.m. in the smaller generators and the compressors. Practically all the circulation water and feed pumps are steam-turbine driven, the turbines running at 1,400 to 1,[illegible] r.p.m. The circulation cooling water is obtained at Rosherville from a dam containing about 200 000,000 gal. of water and at the Vereeniging power station from the Vaal River.

The security of the supply of energy from Vereeniging station is naturally dependent upon the reliability of the thirty-four miles of 80,000 v. transmission lines. However, as was anticipated when selecting Vereeniging as a station site, these transmission lines have proved more reliable than others.

The main transmission lines of the company extend from Randfontein, on the West Rand, to the Sub-Nigel gold mine, on the East Rand, a distance of about fifty-six miles, and thirty-four miles due south to the Vereeniging power station. The long lines of steel towers bearing these transmission lines are one of the first "sights" to be commented upon by people arriving in the "Gold City." The lines to Vereeniging appear to stretch way out into the wild veld and seem to have no object until one sees the tremendous chain of gold mines along the reef. Transmission pressures are 80,000 volts from Vereeniging, 40,000 along the reef, and 20,000 and 10,000 for distribution networks.

The mileage of the main transmission circuits is as follows: 80,000 volts overhead, 136 miles; 40,000 volts overhead, 82 miles; 20,000 volts overhead, 93 miles; 20,000 volts underground cable, 49 miles; 10,000 volts overhead, 40 miles; miscellaneous low-tension circuits, 21 miles; pilot and telephone cables, 202 miles; and telephone overhead, 55 miles; in all a total of 678 miles.

The following facts will be of general interest: In 1920 over 800 million units of energy in the form of electricity and compressed air were sold to consumers. This meant the burning of more than 1,000,000 tons of coal, a large proportion of which consists of duff, a byproduct from the collieries.

The Victoria Falls & Transvaal Power Co., Ltd., still remains the largest power undertaking in the British Empire, and would be considered large in the United States. As regards the supplying of compressed air, its position is, of course, unique. During 1920 about 1,500,000 short tons of air passed through the main pipe network from two compressor stations to the mines. At the time of the maximum load each day air is delivered at the rate of nearly ten short tons per minute. I am indebted to Bernard Price, chief electrical engineer of the V. F. P., for the details of this huge undertaking.

Welsh Spelter Works Reopen

[illegible]

London, Oct. 4—Villiers' Spelter works, near Swansea, restarted 50 per cent of its plant yesterday. This is the first Welsh spelter works to reopen after many months of idleness.

Arizona Checking Delinquent Corporations

There is to be a grand scattering of Arizona incorporations, most of them based upon alleged mining or oil prospects. In all, the Arizona Corporation Commission has in its files the incorporation papers of 33,000 companies. More than half of them have failed to file annual reports or to forward the annual filing fee of $20. Now there is to be notification, mailed to the Arizona statutory agent, to the effect that the corporation concerned will be dissolved and its power annulled unless all missing reports are completed and all annual fees are paid within ten days. These demands, checked by the Attorney General, are to be sent out at the rate of 100 a day till the last letter of the alphabet is completed.

Some of the corporations are delinquent since their first filing, even twenty years ago. Most of them are believed to be out of business, though word has come of the sale of stock in the East by a number of corporations that have failed to obey the Arizona laws under which they exist. It is believed that at least 15,000 corporations will have been wiped out when the task of checking them has been completed here. A large proportion date back to the Nome rush and to the earlier Texas oil boom, which happened in a time when the Arizona incorporation laws were of the "wide-open" variety, passed mainly for the benefit of local incorporation agents.

Tin Output Curtailed in Dutch East Indies

[illegible]

London, Oct. 17—A cable dispatch received from Amsterdam states that the board of directors of the Banka & Billiton Tin Mines, in the Dutch East Indies, has decided to close several unprofitable mines, thereby reducing the production.

Consolidated Arizona Smelting To Be Sold

At Tucson on Oct. 24, in the U. S. Court, will be heard a receiver's petition for the sale of the property of the Consolidated Arizona Smelting Co. of Humboldt. The Southwest Metals Co. has been organized for the purpose of taking over the property, its assets, and liabilities, and already is understood to have acquired by purchase nearly all the claims against the old corporation. Small claims have been paid in cash, and larger claims generally have been satisfied by exchange of stock in the new company. The property is of large value, including a modern smelter of efficient type, capable of handling complex ores, a concentrating mill and two large mines, the Blue Bell and De Soto, from which has come a major part of the copper ore tonnage handled by the furnaces.

Spain Forms Chambers of Mines

[illegible]

Madrid, Sept. 28—A [illegible] announces the obligatory formation of chambers of mines in all the mining districts of the country. The object of the new chambers will be to encourage the mining and metallurgical industries, to furnish statistics and information, to found or subsidize mining schools, to raise loans with the authorization of the Ministro de Fomento, to intervene in labor disputes, to attend to all questions relating to hygiene and sanitation in the mines, and to assist in the distribution of labor by the establishment of labor exchanges.

The number of members in each chamber is fixed at not less than ten nor more than forty. The new chambers will act as consulting bodies to the government, and their views will be requested on all new projects, customs changes, and related matters.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Mellon Gives Reasons Against McFadden Gold Bill

Events Have Proved That Government Subsidy Is Unnecessary, Says Secretary of Treasury

No legislation, such as the McFadden gold bonus bill, is needed to protect the gold reserve, says the Secretary of the Treasury in reply to the resolution of twenty-two Western senators transmitted to Secretary Mellon by Senator Oddie, of Nevada. Secretary Mellon expresses the opinion that [illegible] "without a Government subsidy."

[illegible] the Secretary. This reply, he states, [illegible] Mr. Mellon [illegible]

"The Treasury's position with respect to this bill has already been stated in my letter of [illegible] Committee on Ways and Means, a copy of which is inclosed for your information. The developments [illegible] normal and costs become stabilized on a lower level relief should gradually come in the ordinary course of events from the difficulties of which the gold mining industry has been complaining. Already there are signs of some improvement.

"The bill presents two main questions, the first of which is of chief concern to the Treasury; namely, whether [illegible] protect the monetary gold reserve of [illegible] from every [illegible] normal annual product[illegible]

"[illegible] tary gold in the country on Sept. 1, 1921, according to the inclosed monthly circulation statement of that date, is $3,377,417,980, of which $2,641,061,000 [illegible] Since that date the reserves have been [illegible] end. . . .

"[illegible]

"Th[illegible]

the hardships which the gold-mining industry has suffered during the period of abnormal war costs. As already indicated, I believe that these conditions will gradually right themselves without a Government subsidy, and that the difficulties in which the producers of gold have found themselves in the meantime are due chiefly to the fact that gold is the standard of value. It is true, of course, that the price of gold, as the monetary unit, is fixed by law, but this, in turn, gives compensating advantages to gold producers in other times, when production costs are low, because of the assured market at a fixed price which is always available. It is difficult in these circumstances to see what special equity there is in the claim for a premium when costs are high. There would certainly be no suggestion of a discount if costs were low.

"The tax which the bill would impose upon the use of gold for non-monetary purposes, while in form a tax, would in fact put restrictions upon the free convertibility of the currency into gold. If gold could not be used, except under heavy penalties, for anything else than money, its value would be impaired and there would be, in effect, a clog on the convertibility of the currency. One dollar in paper currency, in other words, would not buy one dollar's worth of gold, if the gold was to be used in the arts. Gold in large quantities, moreover, is imported from abroad and even under legislation like that proposed could be purchased in foreign countries in the open market. To put a penalty on foreign gold thus brought into this country for non-monetary purposes, in order to pay a premium to domestic producers, would seem to have little or no relation to the protection of our own monetary gold reserves.

"I have noted particularly the request made in the resolution which was presented with your letter that if the Treasury be opposed to H. R. 5,025 it formulated a proposal for enactment by Congress to relieve the gold-mining industry and protect the gold reserve. As already indicated, I believe that no legislation of this character is needed in order to protect the gold reserve, and therefore have no proposal to suggest for this purpose. On the question of possible legislation to provide a bonus for the mining of gold, the Treasury also has no proposal to submit, believing, as indicated herein, that if such a bonus were to be granted it would come as an exercise of legislative discretion by Congress."

The letter of May 9, 1921, to the chairman of the Committee on Ways and Means, to which reference is made in the above letter, states:

"I hold the general view that the difficulties in which the gold producers find themselves are due to the fact that gold is the standard of value. In a sense this is the penalty which gold pays for being the standard. These difficulties should gradually adjust themselves without a Government subsidy as deflation progresses and commodity prices return toward normal. As I see it, the question of whether the Government is to give a bonus on these terms to a special class of producers is a question of policy which addresses itself to the judgment of Congress, and not a question upon which the Treasury is in a position to express an opinion."

No Enthusiasm for Exchange Stabilization Conference

Presentation of arguments for an international conference on exchange have failed to arouse any enthusiasm on Capitol Hill. The consensus of opinion appears to be that nothing will be gained by such a conference as is proposed in a pending bill. The opinion seems to be that the causes of the difficulties in the exchange situation are thoroughly understood, as are the steps that would be necessary to remedy it. A conference could only recommend. It could not put its recommendations into effect. As these recommendations could be written in advance, the efforts should be concentrated on securing the necessary legislation and on inducing the banks of issue to take the steps which are obvious.

Sign Contract for German Potash

Six large manufacturers of fertilizer, according to information reaching the U. S. Potash Producers' Association, have closed a contract for 80 per cent of their potash requirements for the next season with the German syndicate. The price is understood to be close to the pre-war level. The closing of this contract, it was stated, leaves comparatively little business to be divided between the French and American producers. No American producer of potash is able to compete with the German product at the price offered. It was stated that they would not attempt to enter the market at the present price level.

The delay in the passage of the tariff bill is blamed by the domestic producers for this large contract going to Germany. They contend that they would have been able to meet the price of the German potash had the duty carried in the tariff bill been in effect.

Pittman Act Silver Purchases

The purchases of silver by the Bureau of the Mint during the week ended Oct. 15 totaled 2,282,000 fine ounces This brings the total purchases of silver under the Pittman Act to 78,173,866 fine ounces. Purchases will total 207,000,000 ounces.

NEWS BY MINING DISTRICTS

London Letter

The Position of New Modderfontein Gold Mining Co., Ltd.

By W. A. Doman

London, Oct. 4—Though maintaining its position as the premier gold mine of the Witwatersrand—it might perhaps be truthfully said the greatest gold mine of the world—the New Modderfontein felt adverse influences during the twelve months ended June 30 last in the same way as other mines on the field. But being such a rich property relatively, of course it was better able to bear the burden. In various directions working results created a record; the outcome, however, would have proved in a sense disappointing had it not been for the additional price received for the gold. The position for the twelve months ended June 30 may be shown thus:

	1919	1920	1921
Tons milled....	920,500	968,500	1,083,000
Profit at standard price....	£1,089,891	£1,029,188	£947,625
Gold premium.	nil	£464,657	£751,427
Total working profit	£1,089,891	£1,493,845	£1,699,052
Premium contributes to profit, per cent.....	nil	31.1	44.2

In other words, owing to the rise in costs over the period shown and a slightly lower grade of ore milled, the treatment of 162,500 extra tons produced less profit at standard rate by £142,266. In part explanation of the increase in costs in the latest period must be mentioned a large amount of abnormal work which represents about 9d. per ton milled.

If expenses be calculated at per ounce of gold produced, the showing during the last four years is: 1918, 38/10; 1919, 38/6; 1920, 42/6; and 1921, 48/2. White wages over the same years have risen from 6/4 per ton in 1918 to 7/1 in 1921. The balance is made up of enhanced prices for stores and materials. Shareholders have again derived considerable benefit from the year's operations, as is indicated as follows:

	1919	1920	1921
Total profit....	£1,089,891	£1,493,845	£1,699,052
Dividends per cent	62½	82½	100
Amount distributed	£875,000	£1,155,000	£1,400,000

It would almost appear from the development viewpoint that the mine had exceeded expectations, for "very satisfactory values" were obtained in the western section, where active work has been resumed, and the eastern section continued to fulfill expectations.

The western section, giving the "very satisfactory values," contributed between the 12th and 13th levels west of No. 2 shaft 302,800 tons, of 9.7 dwt. value over 82 in. stoping width. As there is over seven years' supply of ore for the mine, the reserve position is decidedly strong. The consulting engineer states that the general position of the mine is all that can be desired, and given sufficient labor, the output for the current year can be increased a further 200,000 tons. The mine has worked only 87.4 per cent of its complement of natives, and consequently is to a certain extent handicapped.

A feature of the New Modderfontein is the narrowness of the reef and the great stoping width. A distance of 9,105 ft. was sampled on the Main Reef Leader, the average width being 15 in., the average assay value 53.5 dwt., and the number of in.-dwt. 803. As the stoping width averaged 69 in., the reef was only 21.74 per cent of the total, and surrounding rock 78.26 per cent, or 27 in. on each side of the reef.

Johannesburg Letter

Rand Gold Output for August Greater Than July's—Board of Trade Organized

By John Watson

Johannesburg, Aug. 12—The Transvaal gold output for August was reported by the Chamber of Mines on Aug. 10, and shows an increase over that of July of 21,971 fine ounces, the increase in value being equal to £88,010. The total output for August was 711,526 oz. fine gold, equal in value to £3,966,751. The value for August was taken at £5/11/6 per fine ounce, whereas in July the figure was 1s. per fine ounce more. Out of a total of forty-two gold mines, thirty-one show an increase and eleven mines show a decrease. The largest individual increases are shown by Government Gold Mining, with 5,863 oz., and Van Ryn Deep, with 3,258 oz. increase. On the other hand, the largest decreases are shown by Modder B, with 1,595 oz., and Crown Mines, with 1,203 oz. decrease, as compared with July. The native labor returns show a total of 184,661 natives employed during August on gold, coal, and diamond mines, this total being an increase of 1,728 as compared with July.

A Board of Trade and Industries has been appointed for a period of three years, and Sir [illegible] is chairman.

Rand Makes Rock-Drill Tests

Johannesburg, Sept. 6—I referred to rock-drill tests briefly a few weeks ago in summarizing the presidential address of R. G. Atkinson to the South African Institution of Engineers. A fuller report of this portion of the address has now been published in *The South African Mining and Engineering Journal* of Aug. 21. In September, 1919, investigations were started with a view to finding out the relative merits of the various patterns of rock drills and to collect data relating to the drill steel in use on the mines.

The field of investigation included [illegible], systems in vogue for bringing drills in for repair, testing for efficiency after repair, systems of resharpening drill steel; methods of shanking and tempering; tests with solid and hollow steel; amount of dust created by different drills and steels; relative merits of water attachments for reciprocating machines, and considerations affecting the breaking of ground generally.

Preliminary engineers soon showed that there existed considerable divergence of opinion regarding the most efficient pattern of rock drill and the most economical size of hole. It is generally known that about 70 per cent of the working expenses of a mine are incurred underground; but it is not always realized that the operation of drilling holes involves a greater expenditure than any other individual operation on the mine, either underground or surface. The costs on one of the mines in the central area of the Rand showed: Rock-drilling (excluding blasting) 20 per cent of total working costs; shoveling and tramming, 15 per cent; winding, 10 per cent; pumping, 3 per cent; total reduction costs, 14 per cent of total working costs. One factor which accounts for the high cost of machine rock drilling is the fact that only about three and a half hours (out of the twenty-four) are available for drilling and the machine is actually in operation only about two hours. In some cases a reorganization of the underground shifts has been suggested by the management and opposition was encountered from the advisers of the very men for whose benefit the change was suggested. The industry has thus been handicapped, working costs remain high, tending to close low-grade mines to the detriment of mine workers themselves and of the trading community at large. At the outset of these investigations it was recognized that their magnitude was so great that no one man, or even a number of mining men, could deal (in their spare time) with the records and trials. A strong and representative committee was formed, embracing consulting mining engineers, mine managers, and mechanical engineers, who met frequently in committee and also at the working face underground.

The machines underground were operated under the constant supervision of some one who could be relied upon to conduct the tests without prejudice, and who had the necessary training for experimental work, so that each machine could be operated under parallel conditions. The mining man appointed for this work was trained at the Royal School of Mines, London, and has had considerable and varied underground experience, both practical and in an official capacity. The [illegible] was assisted by observers from the Miners' Training Schools, (one to each machine), who recorded detailed observations continuously throughout the shift, together with the usual complement of "machine boys" (native operators) and drill carriers. The actual results of these trials will be given in detail at a later date, but the present brief sketch may show what is being done and the cost of these trials, in the hope that the average mine worker might be brought to realize that heavy extraordinary expenditure is continually being incurred—necessitating capital—in order to determine the cheapest methods and also to improve the conditions for the operator.

CANADA

Toronto

Allied Porcupine-La Palme Porcupine Agreement Reached

The disagreement between the Allied Porcupine Gold Mines, Ltd., and the La Palme Porcupine Mines, Ltd., referred to in our issue of Sept. 10, and the misunderstanding that arose between the companies, has been satisfactorily arranged. The amalgamation planned is being carried through.

British Columbia

Silver-Lead Mining Improving

Cranbrook—Nickel possibilities of this district have been recently investigated by outside capital.

Cleaning up is under way at the placer property of Wild Horse Creek Placer Gold Mining Co., Perry Creek, and upon completion operations will suspend for the season.

Kimberley—A considerable number of the men employed by the Consolidated Mining & Smelting Co. at the Sullivan mine have been laid off.

Ainsworth—Leasing activity is increasing slightly here, with G. McPherson and Jack Sherman appearing as new lessees at the Silver Hoard, and T. Hawes and Amil Peterson have secured a block of ground at the Consolidated's No. 1 property. W. E. Zwicky and R. Foulkes, of Kaslo, have begun leasing operations at the Krao, owned largely by Butte interests, and which produced several shipments of high-grade silver ore last season.

Nelson—Improvement in the "foreign" price of silver and the likelihood of improved smelter settlements on the part of the Consolidated Mining & Smelting Co.'s Trail plant have combined, along with some reduction in operating costs, materially to better the outlook for silver-lead mining operations throughout East and West Kootenay generally. Prospectors have made several promising strikes during the season and it is generally felt that the worst of the depression [illegible] has been passed.

Alice Arm—A rich strike of high-grade values in gold, silver, and copper has been made recently by John Hauber and William [illegible] on the Cascade Falls group of claims in the vicinity of [illegible] glacier. A [illegible] ledge has been traced for the full length of two claims.

Stewart—[illegible] for the road to the [illegible] property, with other outside work and camp construction, is well in hand.

Development on the [illegible] [illegible] Creek, during the last season, was [illegible] as low grade milling ore.

ARIZONA

Sulphur Dioxide Ore Treatments Encouraging

Tucson—Tests completed in the University of Arizona laboratories are reported to have demonstrated the success of the sulphur-dioxide leaching process on mixed ores from the Miami district. The Inspiration company, at Miami, has been conducting exhaustive experiments looking toward betterment of the methods by which the semi-carbonate ores are handled that now so materially reduce extraction.

From Cananea word has been received of the employment of a force of men for work in connection with the property's rehabilitation, putting the several mines in condition for operation in the event of the expected resumption of the copper industry. A number of the mines are understood to need unwatering, and much repair work will have to be done.

Percy Williams, manager of the Tiro Lease, at Silver Bell, has returned from New York and states that he expects early resumption of work on the property. Production costs are low.

Calumet & Arizona is reported to have purchased ten mining claims in Steeple Rock district, just across the New Mexican line, southeast of Clifton. The property embraces the Ballalli and Norman King groups, both gold-silver producers. Near Lordsburg, to the southward, the C. & A. operated the 85 group of copper mines, managed by Karl H. Mohler.

Near Patagonia, the Montana Development Co. has started on development of silver, lead, and zinc mines. John Hoy, of Nogales, is in immediate charge. Charles J. Vopicka and Mrs. Jennie H. Strong, both of Chicago, are interested in the company.

A business men's organization has been established in Globe, to combat alleged rank discriminations in freight rates in the Southwest. It is said that Montana, which is even more remote from San Francisco than Arizona, enjoys much more favorable freight tariffs than this state. An instance is bar iron, from Kansas City, which takes a rate of $3.78½ per 100 lb. to Anaconda and $5.32 to Globe. Coast bullion rates also show discrimination.

William H. Reynolds, who is rated as the largest individual stockholder in the Copper Mountain Mines Co., has filed protest with the Arizona Corporation Commission against a petition offered by the officers of the company who wish to discharge the corporation's debts by a sale of 194,000 shares of treasury stock at 5c. a share, with possible exception of 60,000 shares. The property is near Mayer.

More Silver Mines Resuming

Tombstone—Regular shipments by the various lessees are going out from here to El Paso, and mining in general is picking up and will take on more life as soon as the two mills that are now idle resume milling. The Milgrim mill is idle, but will again start up as soon as it can get a larger engine. Burt Holland is adding a rod mill to his concentrator and will soon be turning out white metal from the Emerald dumps. The old Pueblo Leasing Co. is working three shifts in its mill and in the State of Maine mine, on which it has a lease. Several bars of bullion have been shipped to the mint.

The Tombstone Extension Mining Co. is hauling vanadium ore from its properties at the old town of Charleston to the concentrator formerly operated by the Co-operative Milling Co. and now operated by Mr. Stockham. The ore concentrates better than 25 per cent V_2O_5, with a goodly per cent of silver and lead. Others that own vanadium-bearing ores at Charleston are considering the advisability of hauling ore to the concentrator. The Tombstone Extension Mining Co. is a new concern, and J. B. Gallagher is its president. It is understood that the majority of the stock is held in San Antonio, Tex.

MONTANA

Moderate Activity Around Butte

Butte—The Butte & Superior drift on the copper orebody on the 2,200 level of the Black Rock mine is continuing. A program for the opening of this orebody on the 2,600 level has been mapped out.

Tuolumne Copper Co.'s west drift is showing improved ore, with the silver content holding up to 12 oz. and the copper up to 2¾ per cent. The promise is such now as to warrant the belief that a large body of ore of a shipping grade is near.

Anaconda is doing a moderate amount of development work. Chief feature of interest in connection with the affairs of this company is the production of a copper-zinc shingle, the size of which has been enlarged to six ft. Work is being pushed at its phosphate deposits near Soda Springs, Idaho, where 200 men are employed.

East Butte Mining Co. is preparing to resume operations at its gold property near Elkhorn, Mont., where it has a cyanide mill. The company has an extensive deposit of iron ore, which carries up to $8 in gold values.

North Butte has a good showing of high-grade ore on its 3,600 level of the Edith May vein.

Deer Lodge—The concentrating plant of the Emery Mining Co. will resume operations this week.

The Evening Star Co. is making regular shipments from the Big Dick mine, near Elliston, to the A., S. & R. Co.'s East Helena plant.

Virginia City — The Old Channel Placer Mining Co. has been organized for the purpose of prospecting the Old Channel of Alder Gulch, the most famous placer gold producing district in the world, considering the area worked.

UTAH

Utah Copper Wins Tax Suit

The controversy between the Utah Copper Co. and Salt Lake County in regard to the assessment of the company's tailings dump as a part of the mine or as a personal property and assessable as such was decided by Judge Tillman D. Johnson in favor of the copper company, which held to the first-mentioned contention, i e. that the dump is a part of the mine and therefore not otherwise assessable than as mining property. In Utah mines are assessable according to three times the value of the net annual proceeds. Acting on the theory that the dump be considered as personal property apart from the mine, Salt Lake County assessed the dump, holding it to be assessable even though there were no net proceeds from it. This assessment the copper company contested.

A similar case is pending between the South Utah Mines and Beaver County, although in this case the positions taken by the mining company and the county are reversed. The South Utah Mines is contesting an assessment made according to the net proceeds, which would make the dump a part of the mine, and which was fixed by the state board of equalization, which took the sum of $120,547, net proceeds from a year's operation in 1918, when the dump was entirely worked out by a leasing company under agreement with the owners. The mining company, which for a number of years has not been working its mine, is contesting this assessment on the grounds that the property value could not possibly have been three times the profits received, that the dump was separate and apart from the mine itself, and that the method of assessing mining properties is in violation of the constitution. Judge Johnson, as mentioned above, holds the tailings dumps of mining properties are not separate properties. The additional issues, however, are of importance inasmuch as the method of reaching the valuation of mines for assessment is involved.

Bingham—The Utah Apex and the Utah Consolidated are at odds in the accounting for ore taken by the Utah Consolidated, from a ground, by court decision, awarded the Utah Apex, the Utah Consolidated presenting $650,000, and the Utah Apex claiming about $1,500,000. The Utah Apex obtained court permission to permit an audit of the Utah Consolidated books, and this it is claimed showed errors and discrepancies which brought the sum up to about $1,500,000. The accounting hearing began in the trial court on Aug. 22, and lasted until Aug. 27. The Utah Consolidated admitted errors and discrepancies, but maintained different charges objected to by the Utah Apex, and applied for an extension of time. The hearing did not take place until Sept. 29, when the court took the case under advisement.

Park City—Shipments for the week ended Oct. 7 amounted to 1,923 tons, as compared with 1,805 tons the week preceding. Silver King Coalition shipped 765 tons; Judge Allied companies, 720 tons; Ontario, 393; and New Quincy, 45.

The New Quincy has opened ore of shipping grade, and the find is regarded as promising. A shipment of thirty-two and a half tons of this ore, dry weight, brought $1,441 net returns. The Spiro tunnel, which has been driven over 14,000 ft. to prospect the Thaynes canyon ground and to make connections with the California Comstock ground, is approaching its objective. Some ore has been recently encountered in drifts from the tunnel.

Salt Lake—The Alta Tunnel & Transportation Co. has opened silver-lead ore of shipping grade. Stoping has been started, and a 5-ft. bed of ore followed upward about 40 ft. from the No. 3 raise. Fifty feet from the raise drifts will be driven each way to determine the lateral limits of the ore. Four teams and two trucks are hauling the ore down Big Cottonwood canyon.

Eureka—Tintic shipments for the week ended Oct. 7 amounted to 178 cars, as compared with 144 the week preceding. Shippers were: Tintic Standard, 63 cars; Chief Consolidated, 40; Iron Blossom, 13; Victoria, 12; Eagle & Blue Bell, 11; Iron King, 9; Dragon, 8; Centennial-Eureka, 6; Bullion Beck, 4; Colorado, 3; Swansea, 2; Gemini, 1; Mammoth, 1; Gold Chain, 1; Alaska, 1; Eureka Hill, 1; and Sunbeam, 1.

COLORADO

Hidden Treasure Mill Ready To Start

Ouray—The Hidden Treasure Mines Co., under E. R. Baur, has nearly completed its experimental mill and expects to be in operation within a few weeks. The mine has a quantity of silver ore developed, carrying lead and zinc. The mill will be started with crusher, rolls, tables, Huntington regrinders, and tables while the flotation apparatus is being assembled. Results from the experimental work will be the basis for more elaborate plant.

The Hardinge 5-ft. ball mill and Dorr Duplex Classifier for the Mountain Top Mining Co. have been delivered and are being put in place to effect the doubling of capacity planned. The scheme involves roughing table operation with additional flotation apparatus. The mine is in unusually good silver-lead ore and making a good production.

Golconda Mines Consolidated have completed their long crosscut in Hurricane Basin and have begun drifting on the vein, with a good showing of milling ore. Operations will continue until the end of the year and be suspended until next spring, the experience of the company during recent winters having shown it to be extremely difficult to continue operations through the winter at so high an altitude so far from the base of supplies at Lake City.

The Lucky Twenty Co. resumed operations the first of the month under [illegible] after a shutdown of nearly a year. The air compressor was started for the first time with the intention of driving a new crosscut to reach the main vein on the Guadaloupe mine under the old shoot.

Fred G. Farish, of the Metals Exploration Co., recently visited the camp and made several examinations, but the company is not now operating anywhere in the county, the Red Mountain Mines Co. being still shut down. Kirby Thomas, of New York, also visited the camp recently, and the old Wanakah is being examined by P. F. Welch, of Denver.

Ophir—The New Dominion property is being operated by Morgan & Chandler, lessees, and ore from development is being shipped to the smelter at Durango. The Carbonero mine is producing two or three cars of shipping ore per month. The American Frenchman and O'Brien properties are being developed by lessees, and payable orebodies have been opened.

CALIFORNIA

Gold Mining Activity Increasing

Gold mining in California continues to show improved interest. Sales of mining property and options on smaller properties are increasing in number. Machinery companies report more inquiries, especially in placer mining equipment. Minor discoveries are announced in local papers, indicating considerable small activity. Grass Valley, Sutter Creek, Jackson, and the Mother Lode, south of Angels, are back to a normal condition.

Sutter Creek—The Central Eureka reports increased production for the current month.

Keswick—Construction of the new wire-rope tramway of the Mountain Copper Co. is going ahead rapidly.

Dedrick—Machinery and other equipment of the Globe mine are being dismantled and shipped to Gold Hill, Nev., for use in the United Comstock Mines Co.'s new mill.

Redding—The old Gladstone mine, near French Gulch, is being rehabilitated. At Lewiston the new 7½-cu.ft. dredge under construction by the Gardella Dredging Co. is expected to be launched next week, when its equipment will be placed in position.

Downieville—The Gold Gravel mine, at Little Grass Valley, is reported to have struck rich gravel in a recently discovered channel.

Oroville—The Morington Mining Co., operating at Hartman's bar, on the Middle Fork of the Feather River, has closed operations for the winter.

NEVADA

Increased Interest in San Antone District

Virginia City—The [illegible] heading of the main [illegible] tunnel of the United Comstock Mines Co. [illegible] connection to the K[illegible] [illegible] on Oct. 4. The [illegible] tunnel, when completed, will have a total length of approximately two miles, and to date the work is 85 per cent completed with only about 1,500 ft. to drive. It is estimated that the work will be completed by Jan. 1, 1922. Building operations on American Flat are progressing satisfactorily.

Mina—The [illegible] being constructed by Mineral County between Hawthorne and this district will be completed about Nov. 1, and the Simon Silver Lead Mining Co. will begin production at that time. The mill as constructed has a capacity of 200 tons per day, is of selective oil flotation type, making two concentrates, one lead-silver and the other zinc. The lead-silver concentrate will be shipped to Salt Lake smelters and the zinc concentrate to the company smelter at Harbor City, Cal., and manufactured into zinc oxide.

San Antone—The Hudson Mining & Milling Co., twenty-eight miles north of Tonopah, in the San Antone mining district, is about to resume operations. Prominent Tonopah and Salt Lake men are interested in the company and former differences between stockholders have been satisfactorily settled by reorganization. Past production is about $40,000 in gold and silver, with a little lead. Development consists of several shafts, the deepest of which is an incline 300 ft. deep. This shaft is to be sunk to a depth of 600 ft. In addition to company work leases are being granted.

Tonopah—Recent bullion shipments from Tonopah, representing clean-up of operations for the last two weeks of September, are as follows: Tonopah Belmont, $150,000; West End, $65,000; Tonopah Mining, $50,000; Tonopah Extension, $47,000; and MacNamara, $26,000. This is at the rate of over $650,000 per month, which is normal and shows the healthy condition of the industry in this locality. All mines are working at capacity, and labor conditions are good. Developments are as usual and about keeping pace with ore production. Operating profit reported by the Tonopah Extension for August was $17,526; the net profit of the Tonopah Belmont for the same period was $52,320, and for the West End $[illegible].

MICHIGAN

The Copper Country

Coal-Pulverizing Plant at Michigan Smelter Giving Good Results—Possibilities of Peat—Copper As a Roofing Material

Houghton—The [illegible] smelter, which treats [illegible] and Wolverine [illegible], has effected a [illegible] by means of its coal-pulverizing plant. It has been in operation [illegible] working [illegible] and [illegible], the results [illegible]. It has [illegible] about two [illegible]. The coal is [illegible] and automatically [illegible] the company [illegible] a [illegible] mineral, it now requires only 525 lb. The plant was built at a cost of $150,000, but will pay for itself in three years' time.

A possibility exists that some day powdered peat will be used as fuel in furnaces in place of coal. There are immense peat beds only a few miles from Houghton, which are about to be developed. One of the first experiments will be with powdered peat as fuel. It is probable that a test will be conducted at one of the local smelters to compare the relative efficiency of coal and peat for furnace purposes. The peat deposit has been declared to be almost inexhaustible, and preliminary tests have already established the possibilities of the product as a fuel.

Much interest has been taken here in the announcement that the Anaconda company has entered upon the manufacture of copper shingles. The belief is expressed that in an extension of the uses of copper the greatest possible outlet for the metal is for roofing purposes.

A Copper Country man just back from Germany reports that roofs in that country were quite generally stripped of copper during the war, and that eventually the metal taken from government buildings in all cities and towns will be replaced. Much copper will be required for this purpose alone in Germany, but it will not be purchased until Germany's finances are on a better basis. For a great many years the Germans have been partial to copper roofs, having found copper the best and cheapest material in the long run.

In connection with the wearing qualities of copper for roofing, it is interesting to note that the Houghton County courthouse, built in 1886, has a copper roof which has required no repairs and is as good as the day it was put on; the tower of the town and fire hall of Houghton was covered with copper in 1883, and no repairs have been necessary to date, a period of thirty-eight years.

There is no change in developments in Mayflower-Old Colony. The main south drift for practically its entire length of 300 ft. from the crosscut at the 1,700 level is still in commercial ground. This opening holds out a greater promise than any other developed in the property to date. No faulting is in evidence and apparently the best values will continue to be found in this direction. The drift to the west from the 1,700 is continuing, but the values are negligible, and it is probable this work will be suspended soon, and that exploration will be started with two drills on the 1,400 level.

Early delivery of a hoist for No. 2 Gratiot shaft of the Seneca is anticipated. It is expected it will be in operation before winter sets in. This shaft is to be sunk to a depth of 4,000 ft. and then connected with the Seneca shaft. All openings in Seneca continue in good ground

MINNESOTA

I. C. C. Rate Case Postponed

The iron-ore rate case now pending before the Interstate Commerce Commission, known as the Adriatic Mining case, was to have come up in Chicago on Oct. 10, but has been postponed until some date in December.

Duluth—The anticipation of the earlier season that Lake shipments of iron ore would be concluded by Nov. 1 will not be realized. The ore has not been moved from either mines or docks as rapidly as had been expected, owing to the congestion of storage areas at the lower Lake ports. As certain of the consumers have tonnage and grade requirements which must be supplied before shipping season closes, it is probable that final cargoes may not leave the docks until Nov. 15. The ore-carrying railroads always desire an early wind-up of the shipping, owing to the expense of thawing frozen ore.

Shipments from all Lake Superior docks for the season up to Oct. 1 amounted to only 18,661,194 tons, compared with 44,273,356 tons on the same date last year, a decrease of 57.85 per cent. The total season's shipments will not reach 25,000,000 tons.

Buhl—The lease on the Woodbridge mine, formerly operated by the Fort Henry Mining Co., has been given up, and all equipment will be dismantled and moved to other operating properties. The houses were sold to individuals who intend to move them elsewhere.

The controversy relative to the payment of taxes between the village of Chisholm and three of the operating mining companies within the village limits—namely, the Shenango Furnace Co., the Hanna Ore Mining Co., and the Oliver Iron Mining Co.—has virtually been settled. The settlement is to be made on a basis which was advocated by the business men of the village several months ago, and which was acceptable to the mining companies, for the sum of $600,000.

Menominee Range

More Companies Resuming Operations

Crystal Falls—The McKinney Steel Co. has resumed operations at the Tobin and Odgers mines, idle since last spring. Over 300 men are now employed at the two properties on a two-shift basis. Practically all employees who were working at the mines when they were shut down have been given places. Hoisting will be done through the old Odgers shaft until the new shaft, which is nearly finished, is completed. These are the first mines on the range to resume work, but it is thought that some others that have little ore in stock will be reopened at an early date. The Balkan Mining Co. is shipping from stockpile from the Balkan and Judson mines. About 200,000 tons will be moved, of which amount 50,000 tons will be from pocket. The new 1,000-gal. Aldrich duplex pump is now in operation.

MISSOURI AND OKLAHOMA

Advance in Metal Prices Stimulates Mining

Joplin, Mo.—With lead ore strong at $60 a ton and zinc showing a tendency to advance toward $25, there is talk of a revival of mining operations in the Missouri section of the Tri-State field, particularly in the vicinity of Duenweg and Joplin. It is an admitted fact that there are innumerable untouched deposits in and around Joplin and Duenweg, as well as at Webb City and Carterville. At $60 a ton, and with the present price of labor and supplies, lead can be mined profitably. In a large number of cases, however, the mining operations now being considered would be carried on by practical miners, working for themselves. It is believed that the situation marks a revival of the once popular practice of "grub-staking." There are many miners in the field who are not steadily at work at other employment, who would be glad to turn to "gouging" for lead, and with prices even as they are now, there will be people ready to back them with money.

West Plains, Mo.—The consolidation of the Missouri Iron & Steel Corporation and the St. Louis Iron & Steel Co. is said to involve an important development. The officers of the company gave it out that it means the blowing in of the big blast furnace at Haigart, ten miles southeast of West Plains, at an early date. Coke will be used as fuel to blow in the furnace and later on will be supplanted with charcoal to be made from timber found in near-by forests. The consolidation of the two companies adds 5,500 acres of ore and timber land to the company's holdings. This land is in Wayne County. It gives the company a visible ore supply of 15,000,000 tons. This is enough to operate several blast furnaces for many years. St. Louis will be the headquarters of the consolidated company, to be known as the Consolidated Iron & Steel Corporation. The officers of the company plan to make St. Louis a rival of Pittsburgh in the iron and steel industry, and predict that within five to ten years St. Louis will have the supremacy over the Pennsylvania industry.

Picher, Okla.—Construction has been started on the new mill of the Commerce Mining & Royalty Co., which is located just to the northeast of the Vinegar Hill Barr mine, north of Picher. It is understood that preliminary development of this property has shown it to be rich in minerals and probably a worthy rival of the Barr mine and the Blue Mound and Webster properties on the other side of the road. The new mill will be at the foot of the big hill known as the Blue Mound. It is understood that it will not be started until the ore price situation has been considerably improved, but the recent upward trend is said to have caused the promoters of the mine to seriously consider beginning operations soon. Several mines have opened recently and the production of the field is steadily increasing.

THE MARKET REPORT

Daily Prices of Metals

Oct.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
13	12.75	26.875	27.25	4.70	4.45	4.65
14	12.75	26.875	27.25	4.70	4.45	4.65
15	12.75	27.125	27.50	4.70	4.45	4.65
17	12.75	27.625	28.00	4.70	4.45	4.675
18	12.75	27.625	28.00	4.70	4.45	4.675
19	12.75	27.625	28.00	4.70	4.45	4.675

*These prices correspond to the following quotations for copper delivered, for the entire week, 13c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets reduced to the basis of New York, cash except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Oct.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
13	68¾	69⅞	75½	155⅞	157⅞	23⅝	23⅞	26¾	27
14	67¾	68⅝	74⅞	155¼	157⅛	23⅝	23⅞	26⅞	26⅞
15									
17	66⅞	67⅞	74	157⅞	159⅞	23⅝	23⅞	26¾	26⅞
18	65⅝	67	73	157¼	159⅛	23⅝	23⅞	26¾	26⅞
19	66⅛	67¼	73	156⅞	159	23⅜	23⅝	26¼	26⅝

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver			Oct.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
13	384½	99⅝	73⅛	42⅜	17	391	99⅝	73⅜	42¼
14	385⅛	99⅝	72⅞	42⅛	18	392	99⅝	70¾	40¾
15	388¼	99⅝	73	42⅛	19	390¼	99⅝	69½	39¾

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, Oct. 19, 1921

The metal markets have been extremely quiet since news of the threatened railroad strike was given out on Saturday afternoon. Buyers have been waiting to see if there was likelihood of their plants being closed for lack of transportation before contracting for further supplies. At this writing, probability of a strike is rather remote, and if it comes at all it is not likely to last long, in view of the number of unemployed, of the split in the union ranks, and of the temper of the public.

Ocean freight rates have again been reduced. They are now $4 per long ton to English ports, Hamburg, and Bremen, and $3.50 to Antwerp and Rotterdam. The $5 rate to Havre is so far unchanged. These rates are still about twice the pre-war figures, but represent a big drop from those which have existed in the last few years. Domestic freight tariffs on the railroads are likely to be reduced before the end of the year, though to what extent and in what manner is yet to be decided.

With this issue we are resuming the regular publication of the prices of many minerals and mineral products the quotations on which change only at rare intervals. It is planned to publish a complete list of quotations in the first issue of every month, and in the other issues prices of such commodities will be published only if changes occur. We are always glad to have subscribers submit information for use in determining these prices.

Copper

A good business was done on last Thursday, but since then the market has been exceedingly quiet. Producers are generally well sold up, however, and are showing no disposition to cut prices, holding at the 13c. delivered figure of last week. In fact, some producers are quoting even higher than this. Plenty of copper is obtainable at 13c., even for delivery as late as December. Some consumers, quickly sensing the decreased demand, have been endeavoring to contract for future supplies at reduced prices, but have had little success. Trading at 12⅞c. might be done on particularly desirable business for near-by delivery, but the price is not a general one.

Foreign demand has quieted down at the same time, and in the last three days practically no business has been done either by the Copper Export Association or outside interests. However, at least one order was placed in Germany, despite financial conditions in that country. Export copper has generally netted domestic producers not far from 13c. New York.

Lead

The American Smelting & Refining Co.'s official contract price of 4.70c. continues unchanged. New York sales have been in fair volume, and one or two good orders have been placed even since Monday. A tendency is discernible to cut prices slightly in some quarters, but the movement seems to have been started by consumers rather than by producers anxious to dispose of the metal, and it would be extremely hard to find any lead under 4.70c., though rumors of 4.65 and 4.675c. are heard. The St. Louis market is quiet. We are discontinuing the range up to 4.50c. as quoted last week, for plenty of lead of the desired kinds seems to be available at 4.45c. However, this price is the bottom figure, as is the Chicago quotation at 4.50c. It does seem unlikely that any material change will take place in the price of lead during the remainder of the year.

Zinc

The activity in zinc has continued, with a good demand from all galvanizing interests, though the brass companies continue generally to be out of the market. [illegible] producers of zinc are willing to sell at present prices, and there is some small talk of a resumption of smelting at one or two of the Western plants. Production is now [illegible] tons a month, with [illegible] tons in excess of this figure. Stocks in England are reported to be small, and in time it may

be necessary to export some metal unless Continental production improves. A premium of 5 points per month is generally asked for forward delivery.

Tin

Sales were fairly numerous toward the end of last week, but in the last three days inquiries have fallen off. There is a scarcity of 99 per cent still, though supplies are in somewhat larger volume than at one time. The cessation of shipments of concentrates from South America should aid the disposal of the Far Eastern tin stocks. About two-thirds of the South American tin ores have been coming to this country, the rest going to England, but producers are not satisfied with present prices and are willing to wait for them to get higher.

Forward deliveries have been commanding premiums of one-quarter to one-half cent.

Arrivals of tin, in long tons: Oct. 6th, Straits, 75; 11th, Straits, 5; 13th, Straits, 15; 14th, Straits, 10; 17th, Rotterdam, 25; 18th, Liverpool, 35; London, 25; Straits, 200.

Gold

Gold in London: Oct. 13th, 107s. 2d.; 14th, 106s. 5d.; 17th, 105s. 4d.; 18th, 104s. 1d.; 19th, 105s. 7d.

Foreign Exchange

Continued strength in sterling and a further depression of German marks featured the week. On Tuesday, Oct. 18, francs were 7.165c.; lire, 3.885c.; and marks, 0.595c. New York funds in Montreal, 9⅞ per cent premium. Sterling cables continue to be quoted at one-half cent premium over demand as given on page 675.

Silver

The features in the silver market for the last week have been the sharp advance in sterling exchange from 384 to 392, and the sudden fall in the London quotation from 42½ to 39⅞d. The drop in the London price was caused by weakness in the China and India exchanges and by speculative selling in London. India is reported as selling silver to China.

Mexican Dollars—Oct. 13th, 56⅜; 14th, 56; 15th, 56¼; 17th, 56⅜; 18th, 54⅜; 19th, 53⅜.

Other Metals

Quotations cover wholesale lots unless otherwise specified.

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 17.50@18c. with practically no sales.

Antimony—Chinese and Japanese brands, 5@5.25c.; W. C. C. brand, 5.25@5.75c. per lb. Cookson's "C" grade, spot, 9c. per lb. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $3@$3.25 per lb.; black oxide, $2@$2.10 per lb. in bbls.

Iridium—Nominal, $150@$170 per oz.

Molybdenum Metal—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominal, $55@$60 per oz.

Platinum—$82 per oz.

Quicksilver—$39@$41 per flask. San Francisco wires $43.75.

The prices of the following metals remain unchanged from the figures published in these columns on Oct. 15: Rhodium, Selenium, Thallium, and Tungsten.

Metallic Ores

The market is generally exceedingly quiet, and prices on the following ores remain unchanged from the figures published in the Market Report in the Oct. 15 issue: Chrome, Iron, Magnetite, Manganese, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, Zircon, and Zirkite ores.

Zinc and Lead Ore Markets

Joplin, Mo., Oct. 15—Zinc blende, per ton, high, $26.50; basis 60 per cent zinc, premium, $25; Prime Western, $23.50@$25; fines and slimes, $23@$20; average settling price, all grades of blende, $23.07.

Lead, high, $64.50; basis 80 per cent lead, $60; average settling price, all grades of lead, $58.33 per ton.

Shipments for the week: Blende, 6,939; lead, 1,388 tons. Value, all ores the week, $241,220.

Sellers practically forced all weekend sales of blende on $25 basis, yet purchases exceeded 5,000 tons. Heavy purchases the previous three weeks enabled shipments to exceed production and materially reduce stocks. The resumption of operation of mills long idle, to meet the increased demand for lead at high prices, was more than offset in zinc production, it is claimed, by large mills that have closed. Latest surveys of production point to this condition, showing the production around 5,900 tons, with a nine-months' average of 6,300 tons per week.

Platteville, Wis., Oct. 15—Blende, basis 60 per cent zinc, $27@$29 per ton. Lead ore, basis 80 per cent lead, $60 per ton. Shipments for the week: Blende, 160; lead ore, 160 tons. Shipments for the year: Blende, 8,621; lead ore, 1,565 tons. Shipped during the week to separating plants, 457 tons blende and 168 tons sulphur ore.

Non-Metallic Minerals

Generally dull markets also exist for the non-metallic minerals, and there is no quotable change in the following from the prices published in our Oct. 15 issue: Asbestos, Barytes, Bauxite, Borax, Chalk, China Clay, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Kaolin, Limestone, Magnesite, Mica, Monazite, Phosphate Rock, Pumice Stone, Pyrites, Silica, Sulphur, Feldspar, and Talc.

Mineral Products

The prices of Arsenic, Sodium Nitrate, Sodium Sulphate, and Potassium Sulphate are unchanged from the quotations published in these columns Oct. 15.

Ferro-Alloys

No quotable changes have taken place in the following ferro-alloys from the prices quoted in the Oct. 15 issue: Ferrotitanium, Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotungsten, Ferro-Uranium, and Ferrovanadium.

Metal Products

Yellow Metal—Prices have been advanced 1c. Dimensions sheets, 17.25c. per lb.; sheathing, 16.25c.; and rods, ⅜ to 3 in., 14.25c.

Copper Sheets and Wire, Lead Sheets, Nickel Silver, and Zinc Sheets are unchanged from the quotations given in the Oct. 15 issue.

Refractories

Prices on the following are unchanged from the figures published in the Oct. 15 issue: Bauxite Brick, Chrome Cement, Chrome Brick, Fire Brick, Magnesite Brick, and Silica Brick.

The Iron Trade

Pittsburgh, Oct. 18, 1921

Steel ingot production is at a rate slightly above 35 per cent of capacity. The increase has been chiefly on the part of the Steel Corporation, which booked a fair amount of business in bars, shapes and plates before it advanced prices to 1.65c. for bars and 1.75c. for shapes and plates.

Most of the independent sheet mills have announced a $5 a ton advance, to 2.75c. for blue annealed sheets, 3.25c. for black and 4.25c. for galvanized.

The general tone of the finished steel market is hardly as good as a fortnight ago, as to current buying and as to prospects for increasing consumption in the next few weeks, but the tone as to prices is improving.

Railroad strike talk naturally has a depressing influence upon business sentiment, but it has not affected actual trade to a noticeable extent.

Pig Iron—The pig-iron market is extremely uncertain, one factor no doubt being the expectation of reduced freight rates, affecting both the cost of producing pig iron and the cost of moving it to consumer. Prices are not quotably changed: Bessemer, $20; basic, $19.25 to $20; foundry, $21, f.o.b. Valley furnaces. Freight to Pittsburgh is $1.96, against 90c. in 1914 and 75c. in 1901.

Coke

Connellsville—Furnace, $3.35@$3.50; foundry, $4.25@$4.75 per ton.

The Copper Situation From the Investment Standpoint

By Harry J. Wolf
Written for Engineering and Mining Journal

THOSE WHO ARE INTERESTED in buying and selling securities for their own account may be divided into eight or ten classes according to the particular attitude they assume in the security market. For ordinary purposes of investigation, buyers and sellers of bonds and stocks may be divided into four general classes, namely, 1, investors for income; 2, investors for profit; 3, traders; and 4, speculators. In this discussion we are interested in the first two classes only.

Investors for income are those who buy a security that is likely to have a stable market value for a reasonable period of time, and pay a regular dividend. In this case the regularity of the dividend is the chief consideration, and the investor does not concern himself over moderate fluctuations in the market price of his security, so long as the corporation is well established and represents an industry that is likely to experience average prosperity over a period of several years. All the investor for income demands is his interest at regular intervals, and his money back at some distant date when he may need his capital for other purposes, or when he is no longer convinced of the stability of his investment.

Investors for profit are those who buy securities of well-established corporations at a time when they believe these securities are selling at a relatively low price as compared to their average market price over a period of years or months, and the dividend on such security is a secondary consideration. Such an investor buys his security with the firm intention of selling it again whenever the corporation is in one of its more prosperous periods and the security has a market value above its average value over a period of years. The investor for profit expects to make much more out of the appreciation in market price than he expects to receive in the form of dividends.

In view of the fact that the term "investment" is usually associated with the payment of a dividend, it might seem at first thought to be inconsistent to review a list of the leading copper securities when all but three of the important copper-producing corporations have discontinued paying dividends. However, those who have a fair conception of the great copper-mining industry know that the temporary dividend policy of a corporation that is strong financially, and is in good physical condition, with many years of life ahead, and that is reasonably sure to resume its distribution of profits after it has passed through a period of unusual depression, should not be eliminated from the investment class, but only suspended.

There are [illegible] copper stocks listed on the New York Stock Exchange, as follows: Anaconda, Calumet & Arizona, Cerro de Pasco, Chile, Chino, Granby, Greene Cananea, Inspiration, Kennecott, Miami, Nevada, [illegible], Ray, [illegible], Shattuck, and Utah. Only two of these companies are paying dividends at present, Miami and Utah. The last company to pass its dividend was Cerro de Pasco. Many of the companies that are not paying dividends at present will be restored to the investment class in due time, for the physical condition of their property and their earning ability are well known. Some of these companies, on the other hand, are in a doubtful position with regard to their future earning ability, and others must be classified as speculations for the time being, and until they can establish a record as dividend payers.

The list of copper stocks on the Boston Exchange is a very long one, and it includes many famous producers. [illegible] of the Boston coppers paid dividends in [illegible], namely, Ahmeek, Calumet & Hecla, Copper Range, [illegible], Mohawk, New Cornelia, Osceola, Quincy, and Wolverine.

It is apparent that investors for income only would not be attracted by the copper stocks at this time. However, the investor for profit would find the copper list an interesting study, and his knowledge of conditions in the copper industry, and [illegible] individual [illegible] would [illegible] to find that many attractive opportunities for investment for profit are to be found in the copper list, in view of fundamental conditions surrounding the copper market. Such an investor may have good reason to believe that substantial copper stocks are ready to advance in price, because they will have a tendency to discount future prosperity, which is appearing on the horizon, and beyond this he realizes that many former dividend payers are certain to resume their customary distribution of profits in due time.

It is of interest to inquire into some of the fundamental reasons why the investor for profit should be attracted now by the leading copper securities. The conservative investor, who exercises care and discrimination in making his commitments, thinks as an engineer should think, and demands fundamental and logical reasons for every action that he takes. Some of the fundamental reasons why the copper situation is now interesting from the investment standpoint are as follows:

First. The unsold supply of refined copper in the United States, which has been one of the outstanding influences in the situation up to this time, is estimated at about 680,000,000 lb. This is substantially less than the supply at the time curtailment of production was initiated. It is probable that this estimate should be increased by secondary coppers and scrap material that may be available, and which might increase the total quantity of metal to as much as 1,000,000,000 lb. However, the fact remains that the unsold supply is beginning to decrease materially.

Second. The demand for copper now exceeds domestic production by about 30,000,000 lb. a month, and from now on this demand is more likely to increase than to decrease or remain stationary.

Third. If it be assumed that the unsold supply of copper under normal conditions is about 300,000,000 lb., the present excess supply of 380,000,000 lb. of refined copper would be absorbed in less than thirteen months.

Fourth. It requires approximately three months for copper to work its way from the producer to the refineries and into the market. Therefore, with a reduction in stock of 30,000,000 lb. per month, the unsold supply would be below normal at the end of thirteen months, unless normal production should be resumed three months earlier.

Fifth. American brass makers, who have been securing brass scrap from Europe until recently, are now entering the domestic copper market with substantial orders.

Sixth. Increase in building construction, which is likely to be accelerated in the near future on account of the deferred demand for buildings during the past few years, will be accompanied by increased consumption of copper.

Seventh. European demand for virgin copper for wire-drawing and sheet-rolling purposes will increase as available European stocks become depleted.

Eighth. As domestic business conditions improve, American consumers will discontinue buying from hand to mouth, and will enter the market with [illegible] market price of the metal.

Ninth. Increased demand for the metal during the last few weeks has hardened quotations, and many of the contracts for future delivery are [illegible] at slightly advanced prices.

Tenth. [illegible] the metal [illegible] during the last [illegible] without [illegible]

Eleventh. The [illegible]

store gradually the normal balance between demand and supply, and it is reasonable to suppose that this process may be accompanied by an increase in the market price of copper.

Twelfth. As the price of copper rises above the cost of production of the various producers, one at a time they will resume operations, earn profits, and resume the payment of dividends.

The experienced investor realizes that the resumption of profitable operations on the part of the leading producers of any commodity may be discounted by many months in the market price of the shares of the producing corporation. It may be that this discounting process is now under way with respect to the shares of the leading copper producers.

It would not be good engineering to consider only the favorable factors in a situation. It is necessary to consider the unfavorable influences. The disturbing element in the situation is the unsettled financial condition in Europe, which is likely to decrease in importance, however, as the domestic demand improves.

In reviewing the above situation from the investment standpoint, the unbiased investigator is led to believe that although there is the possibility of facing a temporary setback due to reaction from current prices, on account of unfavorable European influences or artificial share-market manipulation, there appears to be a greater likelihood of losing a chance to take advantage of gradually rising share prices corresponding to fundamental improvements in the industry, by delaying the serious consideration of the position of leading copper shares until the situation becomes apparent to the general public.

It is beyond the province of this discussion to offer any specific advice with regard to the purchase or sale of securities, but it is proper and fair to call attention to a very fascinating problem, and an industrial situation in the process of important transition.

Conditions in the Mining Industries

EDITORIAL MARKET STUDY*

CONDITIONS ARE IRREGULAR in the different mining industries, but on the whole are better than they were six months or a year ago.

Iron mining is abnormally depressed, the deflation in this industry having lagged behind that of the other metallic-mining industries such as copper, as has been characteristic for years. Lake Superior ore shipments fell off during September, and the total shipments up to Oct. 1 are less than half of those in 1920. A quiet winter is looked for in the iron districts.

The copper industry continues to suffer from the greatest depression it has experienced in many years; nevertheless, conditions are better than they were a year ago. Of the surplus copper stocks, 400,000,000 lb. have been financed by the issuance of bonds by the Copper Export Association, removing this weight from the shoulders of the producers. Most of the large copper mines have closed down in order to curtail production, which has been cut to the lowest figure in twenty-four years. There is a slightly increased demand for the metal, due to domestic buying, and the price has risen somewhat from its low of a few months ago. A beneficial result of the abnormal depression in copper has been to force the attention of producers to the science of merchandising, which is being taken up seriously under the Copper and Brass Research Association; and also to force a study of more economical methods of production.

Just as copper was absolutely deflated before the deflation process in iron and steel had even begun, it is to be expected that it will recover much earlier. The future depends largely upon general world conditions, and upon developments in Europe, especially in Germany, which must be able to absorb something like her pre-war importations of American copper before full production may safely be resumed. There is, however, remarkably little evidence of a serious condition of unemployment due to the idle copper camps, indicating that the miners have for the most part been temporarily absorbed by other activities.

The zinc-mining industry is so dependent on the iron and steel trade, on account of one of the chief uses for zinc being for galvanizing, that a return to prosperous times is not very likely to precede by much the improvement in the latter, which, as above stated, is not expected immediately. Nevertheless, the price of the metal showed an upward trend in September, due to heavier buying, and there are indications of a somewhat better permanent position. Like the copper producers, the zinc producers have been driven to a study of the science of merchandising the metal, and through the Zinc Institute, an association of producers, are trying to find new uses for zinc. Meanwhile, the zinc-mining districts are very dull.

Largely due to its constant demand for paint, lead has never been depressed as much as the other metals. Lead-silver ores have benefited by the prosperous condition of the American silver-mining industry. The silver producers have enjoyed immunity from the industrial depression, for their product has been pegged at a dollar an ounce by the Pittman Act, while the world market for silver slumped as low as 52⅝c. in March, 1921, and now stands around 73c. This support will last some years longer. The Pittman Act, passed during the war, provided for the purchase for the Treasury reserve of American silver till 207,000,000 oz. had been accumulated, to take the place of the same amount borrowed by England to take over a sudden crisis in India, and paid for at the same figure (one dollar) now being paid the mines. This has equalized the silver-mining industry and kept it prosperous.

Compared with a year ago, the gold-mining industry is much better off, and is certain to see increasingly favorable conditions. Gold is, of course, permanently pegged at $20.67 per ounce, and just as high supply and labor costs nearly prostrated the industry during the war and post-war period, the period of deflation and falling prices spells increasing prosperity to it, regardless of business depression, as the marketing factor does not enter into gold mining. Many of the large gold mines are now running again at full capacity.

The non-metallic mining industries, such as those of talc, magnesite, graphite, mica, fuller's earth, barytes, fluorspar, gypsum, and feldspar, go largely into manufactured products and, therefore, have suffered with the depression of manufacturing in general. These industries had an abnormal prosperity during the war. In general, they have never been organized on an efficient, competitive basis, and, therefore, can ill stand the competition resulting from the post-war resumption of importation. Besides being handicapped, in common with other industries, by high freight rates, they have the disadvantage of putting out in many cases unstandardized or poorly standardized products, and in not having worked out the science of merchandizing and of proper utilization.

In general, the mining industries, except iron, seem to have recovered from the greatest depression, and to be started upon the slow climb upward.

COMPARATIVE PRICES OF THE METALS

	Average 1909-1913	Average 1919	Average 1920	Low 1921	Oct. 19, 1921
Copper, per lb.	13.94c.	18.69c.	17.46c.	11.43 (Aug. 23)	12.75c.
Lead, New York, per lb.	4.40c.	5.76c.	7.96c.	3.75 (Feb. 26)	4.70c.
Zinc, St. Louis, per lb.	5.73c.	6.99c.	7.67c.	4.125 (Aug. 27)	4.68c.
Pig iron, Pittsburgh, per ton, (a)	$14.40	$29.26	$43.85	$18.20 (Aug.)	$19.50
Silver, per ounce	$0.554	$1.111	$1.009	$0.526 (Mar. 5)	$69.25

(a) Basic.

---

*Contributed by *Engineering and Mining Journal* to the Symposium on Industrial Conditions at the National Conference of Business Paper Editors, in Chicago, on Oct. 21.

COMPANY REPORTS

Chile Copper's Deficit Increases

A statement showing results of operations of Chile Exploration Co. for the second quarter of the year 1921 shows that 335,871 tons of ore, averaging 1.75 per cent copper, was treated, and in the preceding quarter 581,644 tons, averaging 1.64 per cent, yielding 12,001,873 lb. and 18,006,774 lb. respectively.

The cost of copper produced during the quarter was 11.971c. per lb., including selling and delivery expense, but excluding depreciation and Federal taxes and with no credit for miscellaneous income, compared with 11.012c. per lb. for the previous quarter.

The financial outcome of the Chile Copper Co. and Chile Exploration Co., combined (earnings being based on copper actually delivered), shows for the quarter ended June 30, as compared with the preceding quarter, as follows:

	Second Quarter 1921	First Quarter 1921
Pounds copper delivered	13,878,412	15,070,157
Net profit on copper delivered	$291,667.31	$283,768.18
Miscellaneous income	8,827.58	24,691.75
Interest on time notes and bank balances	122,883.19	181,845.99
Total income	$423,378.08	$490,305.92
Depreciation	$697,249.54	$696,058.99
Amortized discount on fifteen-year 6 per cent convertible bonds	35,000.00	35,000.00
Accrued bond interest of Chile Copper Co.	787,500.00	787,500.00
Expenses of Chile Copper Co.	13,661.92	8,035.44
Total charges	$1,533,411.46	$1,526,594.43
Balance undivided profits for quarter, both companies	$1,110,033.38(a)	$1,036,288.51(a)
(a) Loss		

It will be noted that of the above loss of $1,110,033.38, the sum of $697,249.54 is for depreciation, which is a book entry and is computed on a time basis, regardless of production or sale.

On Sept. 1 the companies had $8,813,000, representing cash on hand and marketable securities, after setting aside $1,921,000 to complete payment of purchase price of the two tank ships mentioned in the last annual report of the company.

Davis-Daly Copper

A report of operations of Davis-Daly Copper Co. for the three months ended June 30, 1921, states that the company has been one of the few copper-mining companies to be in operation, due, fortunately, to the silver values contained in the ore. Practically all work at the property not immediately essential has been discontinued and the organization reduced to what seems to be the minimum practicable for single-shift operation. Sunday operation has been discontinued and hoisting of ore is confined to six days a week. The results obtained, however, were satisfactory. The grade of ore was a little below the average.

Production at the Hibernia has been quite active, and early in June the sinking of the shaft to the 750 level was started, which will determine the values at this depth.

Tonnage hoisted at the Colorado mine, including Hibernia mine, for the quarter amounted to [illegible] tons, producing [illegible] lb. of copper and 417,00[illegible] oz. of silver. The average assay of ore shipped from the Colorado was 5.44 per cent copper and [illegible] oz. of silver to the ton and from the Hibernia 26.41 oz. of silver to the ton.

Receipts from ore returns were $[illegible]; from miscellaneous revenue, $[illegible]; total receipts, $[illegible]. Disbursements were: Development, $[illegible], mining cost, $[illegible], equipment $[illegible]; Butte general expense, $[illegible]; Boston expense, $[illegible] (including United States income and capital stock taxes). Total disbursements totaled $171,601.[illegible].

Tonopah Belmont Development Co.

A condensed statement of operations of Tonopah Belmont Development Co. for quarter ended June 30, 1921, follows:

Received and receivable for ore	$[illegible]
Mining, milling and administration expense	[illegible]
Net earnings for three months	$31,135.43
Miscellaneous income	1,4[illegible]
Total net income for three months ended June 30, 1921	$[illegible]
AVAILABLE RESOURCES, JUNE 30, 1921	
Due from smelter	$[illegible]
Due from others	[illegible]
Cash in banks	[illegible]
U. S. Government certificates of indebtedness	[illegible]012.70
	$[illegible]

The net loss for the quarter ended June 30, 1921, of the Belmont Surf Inlet Mines, Ltd., of which this company owns 80 per cent, was $12,649.27.

American Smelting & Refining Co. Shows Deficit

A report of operations of the American Smelting & Refining Co. for six months ended June 30, 1921, states that a net deficit of $1,100,297.54 was incurred after the payment of dividends on the preferred stocks. A consolidated profit-and-loss account of the A. S. & R. Co. and the American Smelters Securities Co. follows:

	Six Months Ended June 30, 1921	Six Months Ended [illegible]
Net earnings of smelting and refining plants and industries immediately dependent thereon	$2,494,[illegible]	$[illegible]
Net earnings from mining properties	(a) 77,[illegible]	[illegible]
Net earnings of operating properties	$2,417,[illegible]	$[illegible]
Other income net:		
Interest, rents, dividends received and commissions	[illegible]	[illegible]
Net earnings before deducting administrative expenses and corporate taxes	$2,448,[illegible]	$[illegible]
Deduct:		
Administrative expenses	[illegible]	[illegible]
Research and examination expenses	[illegible]	[illegible]
Corporate taxes	[illegible]	[illegible]
	$[illegible]	$[illegible]
Net income from current operations before providing for bond interest, depreciation, obsolescence and depletion and after providing for war taxes	[illegible]	$[illegible]
Less:		
Interest on A. S. & R. Co. 5 per cent [illegible] bonds outstanding	[illegible]	[illegible]
Interest on [illegible] Coal & Coke Co. [illegible] bonds outstanding	[illegible]	[illegible]
Profit-and-loss adjustments	96,700.88	819,555.94
	$[illegible]	$[illegible]
Balance before deducting depreciation and depletion	[illegible]	[illegible]
Depreciation	[illegible]	$[illegible]
[illegible]	[illegible]	[illegible]
Total	[illegible]	$[illegible]
[illegible]	[illegible]	$[illegible]
Dividends:		
On preferred stocks:		
A. S. & R. Co.	[illegible]	[illegible]
American Smelters Securities Co. [illegible]	[illegible]	[illegible]
American Smelters Securities Co. [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	$[illegible]
[illegible]		[illegible]
[illegible]	[illegible]	$[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	$[illegible]
(a) Loss		

MINING STOCKS

Week Ended October 15, 1921

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Ahmeek	Boston	53	53	53	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*42	*38	40		
Allouez	Boston	21	20	20½	Mar. '19	1.00
Anaconda	New York	40¼	39	39½	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2¼	1¾	2¼		
Ariz. Com'l.	Boston	9¼	9	9	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*34	*26	*30		
Bingham Mines	Boston	13½	13	13½	Sept. '19, Q	.25
Calumet & Arizona	Boston			45½	Sept. '21 Q	.50
Calumet & Hecla	Boston	245	240	245	June '20, Q	5.00
Canada Copper	N. Y. Curb	*35	*28	32		
Centennial	Boston	9	9	9	Dec. '18, SA	1.00
Cerro de Pasco	New York	30¼	29¼	29¾	Mar. '21, Q	.50
Chile Copper	New York	12¼	11¼	11¼		
Chino	New York	26	24½	24¼	Sept. '20, Q	37½
Columbus Rexall	Salt Lake	*16	*16	16		
Con. Arizona	N. Y. Curb	....		*1	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1⅛	1⅛	1⅛		
Copper Range	Boston	35¼	34¼	34½	Sept. '20, Q	50
Crystal Copper	Boston Curb	*26	21	24		
Davis-Daly	Boston	7¼	7	7	Mar. '20, Q	.25
East Butte	Boston	9½	9½	9½	Dec. '19, A	.50
First National	Boston Curb	*85	*80	*80	Feb. '19, SA	.15
Franklin	Boston	2¼	2¼	2¼		
Gadsden Copper	Boston Curb			45		
Granby Consol.	New York	21½	20½	20⅝	May '19, Q	1.25
Greene-Cananea	New York	22¼	21½	21½	Nov. '20, Q	.50
Hancock	Boston	2¼	2¼	2¼		
Howe Sound	N. Y. Curb	2⅜	2¼	2⅜	Jan. '21, Q	.05
Inspiration Consol.	New York	35¾	34	34½	Oct. '20, Q	1.00
Iron Cap	Boston Curb	5¾	5¼	5¼	Sept. '20, K	25
Isle Royale	Boston	21	21	21	Sept. '19, SA	.50
Kennecott	New York	22½	21¼	21⅝	Dec. '20, Q	.50
Keweenaw	Boston	1	1	1		
Lake Copper	Boston	†3	†2¼	2¼		
La Salle	Boston	1½	1½	1½		
Magma Chief	N. Y. Curb			8		
Magma Copper	N. Y. Curb	*22½	*22¼	*22½	Jan. '19, Q	.50
Majestic	Boston Curb	†*7	†*6	*6		
Mason Valley	Boston	†2	†1¾	1¾		
Mass Consolidated	Boston	2½	2¼	2½	Nov. '17, Q	1.00
Miami Copper	New York	23¼	22½	22¼	Aug. '21, Q	.50
Michigan	Boston	†2½	†2½	2¼		
Mohawk	Boston	54	53	53	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	6	4¾	5¼		
Nevada Consol.	New York	12	11½	11¾	Sept. '21, Q	.25
New Baltic	Boston Curb			3		
New Cornelia	Boston	15	14¼	14¼	Aug. '20, K	25
North Butte	Boston	11½	10¼	10¾	Oct. '18, Q	.25
North Lake	Boston	†*50	†*25	*30		
Ohio Copper	N. Y. Curb			*6		
Old Dominion	Boston	24	23¼	23½	Dec. '18, Q	1.00
Osceola	Boston	31	28	28½	June '20, Q	.50
Phelps Dodge	Open Mar.	†165	155	....	Oct. '21, Q	1.00
Quincy	Boston	40	39	39	Mar. '20, Q	1.00
Ray Consolidated	New York	13¾	13¼	13½	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*24	*20	21		
St. Mary's Min. Ld.	Boston	37	37	37	June '20, K	2.00
Seneca Copper	Boston			11¾		
Shannon	Boston	†1½	†1¼	1½	Nov. '17, Q	.25
Shattuck Arizona	New York	6¾	6	6¼	Jan. '20, Q	25
South Lake	Boston	†1	†*50	1		
Superior & Boston	Boston	2	1½	1½		
Tenn. C. & C. cfs.	New York	8	7½	8	May '18, I	1.00
Tuolumne	Boston	*45	40	40	May '13	.10
United Verde Ex.	Boston Curb	27½	26¼	27	[illegible] '21, Q	25
Utah Consol.	Boston	†3¼	†3	3	Sept. '18,	25
Utah Copper	New York	53¼	51½	51¾	June '21 Q	.50
Utah Metal & T.	Boston	1½	1½	1½	Dec. '17,	.30
Victoria	Boston	1½	1	1½		
Winona	Boston	*60	*50	*50		
Wolverine	Boston	11¼	11	11		
NICKEL-COPPER						
Internat. Nickel	New York	14¼	13	13½	Mar. '19,	50
Internat. Nickel, pf.	New York	75	74½	74	Aug. '21, Q	1.50
LEAD						
National Lead	New York	76	75	76	Sept. '21, Q	1.50
National Lead, pfd.	New York	103	102	102	Sept. '21 Q	1.75
St. Joseph Lead	New York	12½	12	12¼	Sept. '21, Q	25
QUICKSILVER						
New Idria	Boston	†*60		*50		
ZINC						
Am. Z. L. & S.	New York			11	May '20	1.00
Am. Z. L. & S. pfd.	New York	33½	33	33	Nov. '20, Q	1.50
Butte C. & Z.	New York	4¼	4	4¼	June '18	50
Butte & Super.	New York	15¼	14	14¾	Sept. '20	1.25
Callahan Zn-Ld	New York	4		4	June '20, Q	50
New Jersey Zn.	N. Y. Curb	130	122	126	Aug. '21 Q	2.00
Success	N. Y. Curb			2	[illegible] '16	03
Yellow Pine	Los Angeles			55	Sept. '20, Q	03

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Colorado Springs, The [illegible] N. Y.

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	New York	½	½	½		
Alaska Juneau	New York	[illegible]	[illegible]	[illegible]		
Carson Hill	Boston	14½	13¼	13½		
Cresson Consol. G.	N. Y. Curb			1 9/16	June '20, Q	$0.10
Dome Extension	Toronto	*68				
Dome Mines	New York	18	18½	18½	July '21, Q	.25
Florence Goldfield	N.Y. Curb	*48	*40	*46		
Golden Cycle	Colo. Springs	*58	*57½	*57½	June '21, Q	.02
Goldfield Consol.	N. Y. Curb			*3	Dec. '19,	.05
Hollinger Consol.	Toronto	7.48	7.30	7.35	Oct., '21, 4 wks.	.05
Homestake Mining	New York	56	56	56	Sept. '21, M	.25
Kirkland Lake	Toronto	*37	35	37		
Lake Shore	Toronto	1.28	1.20	1.25	Aug. '21, K	.02
McIntyre-Porcupine	Toronto	1.94	1.92	1.93	Sept. '21, K	.05
Porcupine Crown	Toronto	*16	13½	14	July '17,	.03
Porcupine V. N. T.	Toronto	*19	*17	*18½		
Portland	Colo. Springs	*38	*38	*38	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb			4	May '19,	.05
Schumacher	Toronto	*26	*22	*26		
Silver Pick	N. Y. Curb	*8	*8	*8		
Teck Hughes	Toronto	16	15	16		
Tom Reed	Los Angeles	*66	*58	*60	Dec. '19,	.02
United Eastern	N. Y. Curb	2 7/16	2¼	2 5/16	July '21, Q	.15
Vindicator Consol.	Colo. Springs	†*25	†*20	*22	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*7	*5	*7		
Yukon Gold	N. Y. Curb	1¼	1½	1¼	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	19	*18	*19	Apr. '20, M	.03
Batopilus Mining	New York			⅝	Dec. '07, I	.12½
Beaver Consol.	Toronto	*25½	*24	*25½	May '20, K	.03
Coniagas	Toronto	1.65	1.55	1.65	May '21, Q	.12½
Crown Reserve	Toronto	*13	*12	*13	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3½	3¼	3⅜	Oct. '21, Q	.12½
La Rose	Toronto	*40	35	40	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*24	*22	*23	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.20	1.10	1.20	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	5⅛	5	5⅛	July '21, Q	.15
Ontario Silver	New York	4½	4½	4½	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb			*11	Jan. '12,	.10
Temiskaming	Toronto	*25	*21	*22	Jan. '20, K	.04
Trethewey	Toronto	*13	*10½	*12½	Jan. '19,	.05
GOLD AND SILVER						
Barnes-King	Butte			*60	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	1 5/16	*88	1 1/16		
Cash Boy	N. Y. Curb	*5	*4	5		
Consol. Virginia	San Francisco			*36		
Dolores Esperanza	N. Y. Curb	1¼	1¼	1¼		
El Salvador	N. Y. Curb	*18	*17	*17		
Jim Butler	N. Y. Curb	....	....	*7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	....	....	*3	June '16,	.05
Louisiana Con.	N. Y. Curb			¼		
MacNamara M.& M.	N. Y. Curb	*15	*14	14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.			4	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1¼	1⅛	1⅛	Apr. '21, Q	.05
Tonopah Divide	N. Y. Curb	*79	66	*66		
Tonopah-Extension	N. Y. Curb	1	1⅛	1⅛	Oct. '21, Q	.05
Tonopah Mining	N. Y. Curb	1¼	1 1/16	1 5/16	Apr. '21, SA	.05
West End Consol.	N. Y. Curb	*99	*88	*92	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*7	*6	*7	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1.05	1.05	1.05	Dec. '20,	.15
Chief Consol.	Boston Curb	2½	2¼	2¼	Aug. '21, Q	.05
Consol. M. & S.	Montreal	18	18	18	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†3.60	†1.00	..	July '20, Q	.10
Daly-West	Boston	2½	2½	2¼	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†3	†2½	2	Apr. '21, K	.05
Electric Point	Spokane	*6½	*6½	*6½	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*41	*35	*40		
Federal M. & S.	New York			7½	Jan. '09,	1.50
Federal M. & S., pfd.	New York	25	25	25	Sept. '21 Q	1.00
Florence Silver	Spokane	*10	*5	10	Apr. '19,	.01¼
Grand Central	Salt Lake	†*50	†*12		June '20, K	.03
Hecla Mining	N. Y. Curb	4¼	4	4¼	Sept. '21, Q	.10
Iron Blossom Con.	N. Y. Curb			*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†3.00	†1.00		Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*5	*4	4	June '21, I	.02
Prince Consol.	Salt Lake	*8¼	*7½	7½	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*3	*2	2½	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*10	*9	9		
South Hecla	Salt Lake	†*30	†*1[illegible]		Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*10	*10	10	Oct. '17,	.05
Stewart Mining	N. Y. Curb	*4	3	4	Dec. '15	.05
Tamarack-Custer	Spokane	1.90	1.80	1.85	Jan. '21 K	.04
Tintic Standard	Salt Lake	2.02½	1.87½	1.92½	July '21, Q	.05
Utah Apex	Boston	3½	2¾	3	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb		..	*2	Nov. '17,	.01
VANADIUM						
Vanadium Corp.	New York	31¼	30½	30½	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal			42½	Oct. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	••		70½	Oct. '21, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	38½	36½	36½	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	75¼	75	75¼	Sept. '21, Q	1.75
Am. Sm. pf. A	New York	78	74	77	Oct. '21, Q	1.50
U. S. Sm. R. & M.	New York	33	32	32	Oct. '21, Q	50
U.S.Sm R.& M. pf.	New York	40	40	40	July, '21, Q	.87

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, October 29, 1921 *Number* 18

Importance of the Mineral Industries

THE RAILROADS of the country carry material classified as products of mines amounting to over one-half of the total freight; and this is true even during this period of great depression of the mining industries. During the quarter ended June 30, 1921, out of a total of 222,000,000 tons of freight carried, mineral products constituted 124,000,000. Out of this last figure, most considerable, of course, is the proportion of coal and coke, amounting to nearly 89,000,000 tons; clay, gravel, sand, and stone amounted to nearly 23,000,000, and iron ore to nearly 9,000,000 tons. Crude petroleum amounted to something over 1,000,000 tons, leaving other mineral products counting up to over 2,500,000 tons.

Compare these figures with the freight representing products of agriculture, which amounted to 21,000,000 tons; of animals and products, nearly 6,000,000; of forest products, nearly 20,000,000, and of manufactures and miscellaneous, totaling nearly 42,000,000 tons. This relatively vast tonnage of mineral products goes into a multitude of industries, of which it constitutes to a large degree the raw materials, or supplies the energy to turn the wheels of industry, either directly or through the medium of electricity. The proper development of our mineral resources, their wise encouragement, their sane conservation, is a problem second to none in importance for our statesmen.

How shall this best be worked out and administered? At the present time there is no attempt to do so, no Government organization which is allowed fully to cover the field. The war revealed our lack of preparation and of knowledge, the lack of any conception anywhere of the mineral problem as a whole; and the result was costly and dangerous. The agricultural products are the special charge of a Government department, the Department of Agriculture, which is most useful and necessary. Similarly, the mineral bureau of our Government should be grouped into a Department of Mines. This is the greatest single act which could be contributed to the advancement of the problem. Many people object to this plan—and rightly—because they fear anything in the way of expanding Government expenditures. The change could be made with very little additional expense. After all, it is not so much expenditure as organization which is effective in producing results, and the proposed "department" is merely a demonstration of wise organization.

The Problem of the Publication Society

AMBITIOUS MAGAZINE PUBLISHING plans of the American Society of Civil Engineers were discussed editorially in the *Engineering News-Record* last year, and as the mining industries are cognizant of similar plans on the part of the mining societies, the considerations set forth concerning this similar problem are of interest to these industries and to the members of these societies.

Attention was first called to the fact that the stated object of the society is "the advancement of engineering knowledge and practice, and the maintenance of a high professional standard among its members," and that the methods of accomplishing this purpose have been by discrimination in admitting members, by the presentation and discussion of technical papers, and by committee work.

The society at that time was planning to abandon the publication of *Proceedings* and to substitute therefor a magazine, and to solicit advertising. The mainspring of this decision is stated in this editorial to have been the need of more revenue—colloquially termed the pursuit of the dollar. To get money they must have advertising; to get advertising they must publish a varied, timely, and not too technical magazine. Up to date no decision has been made by the society.

The *Engineering News-Record* queried whether such a commercial venture in the magazine field is fitting for a scientific society:

"The incompatibility of magazine publishing with the conduct of a society appears at many points. Take, for example, the matter of editorial comment. Whose opinion shall be expressed? We have in the past been treated to sharp conflicts even on technical matters which, it would appear on the surface, could be settled by a clear presentation of 'facts.' For the best accomplishment of the society's object a judicial habit of mind and a calm course are desirable—something that will not be encouraged if the society decides to take editorial positions, with the certainty of ensuing controversy.

"The incompatibility appears also in the matter of advertising. Is there not a fine distinction conferred by aloofness from commercial considerations, a distinction inseparable from high professional standing? We believe that there is, and the fact that the other societies do not believe so does not prove the case against us. The American Society of Civil Engineers stands second to none in prestige. The character and consistency of its *Proceedings*, the discrimination it has exercised in the admission of members, the carefulness of its public expressions, the quality of its committee work, have stamped it with a distinct and enviable personality. Will the society retain that personality when advertising salesmen are peddling the society's wares? What will be the society's standing if the publishing committee's query, 'Shall an attractive commission for advertising be inaugurated?' be answered in the affirmative?"

"It should not be necessary to discuss the disturbing effect of the commercial attitude [illegible]. Engineers have always recognized a very distinct cleavage between professional and commercial careers. The two are incompatible. You cannot serve two masters. When advertising revenue becomes big, larger than the dues, let us say, to which phase of the work will the executives of the society give the greater attention?

"Yet another thought is warranted on this important subject—or rather on this *critical* subject, because it involves the entire future attitude of the society. So far has this matter of publishing been carried by certain societies that the expression 'publication society' has been coined. To help the thinking in this direction the extreme case of the National Geographic Society is cited. Any one may become a 'member' of this body by subscribing $3.50 a year for a magazine. It is distinctly devoted to the 'dissemination' of geographical knowledge, but is not distinguished for work in the 'advancement' of geographical knowledge. It is regarded generally as a publishing organization, not as a scientific society."

We commend this problem to the members of the American Institute of Mining and Metallurgical Engineers.

Standardization of Rock-Drilling Machines

ONE OF THE MARKED ADVANCES in mining, as well as in other industries, is the tendency toward standardization and the efforts that are being made to reduce unnecessary expense and diversification and duplication of exertion. There are, no doubt, many instances where standardization is applicable, but in which it has not yet been accomplished in mining, milling, and metallurgy. We have heard much of the "standard" round, sizes of drifts and raises, ventilation, hose fittings, and many other classifications. Where such methods have been put into practice after a thorough trial they have been found to be of advantage and well worth the effort required.

Webster defines "standardize" as follows: "To reduce to, or compare with, a standard; to determine the strength, scale value, etc., of, by comparison with some standard." "Standard" is understood as "the term officially applied to manufactured or prepared articles legally required to conform to specified conditions as to proportions of material."

Contrary to some opinions, a "standard" does not necessarily mean that there should or will be a cessation of effort when a standard has been decided upon. Rather the reverse, for it implies that the practice, machine, or article has been found to present the best performance under a certain set of conditions, these having been determined after experimentation and trial, so that necessarily with altering conditions new standards must be set up.

There is, however, a limit to the extent to which attempts at standardization should be carried. For instance, suppose the automobile manufacturers or the auto-buying public should decide that all motor cars must conform to certain specifications. We can imagine into what chaos the industry would fall and the dissatisfaction that would be caused on every hand. Incredible—such an idea—of course. True, each particular type of car now conforms, within certain limits, to those of similar manufacture, so that there exists an interchangeability of parts, which is the best that can be hoped for unless a throttle is to be placed on the inventive genius of motor car and engine design.

A subject under recent discussion is that of the standardization of parts that enter into the construction of rock-drilling machines. Primarily, the manufacture of drilling machines is highly specialized, requiring a nicety of design, excellence of materials, and careful workmanship. The development has been slow, but has reached the stage today where considerable rivalry exists among the various manufacturers. That they are keenly aware of the needs of the mine operator is evident from the variety of models that are offered.

We have already stated in these columns that mining men and drill manufacturers are agreed that there is no one "best" type of drill bit for every purpose, and this is true also of the "power behind the drill," or the drill machine. Each particular kind of "drilling" rock requires its own particular type of machine. Some operators swear by this make of machine, others by that, so that already a rivalry, which is comparable in few other fields, has been established among drill-machine manufacturers. Such a state can be regarded as a valuable asset to mining, and should be encouraged, for it provides against stagnation of drill-machine design and furnishes the proper incentive for further research and invention.

Obviously, standardization has limitations, and it would seem that the design of rock-drilling machines should, for the present at least, remain on the exempt list.

The Metric System Bill

THE RECENT HEARINGS in Washington on the Ladd bill for the compulsory adoption of the metric system brought out a great deal of testimony in favor of the system as compared with the clumsy English system of weights and measures. The senators who are conducting the hearing were impressed with the gain in efficiency which results from metric usage, and with the views of some that it could be introduced without great upheaval. The president of the Haynes Automobile Co., for example, found no great difficulty in converting machines to metric measurements, and added, "Nearly all research work is done in the metric system. Our industries are dependent upon the research work of our scientists. They work in the metric system because it is simple, more logical, and can be handled with much greater facility. I favor very decidedly the adoption of the metric system."

The main question, therefore, in Congress and out, is the most practical way to expedite a needed change. Should the Government let it alone or take a hand in it? If it should undertake to assist the introduction of the system, what should it do, and how far should it go? The word "compulsory" does not sound good to us, or to any one else. It sounds good only to the compeller, not to the compelled, or the about-to-be compelled. It breeds prejudice and resistance. And so it should. Therefore, we believe that the sentiment is, and should be, against compulsion. Let a man use the Chinese or the Turkish system if he wants to. He has a constitutional right to. But there are a thousand gentle and helpful ways in which the Government can lead, influence, and subtly direct. It can set a good example in its own business, by employing efficient methods, of which the metric system is generally conceded to be one. Already there is an enormous use of the system in this country. Only it has not yet gravitated into common use, the last fortress of habit and tradition. The working down of the leaven could be assisted with very little if any unpleasant disturbance, and with no compulsion.

Riotous Taxation

ONE OF THE MOST VEXATIOUS mine-taxation problems is that where a large mine employs so many workmen that a whole town is supported, and the municipal government of this town of employees, by virtue of their right to levy taxes to any amount, run riot in plundering the company (which is the source of all revenue, and the sole foundation of all prosperity) by exorbitant taxes, which are spent most extravagantly. News comes from Ironwood, on the Gogebic Range, that the city is increasing its tax rate 30 per cent over that of last year, to a rate of $5.20 per $100. The mining companies pay 80 per cent of the taxes, and, therefore, this increase is apparently merely a sandbagging of the mining industries, against which the law so far seems to have provided no recourse.

Most of us have seen and marveled at the iron-mining town of Hibbing, on the Mesabi Range, with its lavish clustered electric lights on its fastidiously paved streets, and its palatial school buildings. All this is mulcted from the local mines of the U. S. Steel Corporation as local taxes. If it were not for the mines there could be no town. Father is rich, and he can pay, and the community of iron-mine employees, with the tradesmen who live on the earnings passed on to them, hold him up without a thought of economy or efficiency. They leave that to the mining engineer and the mine manager.

Liberty is a great thing; and the liberty to tap your neighbor's pocketbook is a sweet and pleasant thing; but it does not look or sound like Liberty to your neighbor. He would spell it differently.

Nitrogen Gas in Metal Mines

A BODY OF HOT NITROGEN gas in one of the lead-silver mines of the East Tintic mining district, Utah, reported by the Bureau of Mines,[1] is considered to be a residual atmosphere, due to the abstraction of oxygen from air through the rapid oxidation of sulphides. The resulting nearly pure nitrogen gas (the samples analyzed ran over 99½ per cent nitrogen), being lighter than air, accumulates in the top of raises and stopes, with a level sharp line of separation from the mine air below. The gas had a temperature of 175 deg. F., though the air three feet below was only 120 deg. F., and at one foot below, [illegible] deg. A candle or acetylene light raised into the gas is extinguished; and the gas, of course, cannot be breathed.

Similar accumulations of nitrogen gas have been reported from various mining districts, as, for example, in Tonopah. They have usually been considered as igneous emanations, from cooling igneous rocks far below the last superficial demonstration of the igneous activity with which the ore deposits are genetically connected in all these cases. The explanation offered in the article under consideration, that the gas is [illegible] nitrogen resulting from oxidation of sulphides, is an interesting alternative explanation; but no proof of this is given, and it would require clear demonstration to show why these gases are only rarely met with, though oxidation processes are universal; further, why these gases occur where there has been no conspicuous oxidation, as was the case in the West End mine, at Tonopah.

---

[1] [illegible]

WHAT OTHERS THINK

Peripheral Discharge From Ball Mill A Patented Feature

On page 579 of your issue of Oct. 8 is a description of a "Convenient Laboratory Ball Mill" (conical mill). The principle involved in a peripheral discharge from the conical mill I have patented in the United States, Canada, Mexico, as well as in many foreign countries, and further patents are pending. Up to the present we have only made sizes ranging from 20 in. to 72 in. in diameter. The 20-in. diameter mill, however, might be a little too large for ordinary laboratory tests. Hence it would be better to adopt the size suggested by Mr. Fahrenwald. The mills we construct for this purpose are used for wet and dry grinding, either as "batch" or continuous-discharge grinders.

To expatiate further upon what Mr. Fahrenwald says about the efficiency of this laboratory mill would be a little like "throwing bouquets" to one's self, for Mr. Fahrenwald is correct in all he says about the efficiency of this mill.

We appreciate the value of this small grinding unit for laboratory use, and also the benefit that is being conferred upon us by its use in any instruction laboratory. The Hardinge company, however, must be consulted before the construction or use of such a mill will be permitted. This permit has been granted the University of Idaho. The Columbia University's Mining School has in its laboratory a conical mill of two tons per hour capacity fitted with a peripheral discharge for the purpose cited.

H. W. HARDINGE.

New York.

Mr. Hubbard and the Black Lake Asbestos Mines

In your issue of Sept 3 you published an article by me entitled "The Black Lake Asbestos Area" which called forth a rebuttal by Mr. C. C. Lindsay.

Mr. Lindsay's article, although very clever, confines itself to a discussion of my personal character and mental attainments rather than my article. In only one place, the paragraph concerning the French Canadians, and their relation to the work being carried on there, does he challenge my statements as to the facts directly.

His fourth paragraph, which deals with steam shovels, inclined planes, cranes, and other appliances, concerns Thetford mines, not Black Lake. Inasmuch as he sums up his article with the words, "has had only slight experience in one small portion of it," [illegible] the asbestos field, I do not think this is fair criticism, as my article was explicitly confined to a discussion of the Black Lake area alone, and I was under the impression that this was made perfectly clear in the article.

Therefore I challenge Mr. Lindsay or any others in this field to publish statements, tables or reports which will prove my statements incorrect. Such facts, however, should be drawn from the Black Lake mines and not from Thetford mines. [illegible]

[illegible] D. HUBBARD

Black Lake, Quebec, Canada.

The Mining of Salt in Louisiana

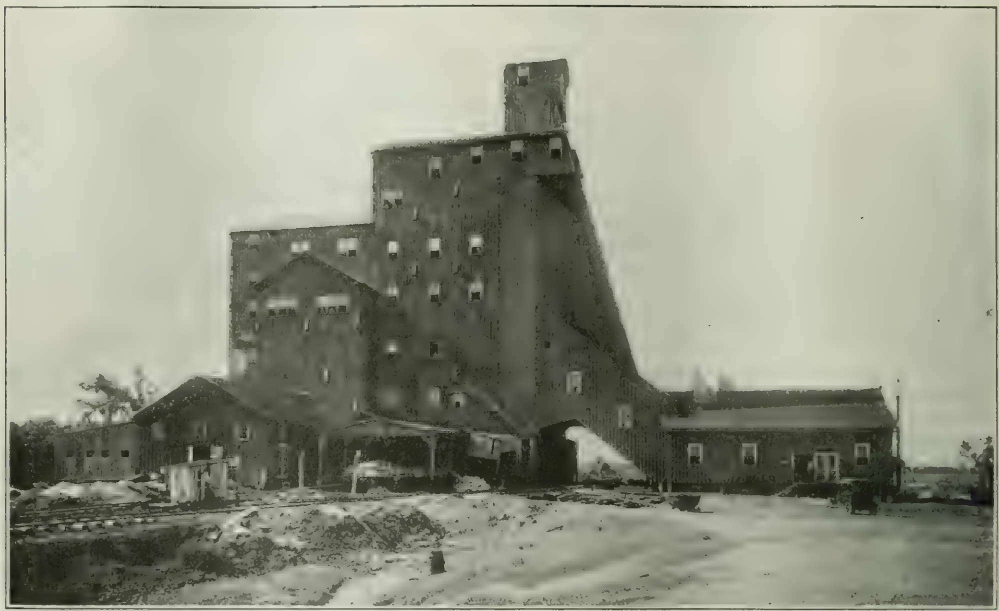


Photo from Ewing Galloway, New York

SHAFTHOUSE AND MILL OF MORTON SALT CO. AT AVERY'S ISLAND, LA.

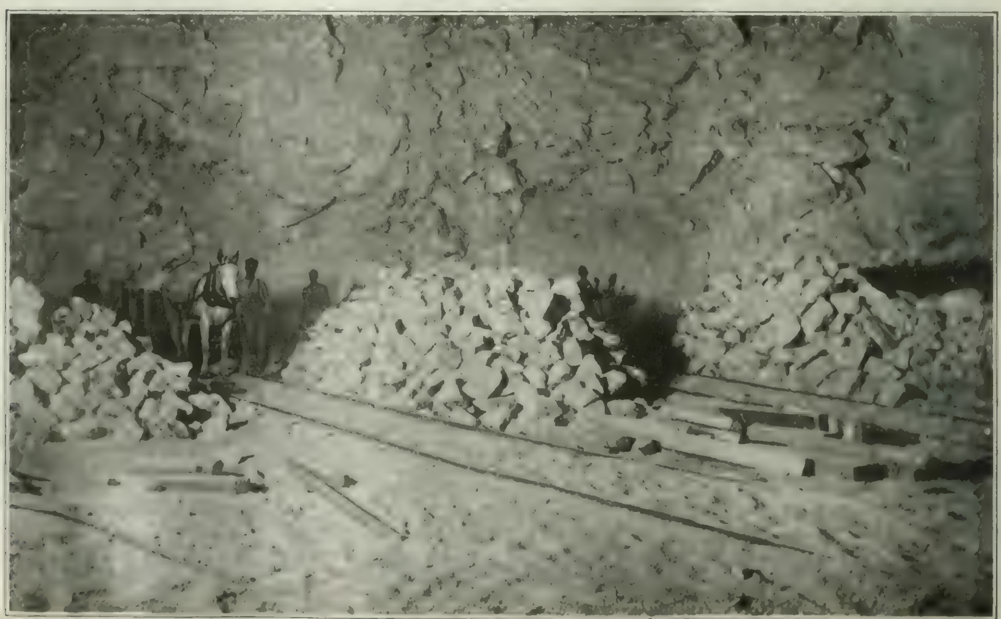


Photo from Ewing Galloway, New York

ROCK SALT FILLED IN STOPE READY FOR TRAMMING AND HOISTING

The Reclamation of Mexican Mining Titles—II

The Question of Forfeiture of Rights to American-Owned Mining Properties Through the Difficulties and Uncertainties of Paying Taxes Under Revolutionary Conditions, With Some Further Suggestions on the Subject of Reclamation

By Paul W. Meyers
Written for Engineering and Mining Journal

In my article in the Sept. 10 issue of *Engineering and Mining Journal*, I enlarged upon a suggested plan by which Americans might undertake to reclaim their mining titles in cases in which forfeiture for non-payment of taxes has been declared by the government of Mexico and new claimants have relocated such properties in violation of the decree of March 31, 1917. Under this decree, mining properties of proved value were specifically reserved from simple relocation, and provision was made for taking up such properties by means of lease contracts with the Mexican government. Since the preparation of the former article, the United States Government has informally requested the government of Mexico to issue a regulation based on the decree of March 31, 1917, which will permit former owners to reclaim their titles upon proving the industrial value of their properties and paying the accumulated taxes, without the Mexican government taking recourse to the article of the said decree, providing that such properties should be submitted to public bidding for lease contracts, obliging former owners to bid in competition with others in order to secure possession of their properties under leases.

It is to be hoped that the Mexican government will accede to this request, but it is evident that before restoring the validity of former mining titles the Mexican government may require former owners to show cause for their omission to keep their taxes paid up, as an article in the present mining code of Mexico provides that the government cannot revoke its former acts in declaring forfeitures of mining titles unless just and legal cause is shown for such revocation.

FORFEITURES DUE TO REVOLUTIONARY CONDITIONS

Broadly speaking, the revolution should be considered as sufficient cause for the non-payment of mining taxes by Americans who were driven from Mexico by conditions over which they had no control. In other words, a case of *force majeure* existed in Mexico from 1910 to 1920, and I contend that ten years of revolution should, in equity, be sufficient ground. The government of Mexico has already given indirect recognition of the practical difficulties which stood in the way of keeping up the payment of mining taxes during revolutionary conditions, the latest decree which recognizes this fact having been promulgated on Aug. 28, 1920, which permitted the payment of accumulated mining taxes, without penalties, on an installment basis, provided such payments were begun prior to Nov. 1, 1920. Many Americans availed themselves of the privileges of this decree, but such privileges were applicable only to properties on which the Mexican government had permitted the taxes to accumulate without imposing the penalty of forfeiture of title. Therefore, it naturally follows that this decree was of benefit only to owners of properties which had not attracted the attention of relocators.

In all cases where speculators had taken advantage of conditions by securing the forfeiture of titles to properties which they desired to acquire at the nominal cost of relocation, the decree did not apply. Mining properties of known value had already been singled out and their titles cancelled, and few properties of material value remained subject to the benefits of the decree of Aug. 28, 1920. As pointed out in my preceding article, it was the custom of the Carranza government not to disturb mining titles on which taxes were in arrears except upon the special application of some one desiring to obtain possession of the properties, in which case it would formally declare the title forfeited for non-payment of taxes and thus permit the applicant to proceed with his plans for relocation. This discriminatory method of imposing the penalty of forfeiture of title naturally inflicted injustice upon the owners, and especially upon Americans who had been driven from the country by the revolution and warned to stay out by their own government, uncertain as to which faction they should pay their taxes, and without facilities for safely effecting the payments.

UNCERTAINTY IN PAYING TAXES

Mining taxes in Mexico are payable either at the local mining office in the district in which the mine is situated, or directly to the Treasury Department in the City of Mexico. Before the revolution it was the universal custom to make such payments to the local offices. During the revolution, when mining districts were occupied successively by partisans of different factions, the matter of paying these taxes became involved in danger and uncertainty. In April, 1913, soon after the Huerta administration had obtained control of the capital, the United States Government served notice upon the Huerta government that it would consider payments of taxes by Americans to *de facto* authorities having control of local offices as completely relieving mine owners of all responsibility in the payment of their taxes, following the generally accepted usages of international law regarding civil wars and *de facto* control of regions. At about the same time, the Huerta government offered to accept payments by check if made direct to the Treasury Department in the capital, and American mine owners were permitted the choice of making their payments under protest, and usually under great difficulties, to local *de facto* authorities, or to remit by check to the Treasury Department in Mexico City. While the officials of the State Department rather inclined to favor the former method, probably because of its policy of non-recognition of the Huerta administration, it was only natural that Americans should favor the latter method as providing the lesser risk. In this way many Americans became accustomed to making their payments in the capital, even though threatened with repudiation of such payments by Carranza as head of the Constitutionalists.

The Huerta government fell in July, 1914, and the question of what constituted a legal government in Mexico, competent to receive taxes from foreign property owners, became still more acute, this situation continuing until August, 1915, when, following the occupation of Mexico City by the Constitutionalist forces under Pablo González and the installation of Carranza, order was restored in the capital. This was followed, on Oct. 19, 1915, by the recognition of Carranza as the chief executive of the *de facto* government of Mexico by the United States.

As is well known, the restoration of order in the capital was not followed by the restoration of order throughout Mexico. Various factions remained in control of large areas of Mexico, holding them in opposition to the Carranza government, and this situation continued through the several years during which Carranza remained in control of the central government. Organized factions in opposition to the central government ceased to exist only in 1920, following the overthrow of the Carranza government and the establishment of order by General Obregón and his adherents.

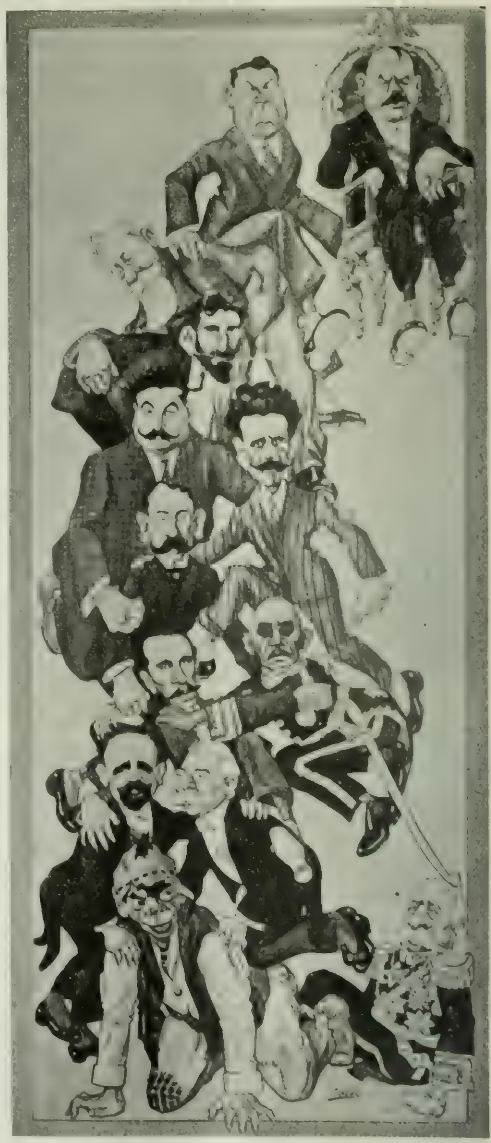
It was during the extended period in which the Carranza administration remained in control of the central government that the large majority of mining titles were declared forfeited for non-payment of taxes. Although the Carranza government received the full recognition of the United States during this period, at no time was it in control of the country, and at no time were Americans free from uncertainty as to the continuance of this government, while the whip was held over the heads of all owners of mining properties by means of the unjust decree of Sept. 14, 1916, requiring operation of mining properties under penalty of forfeiture of title.

It will be freely admitted that the general attitude of the Carranza administration was anti-American and that owners of properties in Mexico were under constant threat of losing them through the promulgation of some decree with which it was impossible to comply, or through the collapse of the Carranza government and repudiation of its acts by its numerous opponents. Therefore, in my opinion, payments of taxes to the Carranza administration imposed a gamble upon American mine owners unless the regions in which the properties were situated were definitely occupied and controlled by Carranza's forces under such conditions of security as to remove them from the possibility of having such regions occupied at any time by the forces of other factions.

THE LEGAL QUESTION

This subject of "regional control" is the crux of the question. *I am firmly of the opinion that all declarations of forfeiture of titles of mining properties made by the Carranza government in the capital, when such properties were situated in regions not definitely occupied or controlled by the Carranza forces, were not only contrary to the spirit of the attitude assumed by the United States on this point, but illegal under generally accepted principles of international law regarding de facto governments, and also under Mexican law as it existed at the time.*

On June 19, 1915, while Carranza was still in Vera Cruz, he promulgated a decree containing three articles: The first, in effect rescinding a preceding decree in which he had declared that all payments of taxes to



A MEXICAN CARTOON DEPICTING THE RULERS OF MEXICO FROM 1910 TO 1920

Name	Term of Office and Date of Assuming Control
General de Division Porfirio Diaz . .	32 years, 5 months, 25 days
Licenciado Francisco Leon de la Barra	5 months, 15 days, May 25, 1911.
Francisco I. Madero	**1 year, 3 months, Nov. 6, 1911.**
Licenciado Pedro Lascurain .	45 minutes, Feb. 19, 1913.
General de Division Victoriano Huerta.	1 year, 5 months, Feb. 19, 1913.
Licenciado Francisco Carbajal	17 days, July 22, 1914.
Venustiano Carranza, como Primer Jefe	2 years, 10 months, Aug. 20, 1914.
General Eulalio Gutierres	**2 months, 10 days, Nov. 10, 1914.**
Roque Gonzales Garza	4 months, 24 days, Jan. 16, 1915.
Licenciado Francisco Lagos Chasaro .	1 month, June 9, 1915.
Venustiano Carranza, como **Presidente**	**2 years, 11 months, 28 days, May 1, 1917.**
Adolfo de la Huerta . . .	6 months, June 1, 1920
General de Division Alvaro Obregón . . .	**Dec. 1, 1920.**

other factions were null and void; the second condoning the non-payment of taxes to other factions until his forces had occupied the respective places for a period of one month; and the third declaring that taxes paid in advance to other factions would not be recognized upon the occupation of the respective places by his forces. The text of these three articles is as follows:

> *Article I.*—All taxes are condoned which the constituents may have been obliged to pay up to the date of the new occupation of each place or town by the Constitutionalist forces.
>
> *Article II.* The accumulated taxes which are found to be pending at the date on which the occupation of the places by the Constitutionalist forces may occur, will be collected without any penalty, provided that the payment may be effected within one month following the date of the occupation. Such period once passed, the collection will be made with the legal penalties.
>
> *Article III.* The Constitutionalist government will not recognize in any case advance payments made to the usurping authorities in the nature of taxes corresponding to a period prior to the occupation of the places by the Constitutionalist forces, and, therefore, all taxes corresponding to a period prior to the date of the occupation of the places will be collected independently, whether they may have been paid to the enemy authorities or not.

Under the terms of this decree, I believe the Carranza government had no legal right to declare the forfeiture of mining titles for non-payment of taxes when the properties were situated in regions where the so-called Constitutionalist forces did not definitely control in peace and security. It is evident, however, that during the administration of Carranza both his Treasury Department and his Department of Industry, Commerce, and Labor frequently violated both the letter and the spirit of this decree by declaring forfeitures for the benefit of interested parties.

I have made and caused to be made strong representations to the State Department at Washington on this point, as well as on the point embraced in my preceding article, but have been met by the difficulty that no definite plan appears to have been formulated as yet for the reclamation of American-owned mining titles in Mexico. Therefore, I present the results of my own experience in the hope that American mining people interested in Mexico may co-operate at this time in presenting a definite program and policy to Mexico through diplomatic channels.

WHAT CONSTITUTED CONTROL?

In this connection I have suggested as a basis for determining what constitutes occupation or control of any region, that the situation on Oct. 19, 1915, when the United States officially recognized the *de facto* government of Carranza, be taken as a starting point, and that the occupation or control of any region by the so-called Constitutionalist government should date only from the definite establishment of peace and order in all such regions, either by the death of the leader in opposition to the Constitutionalist forces and the complete submission of his followers, or by the execution of a treaty providing for submission to the Constitutionalist government which shall have been duly carried out. This would obviate the danger of any mine owner being required to present legal evidence of the exact military situation in his district at the time his property was declared forfeited, in which case his evidence might be controverted by so-called military reports of Constitutionalist leaders, and the whole subject be clouded by the changing fortunes of war and the indefinite character of the guerilla warfare which characterized so much of the fighting. In other words, it would not be just to place the burden of proof regarding temporary military situations upon the shoulders of mine owners who had been driven out by the general situation.

The general facts of widespread revolution, and the impossibility of foretelling during the revolutionary period between 1910 and 1920 which faction would emerge the victor and restore order throughout the country, should count as sufficient evidence in all cases except where the Mexican government could legitimately contend that peace and order had reigned continuously from the Constitutionalist occupation of the capital in August, 1915. It should be understood that the present administration of President Obregón considers itself as the Constitutionalist government under which the Carranza constitution of 1917 and all the laws, decrees, regulations, and orders of Carranza are given full force and effect.

A PROGRAM OF CO-OPERATION NEEDED

I cannot urge too strongly the opinion that now is the time for American mining people to get together on a definite program for reclaiming their rights and properties legitimately acquired prior to the revolution and now in grave jeopardy of being lost beyond recall. Should it not be possible to reclaim titles illegally declared forfeited and illegally relocated by others, it may at least be possible to fix the responsibility for their loss directly upon the Mexican government, where it properly belongs, and make such losses a basis for just claims for indemnification against the government of Mexico.

Eventually it is probable that a Claims Commission will be appointed mutually by the United States and Mexico, and, under general usage, claimants must show that they have sought and been denied justice by the government of Mexico before they are in proper position to collect claims through the United States Government. The time for seeking the reclamation of Mexican mining titles is right now.

Sulphur-Dioxide Leaching Tests Successful

Tests on the sulphur-dioxide leaching of complex ores from the Miami district in Arizona have been completed at the Southwest station of the U. S. Bureau of mines at Tucson. It is considered that sulphur-dioxide leaching is a demonstrated success on the most refractory siliceous ores in the Southwest and also on ores containing a large percentage of acid-soluble gangue. The commercial application of the process appears to hinge largely upon the successful working out of the manufacture of sponge iron. Laboratory work is being done on Walker River siliceous copper ore which has soluble lime, iron, and magnesium aggregating 10 per cent acid-soluble gangue. Results so far obtained are encouraging.

Investigating Theory of Flotation

Co-operative work by the U. S. Bureau of Mines and the University of Idaho on the theory of flotation is in progress at Moscow, Idaho. Some very interesting facts on the adsorption of oil by minerals have been developed, which will be published later in detail.

Drilling Results and Dredging Returns—II

Examples of Placer Operations in Various Parts of the World Indicate That Prospecting Data Must Be Intelligently Interpreted To Obtain Accurate and Reliable Estimates of Probable Gold Content and Recovery

BY CHARLES W. GARDNER

Published Exclusively in *Engineering and Mining Journal*[*]

I BELIEVE it impossible for two engineers, each of whom has been furnished with exactly the same drilling data, independently to interpret the evidence available and reach the same conclusion as to the gold content in the ground, although they should agree closely as to the yardage.

The result from some holes will be obviously too high; other holes may be almost a blank, although in ground which adjacent holes indicate as carrying a fair gold content. Should the assay values of the high holes be reduced, and those of the low holes be increased? If so, by what an amount? Should the high holes only be considered and scaled down? If so, to what extent? Similar results will not be reached by the independent judgment of any two engineers. Even should the same engineer, after a lapse of time, revise his work without having access to his first figures, he will often arrive at a different conclusion.

The amount of yardage is also affected by the decision as to the depth into bedrock which the dredge should dig to recover all of the gold, and in deep ground as to the slope material which will be handled outside the bedrock line of dredgeable values.

Some engineers make a practice of reducing their original estimate 10 to 20 per cent in the computation of the figures to be presented in their report, and claim that this is done more to allow for defective recovery by a dredge than through a lack of confidence in their own judgment. There should be no radical difference of opinion between engineers as to the correct methods to be employed in making the estimates.

Attempts have been made by some engineers to formulate fanciful and mystical theories by which they strive to determine the average value of an aggregate number of drill holes, but such efforts are as useless as an attempt theoretically to revise the multiplication table. If a dredging area, prior to drilling, be laid out in squares of equal size (such a method being seldom or never employed), and then a drill hole be put down in the center or at the corner of each square, the average value of the holes so put down can be ascertained by first deciding on the value to be given each hole and then obtaining the average by common mathematical methods.

PREFERRED PROCEDURE

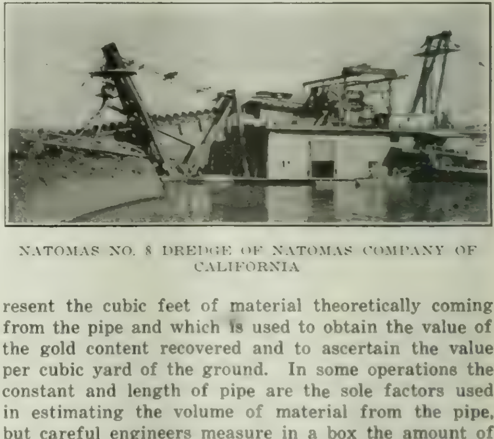
If the tract has been drilled with holes spaced at irregular intervals, they should be platted and triangles drawn connecting all of the holes. The area of each triangle should be figured and the average value of the three holes affecting it be applied to determine its gold content. The nearer the triangles are to being equilateral the more nearly correct will be the result.

If a deposit formed by a well-defined flow has been cross-sectioned by various lines of drill holes, the yardage and gold content in each section should be figured and the average of two sections be applied to the block of which they define the end limits.

Where holes are put down at random and no attempt is made to define accurately the area represented by each, there is no theoretical formula or known mathematical method that can be used to determine the correct average value of all of the holes.

CHOICE OF A CONSTANT INFLUENCES CALCULATIONS

Another factor which has a material bearing on the interpretation of drilling results is that of the constant used in calculating the amount of material displaced by the pipe. By the term "constant" is meant that figure which multiplied by the length of pipe driven will represent the cubic feet of material theoretically coming from the pipe and which is used to obtain the value of the gold content recovered and to ascertain the value per cubic yard of the ground. In some operations the constant and length of pipe are the sole factors used in estimating the volume of material from the pipe, but careful engineers measure in a box the amount of tailing, and make, when necessary, what they consider a proper adjustment of volume, particularly if the amount of measured material is greater than the theoretical.



NATOMAS NO. 8 DREDGE OF NATOMAS COMPANY OF CALIFORNIA

One of the first and, owing to its simple application, a very frequently used constant is that commonly known as the "Radford factor." It is 0.27, which represents 1 cu.yd. of material to every 100 ft. of 6-in. pipe. I do not know the origin of this constant, but as it closely approaches the area of a circle with a 7-in. diameter, I presume it was based on the assumption that the cutting shoe, when driven, would force material covering that area into the pipe. Later it was theoretically considered that as the cutting shoe had an external diameter of 7½ in., and an exterior cutting edge, it would displace, and there be forced into the pipe, its full area of 0.3068 sq.ft. The use of this constant is considered more conservative than that of the first, as by its application the theoretical gravel content figured as coming from the pipe is proportionally increased about

---

[*] Read at the September meeting of gold dredge superintendents at Natomas.

13.6 per cent and the estimated value per cubic yard decreased about 12 per cent.

On some work the constant 0.33⅓ has been employed, and this assures still more conservative results, as in comparison with the first constant its use gives an increase in estimated gravel content of nearly 23.5 per cent and only about 81 per cent of the values.

CONSTANTS AFFECT ESTIMATES

The importance of the difference will be realized when it is considered that if a tract of ground is estimated by the use of the first constant to contain $1,000,000, the amount will shrink to $810,000 if the latter constant be used. Estimates of some properties have been based on the use of the constant 0.30 as being simple and fairly conservative.

There is no common agreement as to the most correct constant, and different engineers adhere to the use of each, as they have not been able to decide, from the knowledge they possess of dredging results, which one is the best. In my opinion it will be impossible to determine on one applicable to all fields, as I believe the character of the material has an important bearing on the result attained.

In reporting the results as obtained by the use of an Empire drill, I will use the term "factor" as the figure representing the length of pipe equal to one cubic yard. The one in common use is 238. Mr. Prichard, in his report above referred to, states that on the Pato property he selected a dredged area in which he had previously drilled seventeen holes. He carefully calculated the area and cubic yards represented by each hole, and then, knowing the actual yardage and gold yield produced by the dredge, he determined mathematically the factor for the drill holes which, when applied, would equal the actual value recovered by the dredge, and found it to be 387. By the use of this factor the theoretical volume from the pipe would be 61.5 per cent of that estimated by using 238, and the values per cubic yard would be increased about 62.6 per cent.

An understanding of the facts set forth makes it possible more clearly to consider the difference between original estimates and actual dredge returns, and more fully to comprehend the reason that discrepancies exist.

EARLY DRILLING WAS UNSYSTEMATIC

Unfortunately, the first few years of the dredging industry in California did not furnish comparative data of value. The ground as a rule was not drilled in a systematic manner, and on some properties one drill hole to about every ten acres was considered sufficient to indicate its value. The proper use of the drill was not understood, as its operator was gaining his first experience with it. It was sometimes the practice to drill below the pipe and then to use the sand pump as long as a color could be found in the tailing.

I remember visiting a drill operating in thawed ground near Nome and being afforded considerable amusement by the manner in which the work was conducted. I asked the drill man how far he was drilling below his pipe. He said he didn't know, but that it might be about time to find out, and after taking some measurements, he replied to my question, "Oh, I guess about nine feet or so."

Such loose and careless methods produced some astonishingly rich results, and these were the foundation of many an air castle built by property owners.

I remember one line of holes drilled in the early days which indicated an average value of 72c. per cubic yard, but when the ground was dredged it yielded less than 18c. per cubic yard.

MODERN DREDGES MAKE BETTER RECOVERY

Even if data were obtainable, comparison between the prospecting and dredging returns of the earlier period would be of little value, as one must consider the fact that the first dredges did not make a close saving of gold, owing to an insufficient area of tables, and that the buckets did not properly dump into the hopper. In modern dredges these defects have been remedied. The dredge of today makes a very close saving of all of the gold which will settle by gravity in the riffles.

One of the best comparisons between drilling results and dredge returns is obtained from the operations of a company whose property was systematically drilled and later equipped with two modern dredges. The deposit was the result of stream action, and lines of drill holes were run across the deposit at right angles to the flow. The blocks of ground between each two lines of drill holes, and defined on the sides by the limit of profitably dredgeable areas, were separately computed as to yardage and gold content. The upper portion of the property, consisting of 121 acres, having an average depth of 18 ft., has been completely mined. The original estimates gave the average value per cubic yard as 16.8c., and the value recovered by the dredge was 15.63c., or 93 per cent of the estimate. The constant used in computing the drill results was 0.33⅓, and had a constant of 0.3068 been used the estimated and actual values would have agreed closely. The lines of drill holes on this tract were spaced about 500 ft. apart, dividing it into eight blocks. The results from fifty drill holes were used in the computations, there being one hole to about every 2.4 acres.

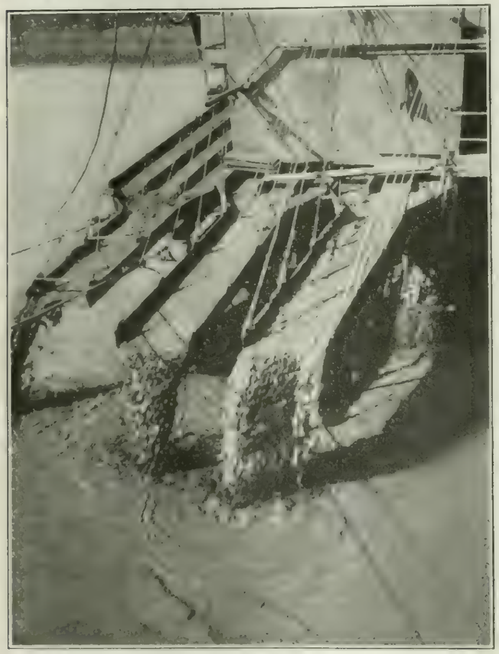
The comparative results from these various blocks varied greatly. In one block the recovered value per cubic yard exceeded the estimate by 49.4 per cent and in another block it was less by 68.2 per cent, making the closeness of the average results, obtained from the whole, the more remarkable.

AN EXAMPLE OF DREDGE RECOVERY EXCEEDING ESTIMATES

There has been mined on the lower portion of this property an area of 480 acres having an average depth of 16 ft. Seventeen lines of drill holes were run across this area at intervals varying from 400 ft. to 700 ft. The results from 130 holes were used in making the estimates, or one hole to every 3.7 acres. The estimated average value per cubic yard for the whole area was 11.61c. and the dredge recovery [illegible], or a gain of 41.6 per cent. All of the blocks returned a higher value than was estimated, but the difference between them was marked. The recovered value per cubic yard in the block at one end, which contained only two and one-half acres, exceeded the estimated value by [illegible] per cent. One block of fifty-five acres exceeded the estimate by [illegible] per cent, and in another block of eight and one-half acres the excess was only [illegible] per cent. The percentage of gain in the other blocks ranged between these amounts. The yardage in the whole area was [illegible] per cent greater than that estimated, owing to the dredge digging outside of the estimated boundaries and a little deeper into the bedrock.

The work on both tracts was done under the supervision of the same engineer, but with different drill crews. The character of the deposit was about the same on both areas, but with a larger proportion of hard bedrock on the upper tract. The gold was concentrated within a few feet of bedrock and was fine in character, with no nuggets. The reason for the comparative difference in results is unknown.

On one property which was drilled many years ago 180 acres had been dredged. The results from thirty-three drill holes were available for use in computing the gold content in this area, about one-half of the holes being within its limits and the others around it. The average value per cubic yard indicated by these holes was 43.74c., and the dredge recovery was 19.97c., or 45.7 per cent.


GOLD SLUICES IN THE DISCHARGE OF NATOMAS NO. 8

In another part of the same property there has been dredged 118.5 acres, and the results from thirty-eight drill holes were used in making the estimate, fourteen of which holes were outside but adjacent to the area dredged. The estimated value per cubic yard in this tract was 29.88c., and the dredge returns were 31.55c., a gain of 5.6 per cent. I believe the constant used in figuring the drill returns on this property to have been 0.3068.

Another Comparison of Results

Some years ago, on another and undredged portion of this property consisting of 493 acres, an estimate was made to determine the gold content. The results from fifty-three drill holes, which were within the limits of the property, were used by taking 70 per cent of their recorded value. Consideration was then given and use made of the values obtained from dredging operations which had been conducted adjacent to and around two-thirds of the tract. Since then 402 acres of this area have been dredged, the returns per cubic yard averaging 12.73c. The data used in making the original estimate were applied to the portion now dredged, and the proportionate values found to be 12.70c. per cubic yard.

On a small property in California where the gold content was low, it was important to ascertain just what dependence could be placed on drilling results as indicating the probable dredge recovery, and some careful tests were made to determine the extent to which future operations could be extended. A Keystone drill was used, and the calculations were based on a constant of 0.27. Tests were made on three different sections of the property and twenty-seven drill holes put down in 15.3 acres which had an average depth of 30.3 ft. The average value per cubic yard shown by the drilling was 3.04c. and the dredge recovery 8.7c., a gain of 186 per cent. On a tract having an area of ninety-three acres and an average depth of 22 ft., forty-two holes were drilled which indicated an average value per yard of 6.01c. and the returns from dredging were 10.11c., or a gain of 68.2 per cent.

The third tract had an area of 23.5 acres with a depth of 31.5 ft., and the results from twenty-three drill holes gave a value of 4.44c., and the dredge operations yielded 6.40c., or a gain of 44.2 per cent.

Obtaining an average of the results on a basis of the total acreage, the average value per cubic yard of the drill results is determined to be 5.38c. and the dredge returns, 9.28c., an average gain of 72.5 per cent. Had a constant of 0.1565 been used to calculate the drill results, they would have agreed closely with the dredge returns.

Colombian Dredging Results Compared

I have previously referred to the test made by Mr. Prichard on the Pato property, in Colombia, and it will be of interest to know if the deductions which he then made have been substantiated by results obtained from later operations. I have nothing official concerning this, but from some rather meager data I infer that a portion of the dredged area on this property, amounting to about eighty acres and represented by nineteen drill holes put down within and adjoining the area, produced an average value of about 42.5c. per cubic yard, and that the average drill results were about 38c. These figures are approximate, but on such a basis the dredging gain would be about 12 per cent. I also infer that the drill results were obtained by using the liberal factor of 387.

On the Nechi property, across the river from that of the Pato, a dredged area of about sixty acres is considered as being represented by a line of ten holes which were originally put down with an Empire drill through about the center of the area. The average value per cubic yard indicated by these drill holes was about 70.5c., and the average recovery by dredging was about 35.5c. Both of these figures are approximate only, but using them as a basis the dredge returns are only 51.3 per cent of the prospect indications. The values from these drill holes were figured by using a factor of 238, and it is of interest to note that had the factor of 387 been used, which had been proved correct on a certain area across the river, the average drill-hole values would have been increased to 114.6c. and the dredge recovery would have then constituted only approximately 31 per cent of such a value.

With the admission that all of the figures given may be far from correct, I still believe them close enough to demonstrate that a factor proved for use on a limited area having certain conditions may not be correctly applied to another tract in the same vicinity.

Reference having been made to the Chicksan property, in Korea, to the prospecting tests made prior to the installation of a dredge, and to the results obtained from shafts and a pit greatly exceeding the drill values, it should be of interest to ascertain to what extent the results obtained by dredging confirmed the drill prospects, and I here give comparative data based on six-month periods extending from Jan. 1, 1918, to June 30, 1920:

Drill values, cents	14.9	11.35	5.55	7.2	7.7
Dredge recovery, cents	12.25	11.30	9.15	10.0	12.9
Dredge recovery, per cent	82	99.5	165	139	167

The explanation is made that the gold-saving appliances on the dredge did not reach the maximum of efficiency until toward the end of the second period and that the results obtained after that were from normal operating conditions.

I present herewith also the following comparative results produced by operations from three separate tracts in a large California property, the third tract having been mined by three dredges:

Tract	Average Depth, Feet	Acres	Number of Holes	Acres per Drill Hole	Value per Cubic Yard — Drill, Cents	Dredge Recovery, Cents	Per Cent
A	[illegible]	173.5(a)	57	3.2	6.8	7.82	115
B	44.5	84.0	20	4.2	5.9	6.7	113
C Dredge No. 1	51.8	183.0	120	1.5	11.1	9.64	87
C Dredge No. 2	[illegible]	106.0	41	2.6	11.2	9.44	84
C Dredge No. 3	[illegible]	135.0	58	2.3	11.6	11.30	97

(a) [illegible] drill holes.

On Tracts A and B the factor used in calculating drill results was 0.27; on Tract C the factor used was 0.30. The average results of all of the above, proportioned to the acreage, is a drill value of 9.48c. per yard, and the dredge recovery 9.12c., or 96.2 per cent.

An area of 11.76 acres of Alaska Creek gravels was prospected with a 6-in. hand drill, with four holes per acre. These were spaced 50 ft. apart with intervals between drill lines of 300 ft. Schist and limestone bedrock was encountered. The drill values were 95.0c. per yard and the dredge recovery was 96.3c., a gain of 1.4 per cent.

TWO CALIFORNIA PROPERTIES FURNISH ADDITIONAL EXAMPLES

A California property is being mined by one dredge, and from a late report I find that the 157 acres now worked were prospected by seventy-six drill holes, an average of one hole to every 2.1 acres. The estimated value was 19.1c. per cubic yard, and the dredge recovery 10.4c., or 54.4 per cent. The report states that in calculating the drilling results on this property the "correction method" was used, and this is described as one "in which the solid material pumped from each foot of drop is measured and the number of colors of gold corrected in the ratio of the actual core extracted to the theoretical volume of core from this foot of drop." The report further states that had the constant of 0.27 been used in making the estimates, the result would have been 16.5c. per cubic yard, and on this basis the dredge recovery would have been 63 per cent of the prospect value.

The manager of a company operating in California gives the following data concerning two separate tracts which have been dredged:

Tract	Average Depth, Feet	Acres	Number of Holes	Acres per Drill Hole	Value per Cubic Yard — Drill, Cents	Dredge Recovery, Cents	Per Cent
No. 1	22.5	559.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
No. 2	35.9	420.5	[illegible]	[illegible]	[illegible]	8.18	[illegible]

The constant used in calculations was 0.27. Proportioning these returns to the acreage I find for the property as a whole an average estimated value per cubic yard of 7.44c., and a dredge recovery of 9.0c., being a net gain of 21 per cent.

Dredging operations on one property in California have produced returns which, taken as a whole, correspond closely with the original estimates, and the following details have been recorded covering the work done in the last three years:

BUCKETS CUTTING TOP OF BANK—NATOMAS No. [illegible]

Year	Average Depth, Feet	Acres	Number of Holes	Acres per Drill Hole	Value per Cubic Yard — Drill, Cents	Dredge Recovery, Cents	Per Cent
1918	32.1	17.94	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1919	34.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1920	29.5	20.45	[illegible]	[illegible]	[illegible]	14.34	[illegible]

The average results proportioned to the acreage show an estimated value of 10.25c. and a dredge recovery of 11.39c., or an increase of 11.1 per cent.

From 1908 to 1917 inclusive the area dredged on this property was 229 acres, which was prospected by 173 drill holes, or one to every 1.3 acres. Figures have been given showing the estimated value and dredge recovery per cubic yard for each year, and proportioned to the acreage their average is 10.86c. and 12.34c. respectively, or a dredging gain of 13.6 per cent. There is a wide discrepancy in the comparative results as obtained from year to year during this period, and in 1909 the dredge recovery was only 58.7 per cent of the prospecting value and in the next year the recovery exceeded the prospecting by 94.4 per cent.

The report by Mr. Neill, mentioned above, states that in the thirty-acre tract, which was tested by two independent drillings, there was later dredged seven acres which were represented by fourteen drill holes. The average value indicated by these holes, without making any allowances, was 7.74c. per cubic yard. The dredge recovery was 6.71c., or 87 per cent. If, in figuring the average value of the holes one-half of the value of the highest three holes had been used, the result would have been 5.55c. and the dredging gain would have been 17.6 per cent.

The report further states that another piece of ground on the property was drilled with sixty-six holes, which ranged in value from 1c. or less to 66c. per cubic yard, with an average value of 9c. The dredge recovery was 76 per cent.

On a certain Colorado property fourteen holes were put down across a valley with a Keystone drill. These holes were spaced 50 ft. apart, with the exception of the last two, which were 100 ft. apart. Later, a dredge made a single cut, which included ground on each side of this line of holes. The ground had an average depth of 46 ft., and the dredged area, considered as being represented by the drill holes, was 4.5 acres. The value per cubic yard indicated by the drill was 17.19c., and the dredge recovery was 8.79c., or 51.1 per cent. The excavated material was a clean washed sand and gravel with little clay and many boulders, all of a nature which rendered the determination of values by means of a drill exceedingly difficult.

On another Colorado property the operations of one dredge, extending over a period of twelve years, returned 165 per cent of the values indicated by drilling. On the same property a dredge cut through a line of eight drill holes gave an average value per cubic yard of 8.6c. The dredge recovery was 33c., being an increase of 284 per cent. In one year the average value of the 1,300,000 cu.yd. excavated was 25c., which was 290 per cent of the prospect value. The depth of the ground was 38 ft., and it was composed of medium fine gravel with few large boulders.

A part of a Montana property consisting of 300 acres was prospected with seventy-seven drill holes spaced at irregular distances. The average value per cubic yard indicated by the drilling was 15.83c., and the dredge recovery 13.55c., or 85.6 per cent. The average depth of the ground was 40 ft. and the larger portion of the gold content was contained in the three feet of gravel next to the bedrock.

A California property, consisting of 152 acres, was dredged during the earlier period of the industry. Its probable value had been previously determined by means of twenty-three drill holes, one to every 6.6 acres, and found to be 38.6c. per cubic yard. The actual recovery by dredging was 16.3c., or 42.2 per cent. The ground was about 35 ft. in depth and the material consisted of a medium-sized gravel with a large amount of clay, which, when dredged, rendered effective washing impossible. The constant used in calculating the drill results was 0.27.

SHAFT PROSPECTING VS. DRILLING

The question naturally arises as to whether prospecting by means of shafts will give more accurate results than by drilling. The volume of material taken from a shaft is much greater than that from a drill pipe, and the formation is clearly exposed, but where a large flow of water is encountered the gold content cannot be accurately determined.

An area of 39,000 sq.ft. in an Alaska creek was prospected by sinking seventeen shafts, which ranged in depth from six to thirteen feet, and were proportionate to twenty shafts per acre. The gold was concentrated on a calcareous schist bedrock overlain by limestone boulders. The value per cubic yard obtained from the several shafts ranged from a trace to $1.18, with an average of 51.6c. The area was mined by means of a hydraulic elevator and the recovery was 93.5c. per cubic yard, or a gain of 80 per cent.

In a dredging property in Idaho there was one block of forty-four acres which was defined by a line of five shafts at its upper end and by a line with the same number of shafts across its lower end. The shafts were all sunk in ground containing but little water. It was 1,500 ft. between the two lines, and the shafts were spaced about 320 ft. apart. By using the results obtained from these shafts, the average value per cubic yard for the whole block was estimated to be 9.9c. The dredging returns were exactly the same.

One California property, containing 140 acres, was prospected by sinking fifty-one shafts, which returned an average value of 15c. per cubic yard. The dredge recovery was 15.9c., a gain of 6 per cent.

The estimated gold content in a property consisting of forty acres was determined by drilling a few holes and sinking a greater number of shafts, twenty-two tests in all. This work gave expectations of recovering 29c. per cubic yard, and the dredge returns were 18.2c., or 62.8 per cent. The formation contained considerable clay.

Reviewing the drilling returns in an attempt to make such deductions as may have possible value, one is confined to the acreage as a basis of comparison, as gross yardage and returns have not been reported.

From all of the properties above mentioned it is possible to segregate 3,743 acres, to which data given in fairly accurate reports can be applied. This combined area was prospected by means of 1,749 drill holes, or one to every 2.1 acres. The average value per cubic yard obtained by drilling was 15.4c., and the average dredge recovery 13.55c., or 88 per cent.

A comparison of returns, segregated as to values, is as follows:

		Average Value per Cubic Yard				
Drill Values per Cubic Yard	Acres	Per Cent of Total Acreage	Drill Value, Cents	Dredge Recovery, Cents	Per Cent Gain	Per Cent Loss
Under 11c.	27.9	0.7	9.21	8.60		6.6
Under 11c.	1,638.1	43.8	7.68	9.34	21.6	
Between 11 and 12c	424.0	11.3	11.28	10.12		10.3
Between 11 and 12c	480.0	12.8	11.61	16.44	41.6	
Between 12 and 20c	582.5	15.6	16.92	13.10		22.6
Over 20c.	392.0	10.5	45.86	20.93	....	54.4
Over 20c.	198.5	5.3	33.15	35.97	8.5	....
Totals	3,743.0	100.0	.....	.....	....	....
Averages			15.40c	13.55c		12.0

Of the whole area 38.1 per cent shows an average drill value of 23.05c. and a dredge recovery of 14.28c., a loss of 38.0 per cent; 61.9 per cent of the whole area shows an average drill value of 10.68c. and a dredge recovery of 13.10c., a gain of 22.7 per cent.

The constant 0.27 was used in calculating the drill results from 44.3 per cent of the combined area and in which the indicated values were all less than 11c. per cubic yard. The dredge recovery from this portion of the area shows a gain of 21.1 per cent.

I feel that a safe conclusion to be drawn from all of the above is that when a property had been sufficiently prospected by an experienced engineer, the results intelligently interpreted, and the calculations accurately made, the result obtained will indicate within reasonable limits the gold content. Full consideration should be given all of these points, and then if the estimated gross value safely and sufficiently exceeds the cost of acquisition, equipment, and operation, there should be nothing to deter or discourage the investment of capital in such an enterprise.

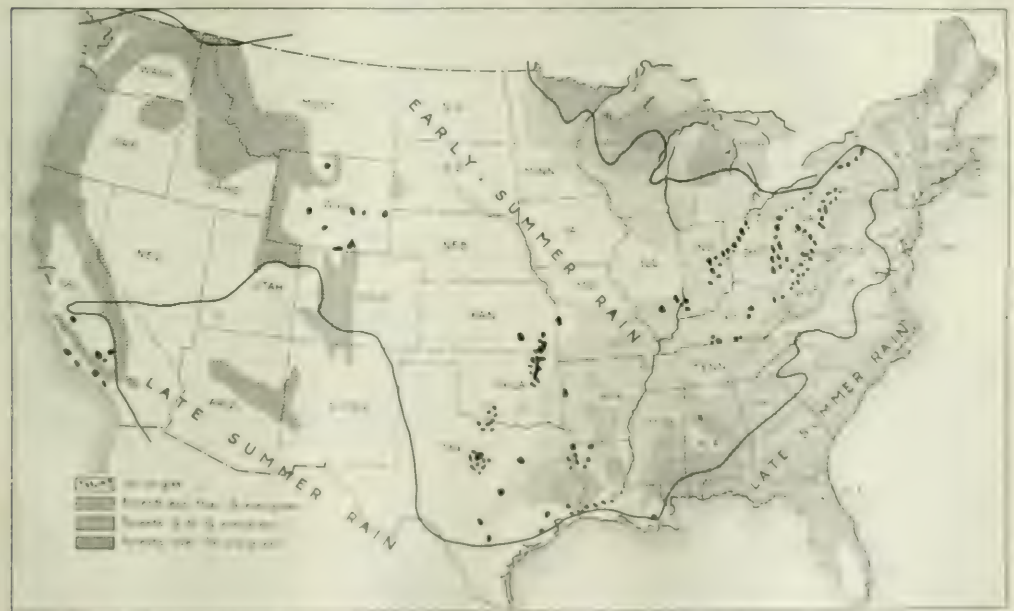
Some Interesting Relations Between Vegetation And Mineral Deposits

Rainfall, Forestation, and Occurrences of Minerals, Particularly of Oil, Appear To Be Coincident, Possibly Due to a Similarity in the Conditions Which Account for Their Existence Together Oil Wells Generally Occur in Regions Favorable to the Growth of Deciduous Trees

BY ROLAND M. HARPER
Geographer, Geological Survey of Alabama

Written for *Engineering and Mining Journal*

THE COMMUNICATIONS on the relation between vegetation and mineral deposits in recent numbers of *Engineering and Mining Journal*, by F. M. Wichman (Dec. 20, 1920), Gordon Surr (Jan. 15, 1921), and Edgar T. Wherry (June 4, 1921), suggest additional observations which may be of interest to many readers. It was observed long ago, particularly in Europe, that certain species of plants are chiefly confined to a specific variety of soil or rock, and sporadic attempts have been made to use such plants as indicators of the presence of useful minerals. Dr. R. W. Raymond, in a short paper entitled "Indicative Plants," in the 15th volume of the *Transactions* of the American Institute of Mining Engineers (1887), summed up previous observations and added a few of his own. Ten years later Sydney B. J. Skertchly, in a Queensland Geological Survey report on the tin mines of Watsonville, included a short chapter on the "copper plant" (*Polycarpaea spirostylis*), which he found abundant in the vicinity of copper lodes in northern Queensland, and determined by careful analyses to contain distinct traces of copper in its ash. He also mentioned a few other instances of supposed mineral-indicating plants in the same country, and referred to Dr. Raymond's observations in the United States.



MAP OF THE UNITED STATES, SHOWING OIL AND GAS FIELDS, LINE WHERE EARLY [illegible] AND LATE SUMMER [illegible] PRECIPITATIONS ARE EQUAL, AND FORESTS IN THREE DEGREES OF EVERGREENNESS. NOTE THAT THE OIL FIELDS ARE NEARLY ALL IN THE EARLY-SUMMER-RAIN AREA, WHERE THE FORESTS ARE MAINLY DECIDUOUS OR ABSENT

A great difficulty about correlating plants with soils or minerals is that few species of plants are confined to just one type of soil. It has happened repeatedly that a botanist has formulated a beautiful hypothesis about such a correlation in a small area, and afterward visited a different region, only to find apparently the same species growing on quite a different soil, thus upsetting his hypothesis. But instead of focusing attention on one species at a time, and determining its mere presence or absence, it is possible to study vegetation quantitatively and get much more satisfactory results.

For example, two different mountains, islands, or other similar areas might have exactly the same species of trees on them, but in very different proportions, indicating different soil conditions. If one had nine-tenths of its trees pines or other evergreens and the other one nine-tenths oaks and hickories, one would naturally expect to find the latter having the richer soil; for trees growing in poor soil cannot as a rule extract nutriment from it fast enough to make a complete new crop of leaves every year, but must keep each leaf two or more years. Or, to put it in another way, trees growing in rich soils take up mineral matter so fast that they have to shed their leaves at frequent intervals, for that is almost the only way they have of getting rid of it. This sort of correlation has been made innumerable times by farmers in clearing new land for agricultural purposes, the hardwood land being cleared first and the forests of pine, spruce, and other similar woods avoided.[1]

In *Science* for Aug. 30, 1918, I pointed out that if for every weather station in the United States, or for as many of them as practicable, the difference between the rainfall for April to June inclusive and that for August to October be determined, and the results plotted on a map, some interesting correlations with soil and other factors can be made. The area of early summer excess, which includes practically the whole drainage basin of the Mississippi River and a few smaller rivers on either side of it, is characterized by silt loams and other fertile soils, with deciduous forests or prairies, whereas the late-summer-rain area, along the northern, eastern and southern edges of the country, has much more sand, peat, and evergreen trees. Furthermore, tornadoes, muddy streams, and river floods are chiefly confined to the former, and hurricanes, clear rivers, swamps, and sheet-floods to the latter.

RAINFALL, MINERAL DEPOSITS, AND FORESTATION SEEMINGLY RELATED

Since the publication of that paper a few other contrasting features of the parts of the country thus separated have come to mind. Mineral springs, petroleum, natural gas, and lignite are found mostly in the early-summer-rain or hardwood and prairie area, and gold and copper in the other. Coal and iron are somewhat intermediate in distribution, but the former tends more toward the hardwood area and the latter to the pine, in the United States at least.

Although these correlations may not hold so well in other continents, and it may not be possible to offer a logical explanation for them at present, it is reasonable to use them as working hypotheses in prospecting, until they are shown to be wholly accidental.

The relation of vegetation to petroleum distribution is especially interesting. At least nine-tenths of the productive oil wells in the United States at this writing are in regions where, if any trees at all exist, they are mostly deciduous; and even if a few wells should be "brought in" in pine regions, this general statement seems likely to hold true for some time.[2] (The correlation is especially striking in West Virginia, where the oil wells are in the northwestern half of the state and the coniferous forests in the southeastern, and in western Louisiana and eastern Texas, where several thousand square miles of long-leaf pine country occur with oil wells all around, but none in the area, as far I have been able to ascertain.) Natural gas extends a little farther into the pine regions than petroleum does, having been obtained near Fayette and Mobile, Ala., for example. Similar relations may obtain in other countries, for, as has been pointed out by Maurice G. Mehl,[3] nearly all the important oil fields of the world are between 20 deg. and 50 deg. north latitude, and between the isotherms of 40 deg. and 70 deg. Fahrenheit. And although Mehl does not allude to the fact, that is just where the largest areas of fertile soil and the great deciduous forests are located (or were located a few centuries ago, before the forests were mostly destroyed to make room for farms). Both boreal and tropical forests, as is well known, consist mainly of evergreens, and comparatively little of the land they occupy has been found worth clearing at any one time for agricultural purposes.[4]

RELATIONSHIP MAY BE EXPLAINED BY SIMILARITY IN CONDITIONS ORIGINATING DEPOSITS AND FORESTATION

The accompanying map of the United States shows, about as accurately as is possible with so small a scale, the oil and gas fields, the line of equilibrium between early and late summer rain, and the proportion of evergreens in the forests in three grades, namely less than a third, one-third to two-thirds, and over two-thirds. The oil fields are delineated from a large map published by the U. S. Geological Survey in 1917, supplemented by later information for a few areas, and the climate line is based on my computations made for the article in *Science* previously mentioned, but has not been published before. The mapping of the forests is based on personal observations in most of the states, supplemented by examination of easily accessible literature which need not be specifically referred to here.

As I am not a geologist, I do not feel competent to explain the correlation between petroleum accumulations and rich soils characterized by hardwood forests or prairies, but probably the most plausible suggestion is that the same conditions of deposition which have favored the production of oil have produced limestones and shales that weather into fertile soils. Of course the strata at the surface may be quite different from those several hundred feet below in which the oil occurs, but the latter usually come to the surface somewhere not many miles away. An important relation between oil possibilities and the percentage of fixed carbon in coal has been pointed out by David White[5] and others, and it may be that the pressure which has increased the fixed carbon has also hardened the rocks over the coal so that they weather more slowly and make shallower soils than they would otherwise.

---

[1] See 6th Ann. Rep. Fla. Geol. Surv. (1914), pp. 175-177, 396.

[2] See 12th Ann. Rep. Fla. Geol. Surv. (1919), p. 160, first foot-note.

[3] "Some Factors in the Geographic Distribution of Petroleum"; Bull. Sci. Lab. Denison Univ., Vol. 19, pp. 55-63, pl. 12, 13; 1919. See also the article on "Petroliferous Provinces," by E. G. Woodruff, in Bull. Am. Inst. Min. & Met. Eng., No. 150, pp. 907-912 (June, 1919), reprinted in the *Petroleum Times* (London), Jan. 17, 1920, and discussion thereof by Charles Schuchert in same, No. 155, pp. 3,058-3,070 (November, 1919), and by Mehl in *Science* for May 28, 1920.

[4] A common agricultural practice in the tropics of both hemispheres is said to be clearing a piece of land and cultivating it a few years, and then abandoning it and clearing another, which would hardly be necessary if the soils were as permanently fertile as those of our Mississippi Valley. For a good account of this practice see C. H. Stigand, "The Lost Forests of Africa," in the *Geographical Journal* (London), Vol. 45, pp. 513-520, 1915.

[5] Jour. Wash. Acad. Sci., Vol. 5, pp. 189-212; 1915. Bull. Geol. Soc. Am., Vol. 28, pp. 782-734; 1917. See also M. L. Fuller, Bull. Geol. Soc. Am., Vol. 28, pp. 619, 643, 649-650; 1917. *Economic Geology*, Vol. 14, pp. 536-542, November, 1919; Vol. 15, pp. 225-[illegible], May, 1920; S. J. Lloyd, *Economic Geology*, Vol. 15, pp. 94-96, March, 1920; D. R. Semmes, *Mining and Metallurgy* (Section 5, separately paged), March, 1920; Geol. Surv. Ala., Bull. 22, pp. [illegible]-56, July, 1920.

Smelting Sulphur and Arsenic Ores in China

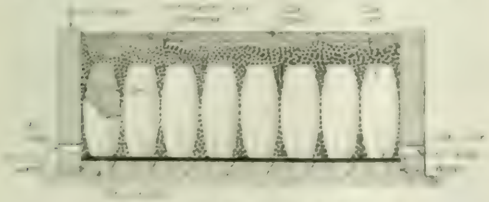
Primitive Methods, Hundreds of Years Old, Still Obtain —Intermittent Processes Using Clay Pots And Retorts Employed

By Robert Slessor
Written for Engineering and Mining Journal

CAKES OF SULPHUR and of arsenic oxide are made in southern Hunan from iron pyrite and arsenopyrite. Like all Chinese metallurgical work, the method is simple, cheap, and inefficient.

The iron pyrite used for sulphur making contains about 35 to 40 per cent of sulphur, but, according to locality, it carries more or less arsenic, lead, and zinc. There is little gangue, usually siliceous, with a small amount of lime. The ore is broken to 1-in. size, a few 4-in. lumps being present, however, as well as the fines. The smelting operation is conducted in a clay retort resting on a clay saucer, which receives the melted sulphur.

The retort is of baked clay, circular in section, about 18 in. high, with diameter of 6 in. at each end and 7 in. at the center. One end is open. The saucer is 8 in. diameter at top and 6 in. at bottom, by about 5 in. high. The retort is filled with the broken ore, the 4-in. lumps being placed along the center line, with the fine ore around, and the 1-in. ore carefully filled in, so as to leave interstices. The retort is filled to within 1 in. from the top, and a ring of dried grass is inserted. The top is covered with 2 in. of soft clay, thinned to about ½ in. at the center. It is then reversed, mouth down, on to the saucer, on which it rests supported by two strips of bamboo. The 1-in. space around the lip of the saucer and the mouth of the retort is luted with a ring of about 1½ in. of soft clay. Eighty of such pots and saucers are arranged in a rectangle. The pots are so placed that the clay rings round the saucers touch each other. A piece of broken earthen pot is placed between the space formed by each four pots, to prevent the fuel from falling down. The four sides of the "furnace" are formed of long stones set together, to about 20 in. in height. Along each long side are a series of air holes, above the level of the saucers.

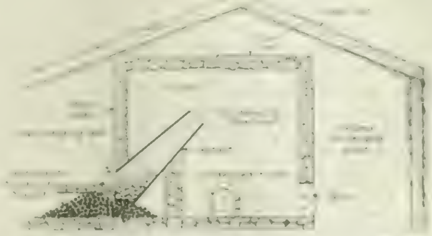


SECTION OF SULPHUR FURNACE

Kindling woods are then packed in the interstices between the pots and charcoal, and coal is added gradually until the whole space between the pots is filled with fuel, level with the top. A layer of old burnt clay lumps is then added, and the whole covered with soft clay.

The air is regulated by the air holes along each side, and by making holes in the clay cover. The whole art of the process is to regulate the heat so as not to sinter the ore into one mass. When the fire begins to take hold, the ore can be heard decrepitating in the pots, and if the explosions are violent, a few filled pots are placed on top to keep the retorts down in place. Water is run around the saucers to a depth of about 3½ in., and as the water is running the melted sulphur cools in the saucers. The thinned center of the lute in the retorts allows the melted sulphur to break through.

The whole operation from lighting to taking out the sulphur cakes lasts from eighteen to twenty hours. Usually, at least two furnaces are in a shed, and while one is being prepared the other is being fired. After each melt, the whole is dismantled and rebuilt. The cinders from the operation are in nowise "purple ore," as the burning extracts only about half or less of the sulphur. Each retort takes about 50 lb. of ore and yields about 5 lb. of sulphur. The sulphur is about 97@98 per cent pure, and is exported for making firecrackers, blasting powder, and medicine. Two furnaces of eighty pots will make about three tons of sulphur from thirty tons of ore. The operation requires the labor of five men about twelve hours daily, and the cost of sulphur is about 3 to 4 Mexican dollars per picul at the plant. Anthracite coal is used, which costs about 7 Mexican dollars per long ton.



ARSENIC FURNACE

The Extraction of Arsenic

Arsenic is extracted from an ore containing about 15 per cent arsenic as arsenopyrite, with a little lead, zinc, and silica, the rest being iron and sulphur. The ore is broken to 5-in. size and roasted in a furnace built of granite boulders or any other rock that is handy.

The furnace consists of a retort and condensing chamber. The base of the retort serves as a hearth, on which is piled the fuel of green wood, charcoal, and anthracite. The draft is regulated by poking holes in the pile of fuel. The retort is inclined and made of burnt clay. A feed hole allows the ore to be placed in front of the fuel, and is covered with a flat slab that is luted down when the charge is put in. The heat is regulated to cause a gentle roast at first, and is gradually raised, after most of the sulphur fumes are driven off.

The arsenic fumes condense as a brown, yellow powder and are drawn from the retort through an opening in the wall. Much fume escapes through the roof and sides, as the clay mortar is not properly put in. Some of this fume is caught in the thatch of the shed at the back, which acts as a second condensing chamber. The grass of the thatch is frequently renewed, and after a charge it is gently beaten to cause the fumes to fall. Each "furnace" consists of four retorts and four condensing chambers, connected in some partitions. Usually two retorts are being fired while two others are being charged and cleaned. Where long rock slabs are not to be had, the roof is often roughly domed like a beehive.

A four-retort furnace takes about one month to build, costs about 25 Mexican dollars, and lasts indefinitely except for repairs to the retort and walls each time the furnace is cleaned. The furnaces last longer than the mines, as many old furnaces, going back to the Ming dynasty (1,500 A.D.) can be seen scattered over the country.

A furnace is about 25 x 8 x 6 ft. high and can produce about three tons of 60 per cent fume monthly, working twelve hours daily. The fume so produced is impure and must be refined in a near-by village. It is slowly roasted several times, and run into cakes of "white arsenic." The No. 1 quality is rose white, and the No. 2 quality is pink red.

Arsenic has always been in great demand in China for the tombs of the richer class. The more arsenic that can be packed into a tomb around the wooden coffin, the more perfectly preserved will be the body. The Chinese belief is that any bodily defects will be transmitted to the body which they will wear in after life.

Most of the lead, zinc, and tungsten mines of southern Hunan were formerly old arsenic mines that have been reopened. Many of these old arsenic mines were worked 500 or more years ago, with apparently the same methods, using steel and blasting powder, as boulders can be seen that were evidently drilled and blasted. These mines were abandoned as the arsenic tenor grew lower. Much of the tungsten exported to America during the war came from the old dumps of these arsenic mines. Once recognized, the tungsten ore was easily hand-picked from the dumps.

Russian Metallurgical Industries

The *Quarterly Journal* of the Russian Economic Association contains several papers dealing with the present condition of the metallurgical industries in Russia which are reviewed in the *Journal* of the Society of Chemical Industry for July 30, 1921. The largest pre-war copper production was at the Kishtim works, in the Urals, where in 1914 more than 32,258 long tons (2,000,000 poods) of copper was produced. This fell off by about 20 per cent during the first years of the war, and has now practically ceased, only a few small works being still in operation.

Although deposits of zinc ore are found all over Russia, the production of zinc metal in 1914 did not exceed 1,129 tons, but works with a productive capacity of 48,387 tons per annum were begun in 1915, and, although not finished, produced 29,032 tons of metallic zinc by the end of 1917. The revolution has arrested the completion of the works, but it is believed that, could they be started again, not only the home market but also foreign demand might be satisfied, especially as many of the Siberian zinc-ore deposits contain sufficient silver and gold to reduce the cost of production below that of the United States or Germany.

Lead-ore mining was begun in Russia in 1704, and during the eighteenth century production steadily increased; it began to decline during the nineteenth century owing to the difficulties encountered in working the complex ores found in Siberia. In 1916, however, works for the production of more than 16,000 tons annually were erected at the Ekibastus mines, and mines were started in the Kirgis steppes, the Caucasus and the Urals. The completion of the South Siberian railway should open up a country rich in lead ores and with good coal deposits, of which those at Ekibastus and Kuz-Chikinsk are already worked. The Russo-Asiatic Consolidated Co., Ltd., on completion of its projects, should be able to produce annually metals and minerals (including coal) to the value of over £40,000,000.

In 1913 Russia produced about 56 per cent of the total world's output of manganese but only 5 per cent of its pig iron. The large surplus of manganese ore supplied 65 per cent of the total German requirements, and as Germany will have to rely almost entirely on Russian supplies, the future of the industry seems assured. The fuel crisis is the real cause of the delay in reconstruction.

Decreased Silver Exports From Chihuahua To the United States

More silver was produced in the Chihuahua consular district (which includes such important silver camps as Parral, Santa Barbara, Santa Eulalia, and Cusihuiriachic) during 1920 than in any year since 1910, according to Consul James B. Stewart in *Commerce Reports*. In fact, judging from the available figures, 1920 was one of Chihuahua's banner years, comparing favorably with the best years previous to 1910 and no doubt exceeding most of them in the total amount of silver produced.

The increased silver production in Chihuahua is not due to the operating of a larger number of mines (fewer are being operated than in former years), but to the ability of large mining companies, mostly American, to work the large low-grade properties, this having been made possible by the installation of modern machinery and new processes of ore handling and treatment. Especially has this been the case in the Parral district, which is one of the world's leading low-grade silver camps.

The following table shows the silver bullion and ore declared at the Chihuahua consulate for export to the United States during the entire year of 1920 and the first six months of 1921:

Items	Calendar Year 1920 Troy Ounces	Calendar Year 1920 Value	First Six Months, 1921 Troy Ounces	First Six Months, 1921 Value
Bullion				
Gold-silver-lead	4,968,570	$4,888,354	3,121,189	$1,866,365
Silver	3,717,747	2,411,250	1,870,786	1,111,304
Raw matte	287,472	241,797	29,854	17,533
Silver ore	187,635	231,621		
Total	9,161,424	$7,773,022	5,021,829	$2,995,202

As the entire silver production of this district is exported to the United States, the preceding table gives a fair idea of the silver produced in the district. These figures, however, must not be taken as showing that the Chihuahua mines are now producing more silver than last year, because for several months the lead smelter at Chihuahua, which produces the gold-silver-lead bullion, has been the only large one of its kind operating in Mexico, and so it has been receiving and smelting rich silver ores and concentrates from various parts of the republic, even from mines in the vicinity of Mexico City. Whereas the ores usually smelted at Chihuahua average around 6 kilos of silver per ton, the high-grade ores being received from the south average as much as 12 and 13 kilos and even more.

BY THE WAY

From a Wandering Subscriber

In one of the South American ports where considerable ore buying is done by several American smelting companies, the agents of two of these companies live respectively next door to and across the street from a respectable native metal engraver who displays prominently the usual engraver's sign in Spanish, *"Grabador de Metales."* One of the many wandering gringo mining engineers, whose first article of faith is that smelting companies are the world's champion robbers, drifted down the street. He stopped before the engraver's sign, contemplated the other signs in the immediate neighborhood and soliloquized aloud:

"Metal grabber, eh! Well, all the ore thieves in this burg seem to live in the same street, but you're the only one with decency enough to say it."

Capacity Wanted

"These days, m'son," said Cap'n Dick, "h'everything is for h'increased capacity. Moore tons per man, larger skips, larger cars, an' so it gaws till h'it seems as though, h'outside o' tha timberin' an' single- an' double-jackin' that we did in the h'early days, we wuz 'ardly minin' h'at all. But, jus' tha same, m'son, t'wuzn't h'as though we didn't 'ave some h'ideas h'as to makin' tha mos' o' wot we 'ad. I remember one time, years h'ago in Grass Valley, Jimmy Trebilcock went to tha livery stable an' sez, 'Gim-me tha bes' ole 'orse thee's got in tha stable. I'm goin' to a gert dance tonight.' 'Thee doesn't want a 'orse, thee wants a 'orse an' buggy,' sez tha h'owner. 'Gos' along do,' sez Jimmy, 'Don't thee tell me w'ot I want. I wants a 'orse with a bloody long back, you—there's five o' us goin'.' "

Alice Does a Little Kicking

"You may be glad to assist [writes Alice to the editor] with advice, if not with situations, the many jobless chemists who are roaming up and down the columns of the technical papers. Thomas Drier, in *Forbes Magazine*, points out the way to a no cost of living, as follows:

> "The chemist has a laboratory stocked with the seventy-eight elementary chemicals. With that stock he can make absolutely every substance needed in his daily life, if he possesses the necessary knowledge properly to combine the elements."

"The necessary knowledge? Bah! A mere trifle! But the stock-rooms of wild laboratories we have known never contain 'the seventy-eight (?) elementary chemicals.' "

Personals

George Johnson, florist and prospector, has returned to his work in Sacramento, Cal., after spending the summer working his claims at Yankee Jims in Placer County.

Elmer A. Wolf and R. A. George have bought the Hill claim next to the Sporting Boy mine in El Dorado County, Cal. They also plan to plant a considerable acreage of grapes.

Luther Burbank will use radium ore in experiments to develop new plants, according to Henry A. Adrian, associate of Burbank.

L. Maquenne and E. Demoussy have published data showing the antagonistic effects of copper and injurious effects of iron on plant roots, which suggest several practical applications.

Lewis Carroll in Wall Street

"It is generally accepted," writes Harry J. Wolf, "that clever promoters regard professional men as 'easy marks.' Engineers are supposed to have an analytical turn of mind, and should therefore be exceptions, but apparently the sharks who try to slip you the red-hot tips do not think so. In any event, I received no less than ten bucket-shop 'market letters' the other day, all within eight hours. On reading their leading recommendations, any mining engineer who has lived in a wide-open mining camp could see a chance to make money by 'coppering' the bets suggested.

"The same evening, while I pondered over the multiplicity of opportunities that had been offered me to play the game of 'Heads you win and tails I lose' by anteing an 'initial payment' or a volatile 'margin,' a certain small boy demanded that the evening story should be a selection from 'Through the Looking Glass,' and it so happened that our progress through this dreamy work included that grotesque little versification called 'Jabberwocky.'

"Later the same evening, a particularly vicious cigar which a friend had given me to smoke after dinner caused a confused short-circuiting and crossing of mental wires, so that bucket shops and jabberwocks got all mixed up, and the following parody was evolved from the cerebral confusion. I send it to you with the thought that if some susceptible young engineer should be so unfortunate as to read a 'market letter' in an unguarded moment, he might counteract the infection by administering at once a full shot of this riptameter":

BUCKETSHOPPY

BY HARRY J. WOLF

With apologies to Lewis Carroll

'Twas bullish, and the guileless lambs
 In slaughter pens did congregate;
All hypnotized by board room dreams,
 They rushed by hundreds to their fate.

Beware the bucket shop, my son!
 The bulls that gore, the bears that scratch;
Beware the payment plan, and shun
 The dope that suckers snatch.

The victim comes, bank roll in hand,
 And eager ear for red hot tips.
For trustful rube the game is planned,
 And headlong in the trap he slips.

Then as his margin fades away,
 And he is breaking through the ice,
He cries for succor in dismay,
 While bear cubs [illegible]

Short sales he tries when [illegible].
 The [illegible]
But little bulls [illegible], and [illegible],
 His profits [illegible].

He listens to the [illegible]
 For payment plan [illegible] preferred.
But when the bucket [illegible]
 His wad is [illegible]!

'Twas bearish, and the guileless lambs
 In slaughter pens did congregate;
All hypnotized by board room dreams,
 They rushed by hundreds to their fate.

CONSULTATION

Assessment Work Must Be Performed

"You have been giving some space to the question of annual assessment on unpatented mining claims. I would like to submit for your opinion a rather common situation. For instance, work is under way but not completed on the last day of the year the assessment work is intended to cover; the work is continued into the following year. When enough has been done to cover the requirements of one year, the owner records his 'Proof of Labor' for the year in which the work ended, leaving the previous year without any recorded evidence of work being done. Where no contest exists is his title jeopardized?

"Another case somewhat less common I believe is this: Because of extra good facilities and efficient work a tunnel is driven or a shaft is sunk a distance that under ordinary circumstances would cost a total equal to the assessment required, but is done at a less expenditure. The owner in his 'Proof of Labor' specifies the footage done instead of the expenditure made. Would a contestant in the face of the filing have to show the work as insufficient to be successful?"

In Bulletin 94 of the U. S. Bureau of Mines, "U. S. Mining Statutes Annotated," by J. W. Thompson, the following annotation is made:

"It is fraud against the Government and the law to hold quartz claims by merely doing a few dollars' worth of work thereon at or near the beginning of the year next following the year on which the claimant failed to do the necessary work, when such work is not commenced with the bona fide intention of being continued until the full amount is done."

Locators are required by law to perform $100 worth of assessment work annually on each claim they hold except when a common improvement benefits all the claims, in which event the aggregate assessment work can be performed on one claim. During the war Congress relieved locators from performing this work. If assessment work is not executed according to the provisions of the mining law, the claim becomes subject to relocation. Another annotation in the same bulletin states: "The requirement that a certain amount of labor each year be done on a mining claim is imperative, and failure to do so renders the claim subject to relocation."

A miner can hardly be said to have title to his claim when it is unpatented. A better expression is possessory right. He does not obtain title from the Government until the land is patented. His possessory right is threatened by a failure to perform the required assessment in the stipulated period. If the locator fails to complete his $100 worth of work on his claim and desires to retain possession of it he should immediately relocate and faithfully perform the work required under the law.

In the example cited by our inquirer the possessory right to the claim would be jeopardized on two grounds: (1) The $100 assessment work was not completed in the first year; (2) a similar amount of work was not done in the second year. In answer to the second paragraph of the inquiry, there is no set standard in mining law by which the value of assessment work can be judged. The value is expressed in dollars, and should the locator be so fortunate as to be able to show a greater amount of development work than an equivalent expenditure would produce on another claim, he should continue his work until the entire $100 has been expended.

No Market for Wollastonite

"Can you give me the following information with reference to the mineral known as wollastonite:

"1. What use is [illegible] this mineral?
"2. Has it a c[illegible] value?
"3. Is there a [illegible] this mineral?

"For your information, will state that there is a large deposit of this mineral in this section, which, according to test, runs about 98 per cent pure and of which there is apparently an unlimited supply.

"If you know of any concern, company, or individual through whom a market for this mineral could be secured, I shall appreciate it as a personal favor if you will give me the address of such company, concern, or individual. Shall be glad to send you a sample of this mineral if you care to have me do so."

The mineral wollastonite belongs to the pyroxene group of rock-forming minerals and is a silicate of calcium. So far as *Engineering and Mining Journal* is aware, it has no commercial application. It is difficult to see from its composition exactly how this mineral could be used. Containing both lime and silica, it cannot even be employed efficiently as a flux. It might be well to communicate with the U. S. Geological Survey, or the U. S. Bureau of Mines, Washington, D. C., to ascertain whether either of these two organizations has heard of any commercial application of wollastonite.

Consumption of Monazite

"Can you tell me what the consumption per annum in the United States is of a monazite that contains 8 per cent of thorium oxide? Where can I sell it? Who are the people likely to want to buy the mine?"

The production of monazite sand in the United States is small, and probably does not amount to more than $5,000 in value per annum. No definite production figures are given by the U. S. Geological Survey for 1919 or 1920, but in 1915, 1916, and 1917 production averaged about $2,900. This gives some idea of the smallness of the industry. Even considering imports of monazite, which reached their peak value of $355,017 in 1917, the magnitude of monazite production and utilization is found to be low.

A monazite sand containing 8 per cent of thorium oxide is a rich grade of mineral and much higher than the average of the monazite produced for commercial purposes in the United States. Monazite may be sold to mineral dealers, chemical manufacturers, light manufacturers, and incandescent gas and electric light manufacturers. A list of possible consumers will be mailed to subscribers upon request. The same companies or individuals offer the best market for the disposal of a mine.

In the Oct. 22, 1921, issue of *Engineering and Mining Journal*, under Consultation, was given some further general information regarding monazite and its uses.

HANDY KNOWLEDGE

A Method for Rapid Removal of Powder Smoke in Tunnels

BY WALTER S. WEEKS AND GEORGE L. WOLFLIN

Written for Engineering and Mining Journal

One of the principal factors which control the speed and economy of tunnel driving is the ventilation system. This must provide for the rapid removal of powder smoke after blasting and supply a sufficient quantity of fresh air for the men at the breast. The object of this paper is to describe experiments made to improve methods of tunnel ventilation. These entailed many measurements of the velocity of air flowing in pipes, so a method for quickly determining that velocity was first developed.

The simplest instrument for measuring air velocity is the anemometer. The velocity of air flowing in a pipe is greatest near the middle and least near the sides. There is no way of determining the mean velocity directly with an anemometer. The anemometer is so large with relation to the pipe that traversing the pipe gives incorrect results. The method used in the experimentation here described was to hang the anemometer in the center of the pipe and with the anemometer running, to make two traverses of the pipe at right angles to each other with the Pitot tube. The arrangement of the apparatus is shown in Fig. 1.

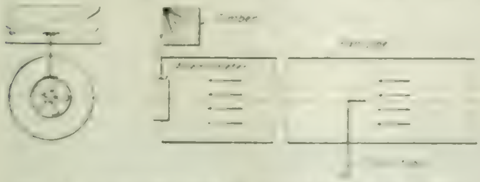


FIG. 1. ARRANGEMENT OF APPARATUS FOR DETERMINING VELOCITY OF AIR

METHOD OF MAKING TEST

Almost all anemometers are tapped with a screw thread at the base. A brass rod with a cross-piece at the top should be fitted into this, so that the anemometer can be held in the center of the pipe without the hand interfering with the air current. A stop-watch was started at the beginning of a test and stopped with the anemometer. The velocity was calculated from the anemometer reading, and this velocity was corrected by the maker's correction.

The average velocity in the pipe was calculated from the Pitot tube readings. The true average velocity determined by the Pitot tube, divided by the corrected reading of the anemometer, gives a factor by which the velocity determined by the anemometer must be multiplied to give the average velocity in the pipe. All of the work was done on 12-in. pipe, so the factors that are here given are applicable only to this size of pipe. Factors for other sizes may be determined by the same method.

We calibrated different sizes and types of anemometers, but for the ventilation experiments used a high-speed instrument with a range up to 6,000 ft. per minute. An anemometer should not be used for a velocity above the maker's rating. They are absolutely unreliable if so employed. The ordinary anemometer for measuring velocity in a drift is seldom rated above 2,000 ft. per minute. Velocities in pipes are usually much greater, so a high-speed anemometer should be used.

The first tests were made with the fan blowing. The average velocity was varied from 900 ft. to 2,100 ft. per minute. A 6-in. Keuffel & Esser anemometer, rated at 6,000 ft. per minute, gave readings which produced an average factor of 0.85. This means that if those making the test hold the anemometer in the center of the pipe as shown in the sketch, and determine the velocity in feet per minute, and apply the maker's correction for that velocity, this value multiplied by 0.85 will give the average velocity in a 12-in. fan pipe.

As the air flows fastest in the center of the pipe, it would be supposed that a smaller anemometer would give higher readings, because the average velocity of the air which strikes the blades would be greater. This did not prove to be the fact. The smaller instrument gave lower readings and demanded a slightly higher correction factor, usually about 0.88. The interference of the air current by the dial probably made eddies which caused this result. If the factor 0.85 is applied to the reading of any anemometer used under these conditions and within the rated speed of the instrument, a close approximation of the average velocity will be obtained.

Next a set of readings was taken with the fan exhausting. With the same average velocity in the pipe, the anemometer gives higher readings when the fan is exhausting than when blowing. This is because the column of air contracts when it enters the pipe so that the air that passes through the blades is going faster than it would if the air entered the pipe [illegible]. We found the factor to be 0.70 when the fan was exhausting.

That there may be no doubt as to the use of these factors let us correct two readings.

1. Fan blowing. Anemometer reading, [illegible]. Maker's correction —50. Average velocity [illegible] × [illegible] = [illegible].

2. Fan exhausting. Anemometer reading, [illegible]. Maker's correction —34. Average velocity = [illegible] × [illegible] = [illegible].

Turning to the ventilation system. In preliminary tests we determined the following facts:

1. To remove smoke quickly from the breast the air must be delivered at the toe of the muck pile so that it sweeps up the muck pile and forces the smoke out along the back.

2. There is a critical velocity of air in a tunnel, below which the smoke is merely stirred up and diluted. If this velocity is exceeded the smoke moves out as a body.

The system that we devised may be best explained by referring to Fig. 2. A is the main fan outside, equipped with a four-gate system so that the fan may exhaust or blow. The main air pipe B is carried in along the back to within 100 ft. of the breast. C is a low pressure auxiliary fan direct-connected to a motor. It is mounted on handle bars as shown in Fig. 3. To the small fan is connected enough 12-in. Flexoid tubing to reach to the toe of the muck pile. *D* is a canvas closing the tunnel to within 2 ft. of the back. An opening is left at the top so that the operator may watch and control the smoke. Before blasting a small pulley is fastened behind a timber near the breast or anchored to a wooden plug in the side. A small wire rope is led from the fan *C* to the pulley and back where it is fastened to the Flexoid which is piled up at the fan. After blasting the Flexoid is quickly pulled to the breast.

The mode of procedure after blasting is as follows: The fan *A* is started exhausting and the fan *C* is started blowing. The speed with which the smoke can be removed is determined by the capacity of the fan *A*. If we bring the smoke back from the breast as fast as the exhaust pipe can take it out we have attained the maximum speed possible with the equipment.

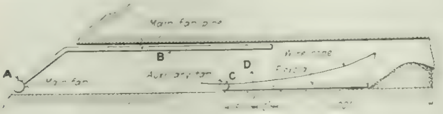


FIG. 2. ARRANGEMENT OF APPARATUS IN SYSTEM DEVISED FOR REMOVING SMOKE RAPIDLY

When we start blowing with the fan *C* we may force any amount to the breast—the more the better. This will clear the breast almost instantly and start the column of smoke moving out. When, however, the column of smoke reaches the exhaust, if more air is going through the Flexoid than is removed through pipe *B*, the smoke will pass the brattice and enter the fan *C* and be driven to the breast, so as soon as the smoke arrives at the exhaust pipe, a gate on the auxiliary fan is closed until no smoke passes the curtain.

As we have said, the speed with which the smoke is removed depends upon the capacity of the outside fan, but for reasons of economy we wish to do the work with the smallest amount of air that will take the smoke out in a short time, say ten minutes.

To make the smoke for the tests we used 115 grams of black sporting powder. This made a dense smoke comparable to that from a round of shots.

The lowest velocity of air from the breast back to the entrance of the exhaust pipe must exceed the critical velocity of which we have already spoken. We determined this velocity to be 30 ft. per minute. That is, the auxiliary fan must force sufficient air through the Flexoid to cause a velocity of 30 ft. per minute toward the exhaust. The amount of air taken out through the exhaust must exceed the amount blown to the breast, to prevent short circuiting. If the brattice is used as shown, the exhaust must take out 10 per cent more air than the auxiliary blows in. If the brattice or curtain is not used, the exhaust fan must take out 30 per cent more air than the auxiliary fan blows in.

We were able to clear the smoke from the tunnel in nine minutes with the black powder smoke. We shot a round with dynamite and found the tunnel clear for 40 ft. back of the breast in five minutes and completely clear in nine minutes.

Let us next see how we can use the data to select an equipment: A drift is 5 x 7 ft. or 35 sq.ft. in area. To cause a velocity of 30 ft. per minute would require a capacity for the auxiliary fan of 1,050 cu.ft. per minute. This is the minimum. A fan of larger capacity should be selected, because any amount of air can be blown to the breast before the smoke reaches the exhaust pipe. If the brattice is used the capacity of the outside fan must be 110 × 1,050, or 1,150 cu.ft. If the brattice is not used the exhaust fan must take out 130 × 1,050, or 1,365 cu.ft.

The distance from the breast to the end of the exhaust pipe is of course not fixed. This may be 150 ft. if necessary.

After the smoke is removed we have the problem of supplying air for the men to breathe and to make them comfortable. If it requires only ten or fifteen minutes to remove the smoke, we can afford to use a large amount of power during this operation. It is the steady use of power during the twenty-four hours to supply proper working conditions that makes the costs mount, so we must run the fans during this time with as small amount of power as possible and yet supply a healthful atmosphere.

The amount of air consumed by a man each minute is very small, about 1 cu.ft. We must, however, dilute such gases as may be given off from the muck. If the temperature is below 70 deg. F. it will be necessary to deliver at the breast only enough air to make an atmosphere healthful to breathe. To accomplish this, the auxiliary fan is stopped and the Flexoid is put on the main air pipe. The outside fan is reversed so that it blows, and is slowed down until enough air is delivered at the breast.

If the temperature is high and the humidity is high the best remedy is to blow in from outside a large amount of air of low humidity. In long tunnels, however, this may be economically impossible. The effect of high temperature and humidity may be counteracted a good deal by a vigorous circulation. This may be accomplished in the following manner:

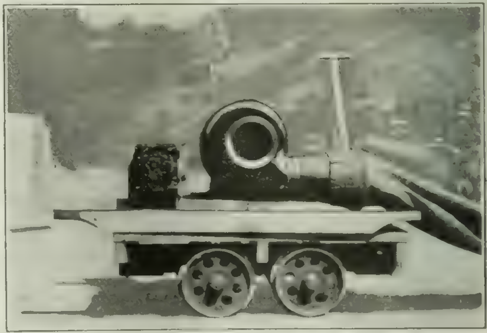


FIG. 3. AUXILIARY FAN *C*, WITH FLEXOID TUBING ATTACHED

Leave the Flexoid on the auxiliary fan and set the fan at the end of the main air pipe. Put an elbow and short length of pipe on the main air pipe so that the air from the outside is delivered near the intake of the auxiliary fan. Run the outside fan to deliver about 1,000 cu.ft. of fresh air and turn the auxiliary fan to deliver at the breast 5,000 or 6,000 cu.ft. The men will thus receive each minute 1,000 cu.ft. of fresh air and 4,000 or 5,000 ft. of recirculated air. The power consumed by the auxiliary fan will be small because it is blowing against a small pressure, and thus the cost will not be unduly high.

THE PETROLEUM INDUSTRY

Strikers in San Joaquin Valley Attempting "Nationalization"

Development work in the oil fields of Kern County, Cal., continues to be held up by the strike of the oil workers. An apparent deadlock prevails. D. S. Ewing, vice-president of the Oil Producers' Association of Californa, after a recent visit to the oil fields, gave out a statement, the following being an abstract:

"The Oilfield Gas Well and Refinery Workers of America are not organized as other organizations in the United States, for the reason that it is an industrial organization of the various crafts in the different industries. In all craft labor organizations some knowledge and experience of the business is required of the applicant for membership, but in the Oilfield Gas Well and Refinery Workers of America no knowledge whatever is required of the member before he is admitted into the organization, and all that is necessary is that the applicant either be at work in the industry or intending to go to work therein.

"No craft union has for its ultimate object 'nationalization' of the industry in which it is engaged, while the direct ultimate object of the Oilfield and Gas Well and Refinery Workers is the 'nationalization' of the industry in which they are engaged. They admit their satisfaction with the wage offered, with the working conditions, and with the hours of labor; they even admit that they are not intending to demand the closed shop, but will permit the operators in the industry to employ whomsoever they please, irrespective of affiliations with labor organizations, but boldly and publicly state that the only point of difference between them and the operators in the industry is the mediation by the Federal Government in order ultimately to bring about complete 'nationalization' of the industry.

"From the fact that this particular strike does not at present affect the whole industry even in the State of California, nor does it affect the industry in any other part of the United States, nor does it affect all of the operators in the San Joaquin Valley, irrespective of the question as to whether they have heretofore signed an agreement with this oil workers' union or not, it is apparent that the only object of this organization is to force a few of the operators in the industry to recognize the principle that the Government has the right to dictate the terms of labor contracts in private industry between these few operators and this oil workers' union, so that it may use that first step as an entering wedge upon which to compel all other operators, first in the San Joaquin Valley, to recognize this principle of 'nationalization' and thereafter to attempt to compel the whole industry in the United States to recognize this principle.

"After one industry is forced to recognize the principle of 'nationalization' then, of course, it would be easy for them to take one industry after another and force Federal governmental control upon all of those industries in such a way that sooner or later complete 'nationalization' would be put into existence. It is a noticeable fact that all statements emanating from the headquarters of the principal officers of this workmen's organization are to the effect that this strike is a 'peaceful strike,' though at the same time these statements admit that if the operators even attempt to resume operations upon their respective properties every effort which could be brought into existence on their part will be used by them to stop such operations, and of course this could only mean that destruction of property and loss of life would ensue. They do not seem to realize or recognize what a peaceful strike is when they admit the maintenance of armed patrols upon the public highways, as well as upon private property, in order to prevent the operators from doing any work upon those properties in any way; also by their admission to the secretary to the Governor of the State of California of the violation of the law in this respect and of the infringement of the rights of citizenship in the State of California.

"They knew from the inception of this strike that it was not and could not be peaceful and they also knew then and know now that the only reason that there has not been destruction of property and loss of life is that the operators themselves have refrained from asserting their constitutional rights in an attempt to operate these properties."

Northwestern Canada Oil Fields

SPECIAL CORRESPONDENCE

The Imperial Oil Co. has officially announced the striking of a 2,000,000 ft. flow of gas in the Pouce Coupe field, Province of Alberta, now being prospected. The gas was reached at a depth of 1,650 ft. Drilling began last June. At a depth of 150 ft. the drill encountered oil and gas, and since then has passed through a dark marine shale with a considerable showing of oil. A. McQueen, vice-president of the company, is quoted as saying that drilling will be prosecuted all winter in all of the Alberta fields now being tested. He asserts that drilling during the next twelve months should reach such a stage as to elicit definite information regarding the oil-producing possibilities of all the sections of western Canada now receiving attention.

Reports have been received from officials of the Mines Department, Ottawa, who have been in the Fort Norman section of northwestern Canada. They take a middle position in regard to the commercial possibilities of this field—neither optimistic nor pessimistic. They say that undoubtedly there is oil in that section, that much of the likely area has not yet been explored, but that production in large quantities is not yet in evidence. Though one gusher was struck and poured forth in volume for a time, the run has now fallen to a few barrels a day. Another boring has struck oil at 1,500 ft. but only in small quantities. The officials do not condemn the field, nor do they deny its possibilities; but on the basis of what has been discovered they are not enthusiastic, especially in view of the isolation of the territory and transportation and other difficulties.

Terry Field, Texas, Under Development

SPECIAL CORRESPONDENCE

Extensive development work will begin immediately in the new Terry field, in Orange County, Tex. The Gulf Petroleum Co. has purchased the [illegible] gusher from the Edgerly Petroleum Co., and will at once install a barge line to haul the oil to Sabine until such time as increased pipe-line capacity is [illegible]. This company is moving three new rigs into the field. The Humble Oil & Refining Co. is also bringing in two more rigs.

The White Point Oil & Gas Co. has contracted to have five wells drilled on its property in the White's Point gas field. It was in this area that a gas well ran wild for three years under an estimated pressure of 500 lb. before being capped.

Recent Patents

Zinc Extraction—No. 1,378,699. R. L. Lloyd, New York, N. Y., assignor to Dwight & Lloyd Metallurgical Co., New York, N. Y. A method for treating a zinc-bearing ore or material containing a negligible quantity of sulphur, consisting in mixing with a mass of such material a reducing agent, subjecting the commingled materials to a temperature lower than that at which zinc reduces and volatilizes, then subjecting the mass to the action of a solvent and dissolving out therefrom the zinc component. In case sulphur is present, the process given in patent No. 1,378,822 is used. This consists in roasting the ore and forming soluble zinc compounds which are dissolved out. The residue is then mixed with a reducing agent and the process of the first patent is followed for the remainder of the zinc.

Chloridizing—No. 1,388,086. E. A. Ashcroft, London, England. A process of treating ores embodying the conversion of the metallic constituents into chlorides and combining these with an alloy of heavy and light metals to effect precipitation of the extracted metals.

Pneumatic Flotation Machine—No. 1,378,920. R. S. Towne, New York, N. Y., and F. B. Flinn, Orange, N. J., assignors to Pneumatic Process Flotation Co., New York, N. Y. Each unit of this machine consists of a cylindrical body and a conical bottom. A porous plate is fitted in at the junction of the two, with a small space left around the periphery, so that the tailing may pass down into the conical bottom and thence to the next unit, or to waste.

Metallurgical Furnace—No. 1,379,083. G. H. Clevenger, Washington, D. C., assignor to Research Corporation, New York, N. Y. A furnace having a reaction zone through which material to be treated is moved progressively, and means for burning and passing a combustible gas through such zone.

Thickener—No. 1,379,095. A. L. Genter, Salt Lake City, Utah, assignor of one-half to General Engineering Co., Salt Lake City, Utah. A continuous thickening process consisting in submerging a series of hollow filter elements in the mixture being thickened, in a common reservoir; and continuously cleaning and removing the filtrate from any desired portion of the filter elements.

Zinc Smelting—No. 1,378,411. J. W. Hegeler, Danville, Ill. A preliminary treatment for the purpose of producing a fixed mixture of zinc ore and carbon, which consists in mixing ore and coal and then coking the resultant material.

Flotation Reagent — No. 1,378,562 R. E. Sayre, Pittsburgh, Pa., assignor to Metal Recovery Co., New York, N. Y. The addition of a small amount of an aldehyde condensation product to the mineral pulp before flotation.

Flotation Machine—No. 1,390,080. S. L. Boggs, Ivanhoe, Va. A machine comprising an agitation compartment, a froth overflow, and settling chamber, and means for removing the mineral concentrate and tailing.

Amalgamating Sluice—No. 1,379,417. J. W. Pollock, Sawtelle, Cal. A sluice with a riffled screen covering a cavity in which an amalgamating tray is fitted.

Book Reviews

Introduction to the Study of Minerals and Rocks. By Austin Flint Rogers, Ph.D. Flexible Cover; 5 x 7; pp. 503; 577 figures. Second Edition. McGraw-Hill Book Co. 1921. Price, $4.

This handy and useful volume is planned for use both as a textbook and in the laboratory and field. The first part treats of the properties of minerals, chemical, morphological, physical, and optical. Part II describes 175 carefully selected minerals, including all the common minerals and most of those of any special economic, geological, or scientific importance. The very common minerals, fifty-six in number, are distinguished by large type, and may thus be selected for a shorter course of instruction in mineralogy. Part III contains an elementary discussion of the occurrence, association, and origin of minerals, including a brief description of some of the more common and important rock types and also of the prominent classes of veins and replacement deposits. Part IV treats of the determination of minerals.

Mining Laws. By Calvert Wilson. Paper; 5½ x 8¾; pp. 240. Calvert Wilson, 340 Wilcox Building, Los Angeles, Cal. Price, $1.50.

This is a compilation, by an attorney, of the important mining laws of the United States and those of Arizona, California, Nevada, Oregon, and Utah. It is not a guide to solving legal problems without the aid of a lawyer, but it will be found convenient as a reference, particularly as to recent enactments. A valuable feature is the reproduction of the blank forms required by law for location and other notices and affidavits of various kinds that may be needed in handling mineral property.

Annual Statistical Report of the American Iron and Steel Institute, 1920—Cloth; pp. 96; 6¼ x 9⅜. American Iron and Steel Institute, New York.

The ninth annual report contains, as in past years, the statistics of the iron and steel and allied industries of the United States and Canada. The information has been prepared in tabular form and contains most complete data on the production of pig iron, steel, steel products, and related manufactures. Materials consumed, exports and imports, and average monthly and yearly prices are also given.

Technical Papers

Oil Shale Distillation—The department of chemistry and research of the Day Company, San Francisco, Cal., has issued Bulletin No. 3, "Principles and Methods of Oil Shale Distillation," which discusses the factors governing the efficiency, economy, and oil recovery of a retort considered from the standpoint of the retort alone and eliminating the factors introduced by the type of shale or its preparation before retorting. A diagrammatic sketch and description of the Day-Heller retort are given.

Hewitt Oil Field—"Petroleum Engineering in the Hewitt Oil Field," by T. E. Swigart and F. X. Schwarzenbek, has been issued jointly by the U. S. Bureau of Mines, the State of Oklahoma, and the Ardmore Chamber of Commerce. This report treats of the various phases of the oil industry from the time drilling is begun until oil is delivered to the gathering system of the pipe line. The subjects covered are not confined to those of a purely engineering nature, but the writers have taken the liberty of discussing many practical problems as well. The report covers 132 pages and many illustrations, diagrams and charts are given.

Petroleum—The principal deposits of petroleum throughout the world are outlined in "Petroleum," a 110-page monograph of the Imperial Institute, recently issued. (John Murray, 50A Albemarle St., London, W. 1; price 5s.)

Vanadium—The University of Arizona and Arizona Bureau of Mines have recently issued Bulletin 115, Mineral Technology Series No. 26, "Vanadium," by M. A. Allen and G. M. Butler. This bulletin covers quite thoroughly the occurrence, production, uses, treatment, and other information concerning vanadium ores. Included is a list of vanadium claim owners in Arizona. It may be obtained on application to the Arizona Bureau of Mines, Tucson, Ariz.

Precipitating Copper—An article by Joseph Irving, Jr., in the *Mining and Scientific Press* for Oct. 15 (San Francisco, Cal.; price 15c.) describes experiments on precipitating copper in a Dorr vat, using scrap iron, which were carried out at the leaching plant of the Nevada-Douglas Consolidated Copper Co.

Brazilian Gold Mines—A short history of gold-mining operations in Brazil is contained in a two-page article in *Brazilian Business* for September (Rio de Janeiro; price 25c.)

Rope Drive—In *The Travelers Standard* for October (Travelers Insurance Co., Hartford, Conn.; free) is a seven-page article on the rope drive for machinery in which the principal advantages are summarized and information is given on the proper method of installation.

American Mining Congress Meets at Chicago

Mine Taxation, Standardization, the Gold and Tariff Situations, and Mining Education Among Topics Discussed at Convention —W. J. Loring Re-elected President

Written for Engineering and Mining Journal

QUESTIONS of real importance, such as standardization and state taxation, occupied the attention of the delegates to the convention of the American Mining Congress held in Chicago last week. About 470 had registered by the end of the second day, and more came later in the week. This number included many coal and machinery men.

W. J. Loring was re-elected president of the organization; James F. Callbreath secretary; D. B. Wentz, first vice-president; E. L. Doheny, second vice-president; and T. T. Brewster, third vice-president.

The convention as well as the machinery exposition was in full swing by the evening of the first day, a fact in itself complimentary to the management. The sessions of the former were held either in the Congress Hotel or in the hall of the Coliseum, adjoining the exposition floor. Sessions on standardization and the formal opening of the exposition comprised the first day's program. The feature of the latter was a message from President Harding commenting on conditions in the coal industry. Mayor Thompson, of Chicago, was to have greeted the delegates, but sent the Corporation Counsel instead, who welcomed all to the city.

THE STANDARDIZATION CONFERENCE

The Standardization Conference was stretched over several days, as were most of the other conferences. Charles A. Mitke, the chairman of the Metal Mines Branch, was absent, being in South America. T. O. McGrath, of Bisbee, Ariz., acted in his place. The only subcommittee of this branch to present a completed report was that on Underground Transportation, the others merely reporting progress. This was largely owing to the fact that so many plants have suspended operation during the year and so curtailed the forces that the data necessary to complete the reports were unobtainable.

According to Mr Mitke's report, the Metal Mines Branch at present consists of nine subcommittees, covering the following subjects: Drilling Machines and Drill Steel; Underground Transportation; Fire Fighting Equipment; Steam Shovel Equipment and Operation; Mechanical Loading Underground; Metal Mine Ventilation; Mine Timbering; Mine Drainage, and Metal Mine Accounting.

All of these committees have been at work, and though the progress made thus far is such that it does not readily lend itself to publication, it is of the utmost importance in paving the way for the standards which the committees hope eventually to evolve.

The standardization movement, according to Mr Mitke, is not a matter for immediate decision, but rather a slow growth, the details composing the various units of standardization being worked out by engineers in various mining camps throughout the country. In this connection the report states that there are general inquiries by the various departments of leading mining companies for simpler methods, a more economical classification of products, a reduction in the number of stages of routine, and an extension of the previous standards to much further dimensions. Naturally, these inquiries are largely in the nature of investigations, which are taken up and discussed pro and con before they can be crystallized into local standards. The work of the Metal Mines Branch has been extended during the present year by the addition of two new committees on metal-mine accounting and metal-mine drainage.

Both the metal and the coal sections of the Standardization Division of the American Mining Congress are working harmoniously with the American Engineering Standards Committee, the U. S. Bureau of Mines, and other mining organizations interested in the standardization movement. It is believed that this co-operation will be of the utmost importance when the time arrives for the formation of national standards and their adoption by the metal and coal industries.

The subject of standardization was considered from other angles in a number of addresses. S. J. Williams, of the National Safety Council, spoke on "Safety and Standards"; C. R. Thomas, editor of the *Professional Engineer*, on "Standardizing Research Results Through Public Information"; C. E. Lesher, of *Coal Age*, on "The Mining Industry's View of Standardization"; and P. G. Agnew, secretary of the American Engineering Standards Committee, on "Industrial Standardization in Europe." C. E. Butterfield, of the Associated Companies, had for his subject the "Benefit of Standardization as Reflected by Insurance Rates."

Among the other papers on the subject was a brief one by Colonel Warren R. Roberts, chairman of the Coal Section, on the important subject of "National Co-ordination of Standardization Through the General Correlating Committee." This necessary committee, which reports to the American Engineering Standards Committee, was organized last year, and its method of functioning was sketched by Colonel Roberts.

THE CONFERENCE ON MINE TAXATION

The Conference on Mine Taxation had as its object the gathering of facts on taxation, so that they might be placed in the hands of the state legislatures to secure more uniform taxation laws. Paul Armitage presided over the sessions, with McKinley W. Kriegh, head of the Tax Division of the congress, as secretary.

According to Mr. Armitage, three distinct and mutually inconsistent points of view as to taxing mines have prevailed; namely, a policy of subsidation; a policy of equalization; and, lastly, a policy of penalization of mines. In recent years among the states there has been a progressive movement toward penalization. This movement has been growing in force, according to Mr. Armitage, until in certain states mines are in the position where they cannot operate against it. Mines are national, in part international, not local, and in that respect are distinct from real property. They do not sell their product in the state, but over the entire country in competition with mines of other states and other countries, and, therefore, uniform taxation was greatly needed.

General N. W. MacChesney, of the National Conference of Commissioners on Uniform State Laws, described the method of operation of that body and indicated the difficulties to be encountered in securing uniform tax legislation. His organization, he said, had not contributed much in this direction, principally because each state regarded the matter as its own concern. On the other hand, he declared, there is a growing feeling that a state cannot afford to penalize its own industry so as to drive it away. If the matter were approached from this angle, he said, some progress might be made. The National Conference of Commissioners on Uniform State Laws could be of real service, if desired, in formulating an act which would stand a chance of passing in the various states, particularly if backed by the Mining Congress in the legislatures.

Robert N. Miller, formerly Solicitor of Internal Revenue, was firmly convinced that the movement toward uniform state taxation was very important. If the movement started now, said he, and took fifteen years to develop to fruition in a reasonable number of uniform state tax laws on mining, it still would be worth while to start now. The reason why state laws are so often poor in theory is because of the lack of understanding of fundamentals, but this would lessen as the matter is more extensively discussed and understood.

The idea seems to be growing, said Mr. Miller, that a man has no right to buy natural resources, and that if he has paid a million for them he has bought something in which the people have no right to trade. This idea is wrong, he said. Another point made by the speaker was that there is a natural restraint on the taxing power even when directed against a small state if the people of the taxing sovereignty use the power. After they have gone a certain way in taxing a small group, they begin to wake up and find the supply of what they need is falling off. This restraint was lacking in the case of mine taxation, because mine products are not consumed locally.

The mine tax situation in New Mexico and Colorado was outlined briefly by Judge E. C. Stimson. He characterized taxation as an effort to get the most feathers from the goose with the least squawking. He gave the salient points of the recently enacted mine taxation law of New Mexico.

Mine taxation in Montana was discussed by Dan Kelly, an attorney of the Anaconda company. It was his judgment, said Mr. Kelly, that taxpayers' rights are better protected by constitutional provisions that are inflexible and furnish the same yardstick for everybody. The method of assessing mines in Montana is prescribed in the constitution of the state.

The classification law passed in the last two years provides in substance that all property be originally valued at its full cash value. The average levy in Montana is a tax on slightly over 30 per cent of the actual value, whereas the proceeds of mines are taxed at 100 per cent, thus putting Montana in the same position as Utah.

All taxes considered, the total is such that in one year, for instance, the Anaconda company paid $20.13 out of every $100 that went into the State Treasury. In concluding, Mr. Kelly stated that uniform laws will not necessarily mean uniform taxes.

Mine taxation in Minnesota was discussed by J. G. Armson, of the Minnesota Tax Commission, who described the method pursued by the commission in valuing iron ore in the ground for purposes of taxation and the steps by which this valuation was finally determined.

The total of taxes levied for all state and local purposes on mineral property in 1920 amounted to $20,255,223, according to Mr. Armson. Of this amount the state levied $1,603,119 and the counties and local districts $18,652,104. He later stated that the total in 1920 was much the greatest ever levied.

Some instances of local levies were cited by Mr. Armson. The average per-capita levy for local and school purposes in seventy-seven cities and villages in the state, not situated in the mining districts, was $31.89 in 1920, and in seventeen cities and villages in the mining districts the average per-capita levy for local and school purposes last year was $164.29. In one village of about 2,000 inhabitants the levy represented a per-capita tax of $557.28 for every man, woman, and child in the village. Another village levied $320.16; one $263.15; and another $244.91, and Hibbing, the so-called "richest village in the world," had a per-capita tax levy for local and school purposes of $222.13 for each of its 15,000 inhabitants. A bill was passed at the last Legislature limiting the per-capita levy for local and school purposes to $160.

A paper explaining the laws of Mexico in reference to the taxation of mines was read by L. de Silva, specially commissioned by President Obregon.

The local mine tax law of Utah was the subject of a brief talk by J. C. Dick, formerly head of the Natural Resources Division of the Income Tax Unit at Washington. Mr. Dick said that the valuation of mines for state purposes, for Federal purposes, or for another purpose involved three different and distinct principles. The valuation of mines for state tax purposes is altogether a state issue, according to Mr. Dick. The method used in one state might not be applicable in another.

Mr. Dick said also that the net-proceeds method of taxing or valuing mines was fair, declaring, "I believe that three times the net proceeds is right. . . . Maybe three times is pretty near the value of the mines in Utah and pretty near the share of the tax that the mining industry should pay. The mining industry of Utah wants to pay its full share, of course." In determining the full share, Mr. Dick thought that the millions spent in prospecting and finding these mines should be taken into account.

Charles R. Howe, chairman of the Tax Commission of Arizona, discussed the system of taxing mines in that state. This, he explained, is predicated on three things: First, the needs of government; second, the ability to pay; and third, the wasting asset with reference to the future of the state. The principal advantages claimed for it are elasticity, avoidance of peaks and hollows or lean years and fat years, and, lastly, equalization of the burden within the state.

The tax system of Michigan was characterized by L. B. Barrett as being purely an ad valorem system. All property in the state is assessed at its full value. There is no classification of property for tax purposes, and no attempt is made to treat mines in a differ manner than that applied to farms.

THE GOLD CONFERENCE

The reply of Senator Oddie[1], of Nevada, to the statement of Secretary Mellon, of the Treasury, which dealt with the resolution on the gold situation recently presented to him by twenty-two Western Senators, was given out in time for it to be the feature topic of the Gold Conference, which was presided over by H. N. Lawrie, economist of the American Mining Congress. Another question of great importance that received attention was that of exchange stabilization. A bill (H. R. 8404) has been introduced recently at Washington calling for an international conference to study this problem. A large amount of data on this subject was recently placed by Mr. Lawrie before the House Committee on Banking and Currency, and this material formed the nucleus of the discussion at the conference. A feature of this data was a series of nine charts giving the exchange fluctuation for as many countries from 1918 to date.

THE TARIFF CONFERENCE

The Fordney Tariff Bill having passed the House and being before the Senate Finance Committee, there was little for the Tariff Conference to do. Herbert Wilson Smith, chief of the tariff division of the Mining Congress, presided at the sessions, the discussions at which were of an informal nature and bore on the varying needs and hopes of the different producers. A chart recently prepared by Mr. Smith, giving all necessary statistical information about every mineral produced in the country for which tariff protection is sought, was found very valuable.

THE EDUCATIONAL CONFERENCE

The Educational Conference was formed in St. Louis in 1919 and met in Denver last year. Its purpose is to discuss problems in mining and metallurgical education and those of the State Geological Surveys and other public-service organizations relating to mining. This year's meeting was confined to mining and metallurgical education. It was conducted under the chairmanship of Charles H. Fulton, of the Missouri School of Mines, and practically all of the mining schools had representatives in attendance. The committee decided to continue its activities under the auspices of the American Mining Congress, as the annual meeting of the congress affords an exceptional opportunity for those engaged in this work to exchange views and opinions aside from taking formal action.

The principal subject discussed was "What Is the Scope and Content of a Modern Course in Mining or Metallurgy?" In this connection a paper on "Can an Efficient Course in Mining Be Given in Four Years?" by Prof. Robert Peele, of Columbia University, was read, and fully discussed. Prof. J. R. Nelson, of the University of Michigan, read a paper on "The Development of a Special English Course for Engineering Students." The subject of mathematics in the mining and metallurgical course was presented by Dean Francis A. Thomson, of the School of Mines of the University of Idaho, and was discussed at length and with considerable difference of opinion. President C. C. O'Harra, of the South Dakota School of Mines, spoke on the desirability of some revision of the mining curriculum to permit the introduction of biological subjects and other studies necessary to an understanding of life and human relationship in industry. Prof. Arthur L. Walker discussed the six-year course in mining and metallurgy offered by Columbia University and elicited much interesting comment. A paper by Prof. E. A. Hersam, of the University of California, on "The Training in College for the Practice of Metallurgy," was read in abstract. Prof. F. W. Sperr, of the Michigan College of Mines; Carle R. Hayward, of the Massachusetts Institute of Technology; Dean P. F. Walker, of the University of Kansas, and Dean G. M. Butler, of the University of Arizona, made remarks on the subjects under discussion.

---

[1] Printed on p. 704.

INTERESTING TOPICS DISCUSSED AT GENERAL SESSIONS

Though the consideration of particular subjects took most of the delegates' time, several sessions of a general nature were held. At these the opportunity was afforded of hearing many speakers whose talks were of especial interest. Francis S. Peabody, who figured so prominently in the handling of the nation's coal problems during the war, unburdened himself for the first time of some long-pent feeling over the conduct then of certain Government officials, including Secretary Baker and Secretary Daniels. Edwin Ludlow, president of the A. I. M. E., in a speech entitled "Coal and Labor," discussed the anthracite and bituminous situations briefly.

At another session Governor Preus of Minnesota made one of the most interesting speeches of the week. Starting by telling how he had refused to cancel the lease of the Steel Corporation on certain iron-ore lands of great value on the Mesabi Range because of the company's refusal under protest to pay certain taxes, and giving his reason therefor, the Governor launched into a discussion of the growth, aims, and methods of the Non-Partisan League in his state and elsewhere, there being a natural bridge between the two topics. It was Governor Preus who signed the occupational tax bill recently enacted in Minnesota.

The Government policy as applied to conservation was the target of another speaker, Falcon Joslin, of Seattle, who, in discussing the needs of Alaska, said that the territory is losing population at the very time when the Government is building a railroad. Furthermore, said he, Washington is too far away to be the seat of the territory's government. For any wrong, he said, the early Russians in Alaska had a saying, "Heaven is high and Moscow is far away," and today Washington is almost as far as Moscow was then.

Senator Nicholson, of Colorado, spoke on behalf of his bill, now pending in the Senate, providing for the creation of a Federal Department of Mines.

A special session devoted to a discussion of methods for increasing the use of metal products was, somewhat to the surprise of some delegates, only slightly attended. Sidney J. Jennings spoke on "Some Methods for Increasing the Use of Silver." The use of silver as money, he said, presents great possibilities, in view of the present currency situation abroad. T. D. A. Brophy, of the Anaconda company, discussed the subject of "Copper, a Metal of Commerce." Henry George, of the Chase Metal Works, of Waterbury, Conn., spoke on the "Commercial Future of Copper, Brass, and Bronze." An interesting paper was one on "Future Electrification in the Development of the Mining Industries," by G. B. Rosenblatt and Graham Bright. Eugene H. Wolff, president of the American Zinc Institute, presented a paper on the "New and Extended Uses of Zinc Products."

A smoker held at the Coliseum during the week was well attended, as was the annual banquet at the Congress Hotel on Oct. 21. Charles M. Schwab delivered a forceful address at the latter, rapping the Government's "meddling," as he termed it, in the coal situation.

RESOLUTIONS ADOPTED

The resolutions adopted were as follows:

Gold and Exchange Situations. A resolution adopted by the Gold Conference expressing appreciation of the activities of Senator Oddie, of Nevada, in support of the gold standard and pledging support to the principle that the consumption of gold in manufactures and the arts should be curtailed and the production of new gold stimulated; also endorsing Bill H. R. 8404, introduced by Representative Louis T. McFadden, providing for a conference of representatives of Great Britain, France, and the United States to investigate the subject of exchange stabilization.

Department of Mines. A resolution introduced by W. J. Loring indorsing Bill S. 1957, introduced at Washington by Senator Nicholson, of Colorado, which provides for centralizing all Governmental activities related to the mining industry in one department to be presided over by a Secretary of Mines, who would be a member of the President's Cabinet.

Mining Law Revision. The full text of this resolution, introduced by Horace F. Lunt, of Colorado, is as follows:

"Whereas, the metal mining laws of the United States have been in effect for more than fifty years and during that long period have been interpreted and made definite by a vast number of rulings and court decisions—and while the law may have some defects, the tremendous development of the mining industry under its provisions proves it to be one of the best mining laws in the world; and,

"Whereas, any general revision would in all probability have as many, if not more, defects than existing law and would, in addition, unsettle the great system of mining law which has grown up through so many years of experience and interpretation; and,

"Whereas, it would be easy to correct the defects in the existing law such as the extralateral rights provision by a simple amendment without disturbing the great body of the mining law which has worked so well;

"Now therefore, it is the sense of your committee that any general revision of the metal mining laws at this time is unwise and inexpedient; and be it

"Resolved, That the board of directors of the American Mining Congress be instructed to appoint a committee to ascertain, as quickly as possible, the opinions of other mining men of the states affected by the proposed revision regarding the necessity for changing the present mining laws and the desirability of the changes embodied in R. No. 7736, and be it further

"Resolved, That the Mining Congress use its efforts to further the desires of the majority of mining men of the states affected by the proposed revision as so ascertained."

State Mine Taxation. A resolution introduced by the Tax Conference reads as follows:

"Resolved, That the president of the American Mining Congress appoint a committee of not less than ten, with authority to increase its number, to study the question of state taxation of mines within the several mining states of the Union and to make a report to the secretary of the congress as soon as practicable."

State Tax Legislation. Omitting the preamble, the text of a resolution introduced by E. C. Stimson is as follows:

"Be it Resolved, That the American Mining Congress protest against all such forms of taxation which directly or indirectly discriminate against mining property or mining enterprise and all forms of taxation which have for their purpose the object of obtaining any greater amount of revenue from mining property or mining operations than is obtained from other property."

Alaskan Government. A resolution introduced by Falcon Joslin reads as follows:

"Whereas, the development of the great territory of Alaska is a subject of national importance, but a serious decline in the population of the territory is taking place; and whereas, the form of government of the territory, with its administration distributed through a great number of bureaus, boards, and commissions, acting without co-ordination from Washington, where the law-making power also rests, 4,000 miles and more away, has been mainly responsible for the ill-adapted or unworkable policies under which the territory is suffering; now therefore be it

"Resolved by the American Mining Congress in convention assembled, That it is the sense of this organization that the restrictive policies in effect in Alaska should be reversed and the resources there opened for development on the most liberal terms, and

"Resolved, further, That it is the sense of this organization that the government of Alaska should be [illegible] and its administration consolidated and placed within the territory and made directly responsible to the President."

Economic Education. The text of a resolution introduced by A. [illegible] reads as follows (omitting the preamble):

"Be it resolved that the American Mining Congress in convention assembled [illegible] a program of [illegible] education with the end that labor and capital [illegible] the problems of [illegible] and [illegible] the problems of labor and [illegible] a return to [illegible] upon which the employment and [illegible] of all our people depend."

Railroad Rates and Wages. The text of this resolution, introduced by William J. Loring, is as follows:

"Whereas, all commercial progress is based upon transportation, no commodity being of any value until it is removed from the place of its original [illegible]; and

"Whereas, the transportation facilities furnished by the railroads of the

United States have been a controlling factor in the development of our industries; and,

"Whereas, a large part of the costs of transportation are based upon the wages paid to the labor employed in its operation; and,

"Whereas, at the beginning of the war the wages paid to railroad operatives were equal to or above the average paid for similar service in other activities; and,

"Whereas, during the war the increasing cost of living made necessary increases in the wage scale to all labor, and particularly high increases were granted to railroad operatives; and,

"Whereas, because of this increased cost of operation the transportation rates of the railroads were of necessity increased in approximate proportion to the increase in wages; and,

"Whereas, the costs of living are gradually decreasing; and,

"Whereas, wages in other lines have been decreasing, and living costs to wage earners in other lines which have accepted reductions would be more nearly commensurate if costs of transportation could be reduced; and,

"Whereas, the last advance in wages granted by the railroads to their operatives was approximately 25 per cent, which increase in wage resulted in an increase in freight rates of approximately 35 per cent; and,

"Whereas, the cost of living now is less than at the time when the wage scale was fixed, to which the 25 per cent increase was added, and, further, a reduction in freight rates would immediately reflect itself in a further reduction in living costs; and,

"Whereas, high freight rates furnish a continuing barrier to a return to normal conditions, which freight rates cannot be materially diminished so long as the present wage scale is in effect; therefore, be it

"Resolved . . . That we urge the railroads of the United States, in conjunction with the Interstate Commerce Commission and the Railway Labor Board, to order immediately that at some early date the last increase in freight rates will be abolished for the benefit of shippers, and that at the same time the last advance which was granted to the railroad operatives will be rescinded; and, be it further

"Resolved, that we pledge the indorsement and full support of the mining industry of the United States to the railroads in their effort to simultaneously reduce rates and wages to the level existing before the last increases were made."

Tariff. A resolution introduced by the tariff committee urges that the tariff schedule proposed in the Fordney bill be sustained before the Senate Finance Committee and that the proposed amendment be speedily enacted; also that the committee consider the needs of those mineral industries not yet adequately protected.

American Valuation. A resolution introduced by the Tariff Conference reads:

"Whereas, in order to provide tariff duties which shall adequately protect the industries to which the mining industry furnishes its products as basic materials, a method of valuation must be established which will prevent the dumping of undervalued foreign products in times of industrial depression, be it

"Resolved, That the American Mining Congress indorses the broad principle of American valuation, and leaves to the wisdom of the Congressional committees the determination of the administrative methods necessary for its proper application."

War Minerals Relief. A resolution introduced by the War Minerals Relief Committee commends the attitude of Secretary Fall as expressed in his letter of June 2, 1921, indicating a desire to achieve justice and equity for war mineral claimants. It also commends the sympathetic consideration of the House and Senate committees on Mines of means for securing relief and urges support of the needful additional legislation.

Colorado River Project. A resolution introduced by the Arizona delegation urges the Federal Government to proceed at once to complete investigations needed for this undertaking and to provide funds for building the first unit.

Conference With Secretary Hoover. This resolution provides that, in response to certain requests from President Harding and Secretary Hoover, a committee be appointed, of which the president and secretary of the American Mining Congress shall be ex-officio members, from the representative mineral producers of the United States, to confer with the Secretary of Commerce and assist in developing methods and plans of mineral production and distribution that will improve present conditions and aid the Secretary of Commerce in his effort to render greater service to the mineral industry.

Sherman Act Amendment. This resolution, introduced by S. M. Evans, reads thus:

"Whereas, the public interest will be served by conservation and the lowering of costs of the necessaries of life and the requirements of commerce; and,

"Whereas, better co-operation between the producers and distributors of these necessary commodities will serve the public interest; and,

"Whereas, certain of our laws now prevent, or fail to provide for, such necessary and beneficent co-operation in such production and distribution of products in the public interest; therefore be it

"Resolved, That the American Mining Congress advocates such revision of the laws as will enable those engaged in mining and other industrial production and distribution to apply in the conduct of all the great branches of our national industries the necessary principles of conservation in production, economy in distribution, greater co-operation with labor and the consuming public, to the end that labor in the mining industry may be relieved of the burden of intermittency of operation, and the products of our mines and industries delivered to the ultimate consumer at the lowest possible price.

"More specifically, we recommend that Congress so amend the Sherman Anti-Trust Act as to vest in miners, manufacturers, and distributors the right to collect, collate, and distribute to themselves, and to the public, statistics of their operations, thus relieving our mining and other industries from the necessity of operating in ignorance of existing stocks, current production, and current demand."

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

E. A. Holbrook Defines School Function in Mining and Like Investigations

In a recent address before the Pennsylvania State College, E. A. Holbrook, assistant director of the U. S. Bureau of Mines, spoke in part as follows:

"The function of the technical colleg in industrial research in the mining, metallurgical, and ceramic industries is both basic and necessary. Broadly speaking, the day is past when sheer inventive ability alone is able to advance these industries and their allied arts. Rather, progress comes through research, the finding of truth by a study of the fundamentals involved, and the ability to apply new principles and processes to the further development of an art.

"It seems popular to criticise adversely the present-day technical college and the shortcomings of its work and output. Yet from the word of men who were graduated in technical courses forty or fifty years ago we must see that real progress has been made, and I, for one, am satisfied that the average technical school today is able to take raw material and in four short years so to train it as to produce men whose minds have an engineering sense, and who because of this will be able increasingly to give this country's affairs an engineering point of view, and to justify their individual existence in industry. The modern technical college, therefore, is justifying its present methods by the quality of its output.

"The Bureau of Mines, with its nearly 300 college-trained engineers, metallurgists, and chemists, engaged primarily in research in the mining, metallurgical, and ceramic industries, offers a measuring stick by which to gage the success or failure of the technical college man in industrial research. Do men from school A make better investigators than men from school B or C? I frankly state that there are several technical schools in the country that furnish us with a high percentage of successes among their product. On the other hand, one of our most successful investigators is a product of a college from which most of the graduates we have employed have not taken readily to our work.

"The practical way it works out with the Bureau is as follows: A technical investigator in mining or metallurgy or chemistry is needed. He must be a graduate of an approved technical college. He must have had more or less practical experience in operating or with engineering of mines or plants.

"It is a popular fallacy, both among students and the profession, that it is the brilliant student alone who is the successful research type. This is not so. To be a successful investigator the man must first of all have a thorough grasp of fundamental physics, chemistry, English, and mathematics. Second, he must possess a natural curiosity, which enables him to 'skillfully eliminate the obvious' detail and follow the main objective. Third, he must have what is best called vision. Not the ability to imagine impossible things or to be eccentric, as some believe, but the ability to assemble known facts from a wide field and project them into an uncharted area.

"The function of the technical college in industrial research is the training of the men. Nowhere else can they so quickly grasp the fundamentals; in no other place can they so readily, under competent guidance, discover their natural bent, as in no fitter place can be fostered and developed those inherent characteristics necessary for moral, mental, and professional success in research."

Geographical Research in Latin America Planned

A scheme of geographical research in the countries of Latin America has been undertaken by the American Geographical Society of New York. This plan, upon which work was started a year ago, has for its general aim the collection, classification, scientific study, and publication of all facts which bear upon the geography, physical and human, of the whole continent south of the United States. An important part of the work is cartographic, and the society hopes to help materially the production of the International Map of the World on the scale of 1:1,000,000 by compiling a number of sheets of this map and devoting special attention to those which apply to countries whose governments are not yet in a position to undertake the work. The sheets will conform in style as closely as possible to the resolutions of the International Conference on the Millionth Map held in 1913; i.e., they will each cover six degrees of longitude and four of latitude. They will be contoured and colored to indicate relief by the layer system of tints. Three sheets have been undertaken so far, and one of them, the "La Paz" sheet, bounded by 16 deg. and 20 deg. S. and 66 deg. and 72 deg. W., will be printed soon.

It is hoped that even confidential maps may be made available to the society, where they will be employed or consulted only under conditions established by the donor, and will be returned if desired.

Any material may be addressed to Alan G. Ogilvie, American Geographical Society, 3755 Broadway, New York City.

Four Founder Engineering Societies Meet in New York

A joint meeting of the Metropolitan sections of the four national societies, the A. S. C. E., the A. S. M. E., the A. I. M. E., and the A. I. E. E. was held in the Engineering Societies' Auditorium on Wednesday, Oct. 19, being preceded by a dinner at Browne's Chop House. Arthur B. Leach, a New York banker, spoke on the "Financing of Large Engineering Undertakings." He emphasized the inflation of money values and urged engineers to make present equipment as efficient as possible before embarking on new undertakings. Philip Cabot, of Boston, in discussing "The Engineer a Failure as a Financial Manager," dwelt on the lack of vision and imagination which he said characterized most engineers. Discussion was led by J. H. Williams, of Day & Zimmermann, and Calvert Townley. This was said to have been the first time that the four founder societies had met together, and the auditorium was crowded. It is unfortunate that the topic of the evening did not provoke as interesting discussion as those in attendance expected.

MEN YOU SHOULD KNOW ABOUT

D. A. Richardson, of Douglas, Ariz., will open an office in El Paso on Nov. 1.

C. W. Purington is visiting New York and will sail from Victoria for Japan on Nov. 18.

Louis A. Wright will arrive in New York from Obermais, Merano, Italy, about Dec. 1.

J. B. Tyrrell is inspecting mining properties in the Caribou district of British Columbia.

H. B. Gillis has been appointed superintendent of the mines and quarries of the British Empire Steel Corporation.

Samuel W. Cohen was the official representative of the University of Minnesota at the McGill University centenary.

J. J. Warren, president of the Consolidated Mining & Smelting Co. of Canada, has moved his headquarters from Toronto to Montreal.

F. S. Norcross, Jr., who recently returned from a three months' trip in Central America, has left for eastern Oregon on professional business.

Frederick Bradshaw, general manager of the Tonopah Belmont Development Co., with headquarters in San Francisco, is in Tonopah inspecting the property of the company.

O. S. Finnie, of the Mining and Yukon Branch of the Canadian Department of the Interior, has returned to Ottawa after spending the summer in the Fort Norman oil fields.

F. P. Williams, formerly an engineer with the War Minerals Relief Commission, has left for the Alamos district, Sonora, Mexico, to take charge of the reopening of a silver mine.

A. E. Perkins, western manager of the Colonial Steel Co., has recently returned from an extended trip to the various mining camps of Alaska, which he made in the interest of the company.

Stephen L. Kaffer, formerly chief engineer of the Burro Mountain Branch of the Phelps Dodge Corporation, at Tyrone, N. M., has accepted a position with the Mine & Smelter Supply Co., at El Paso, Tex.

Floyd W. Parsons, formerly assistant editor of *Engineering and Mining Journal*, later editor of *Coal Age*, and, for the last two years, in charge of the department entitled "Everybody's Business," in the *Saturday Evening Post*, has become editorial director of the *Gas Age-Record*.

A. E. Bendelari, vice-president of the Eagle-Picher Lead Co., who is also a member of the board of directors, has been given charge of the ore buying details of the Tri-State district, which formerly were under the direction of J. Edward Webb, who retains the management of the Joplin smelter and lead products plant.

Mining and Metallurgical engineers visiting New York City last week included **W. R. C. Russert**, of Butte, Mont.; **R. C. Allen**, of Cleveland, Ohio; **E. M. Sawyer**, of Tyrone, N. M.; and **W. E. Wrather**, of Dallas, Tex.

SOCIETY MEETINGS ANNOUNCED

American Association for the Advancement of Science, engineering section, will hold a meeting in Toronto on Dec. 27 to 31. The arrangements for the engineering section are in charge of J. B. Tyrrell.

The New York Sections of A. I. M. E., A. S. C. E., A. S. M. E. and A. I. E. E. will hold a joint meeting at the Engineering Societies Building on Nov. 11 to discuss the St. Lawrence ship channel and power project. Speakers will be Governor H. J. Allen of Kansas, Governor W. L. Harding of Iowa, Dr. R. S. MacElwee of Georgetown University, and H. I. Harriman, of Boston. W. L. Saunders will preside.

The American Society of Mechanical Engineers will hold its annual meeting in New York City, Dec. 5 to 9. The report of the Committee on Elimination of Waste in Industry of the American Engineering Council will provide the basis for the discussion, which will emphasize the engineering phases of the waste problem.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

Senator Tasker L. Oddie has replied to the statements of Secretary Mellon regarding the remedy for the gold situation proposed in the McFadden bonus bill. His letter is published in this issue.

The plant of the Eagle-Picher Lead Co. at Joplin, Mo., is being equipped to make lead products.

At Babbitt, Minn., the Mesabi Iron Co. has tried out the power and coarse-crushing units of its new plant for concentrating low-grade iron ores.

Of considerable importance to the future mining industry in the Southwest are the steps now being taken to harness the Colorado River for the generation of hydro-electric power. This matter is briefly told this week.

All is not dead in the Joplin-Miami district. P. R. Coldren, correspondent there for *Engineering and Mining Journal,* reports increasing activity as prices of zinc and lead ore strengthen.

United Verde, at Jerome, Ariz., has decided to begin construction of its million-dollar crushing plant at once.

In northern Michigan the Mohawk Mining Co. has begun suit against the Federal Government to recover $125,000 for use of its railroad during the period of Government control.

The state tax rate on mining properties in Michigan has been considerably reduced for the current year.

In northern Ontario, the T. & N. O. Ry. has secured the power site on the Abitibi River sought some time ago by the Hollinger Consolidated Gold Mines.

Floods are said to have caused damage in the Salmon River and Alice Arm districts in northern British Columbia.

It is rumored that the Anaconda company may run part of its Washoe smelter on silver ores; also that the Asarco smelter, in Durango, and the Velardeña mines are about to resume.

Planning To Harness the Colorado River

Project of Great Importance to Future Mining Industry in Southwest

Of tremendous potential interest to the mining industry of the Southwest are the plans now being made for utilization of the hydro-electric energy of the Colorado River. The Southern California Edison Co. is proposing development of over 4,000,000 hp. by a 550-ft. dam at Lee's Ferry, backing a storage of 40,000,000 acre feet far up into Utah, and by smaller dams a few miles below the ferry and at three points below the canyon. Still more electric energy is to be developed by the Boulder Canyon project of the Reclamation Service, which primarily is for storage of 20,000,000 acre feet of water, somewhat more than a year's average discharge.

For years J. B. Girand, of Phoenix, has been surveying near the mouth of Diamond Creek, in the lower part of the canyon, planning power works on behalf of the Jackling mining interests, of Arizona, Utah, and Nevada. Girand's filings are the only ones thus far accepted by the Interior Department. It has been suggested that, with lessened costs, electricity in the future might become an effective ore-reduction agent, with especially large saving in the present excessive fuel transportation costs. At present, hydro-electric power is used in Arizona only by the Inspiration and Magma plants, at Miami and Superior, furnished by the Roosevelt works of the Salt River Valley Water Users' Association, which has available only about 25,000 hp., which is consumed mainly in agricultural pumping, manufactures, and civic lighting and power.

Reno Meeting Against Revision Of Mining Law

A meeting was recently called by the Chamber of Commerce of Reno, Nev., to discuss the Mining Law bill, H.R. 7,736. About fifty members attended, largely prospectors and claim owners. The majority opinion favored the existing laws and the rejection of the proposed changes.

Mesabi Iron Co. Tests Crushing Unit at Babbitt

An encouraging test run has been made of the power plant and coarse-crushing unit of the Mesabi Iron Co., at Babbitt, Minn. The ore, loaded by steam shovels, is brought to the plant and dumped into receiving bins, from which it is fed to the first jaw crusher by an apron feeder. It then passes to a second crusher of the jaw type and from here it is distributed to four gyratory crushers of large size. The two jaw crushers are the heaviest machines of their size made, the first one having a jaw opening of 4 x 6 ft. and capable of handling any size of rock that can be loaded by the steam shovels into the cars. The final product from the gyratory crushers will be approximately 1 in. or less. The other units of the plant are not quite complete, but will be in the near future, it is anticipated.

Eagle-Picher Lead Co. Equipping To Make Lead Products

Business Already Received Reported Encouraging—New Warehouse Roofed With Zinc

By P. R. Coldren

About $15,000 worth of special machinery is being installed by the Eagle-Picher Lead Co. at its plant in Joplin, Mo., for use in the manufacture of lead traps, bands, and ferrules, and also for the manufacture of wire solder. The company went into the lead-products business at its Joplin plant some months ago, and reports that the business received has been encouraging. It has just completed a warehouse, 120 x 75 ft. in dimensions, for the purpose of storing lead pipe and plumbers' supplies, so that more room may be provided in the manufacturing building. The new warehouse has been covered with a roof of 12-gage corrugated zinc sheets, and is so designed that the roof can be raised and a second story built whenever occasion may demand.

Engineering and Industry Building Proposed in San Francisco

Plans are under way for interesting a large number of engineers of San Francisco in an enterprise for constructing and operating a twenty to twenty-five-story office building which would be recognized as a center of engineering activity. The movement is fostered by the San Francisco Electrical Development League, which estimates the cost of the project at about $2,000,000.

NEWS FROM WASHINGTON

By **PAUL WOOTON**
Special Correspondent

Oddie Replies to Mellon on Gold Situation

Debates Points Raised Against McFadden Bonus Bill by Secretary of Treasury in Answering Resolution Presented by Western Senators Recently—Asks for Further Reply

REPLYING to the Secretary of the Treasury for the Senators from the gold-producing states, Senator Oddie, of Nevada, makes an extended plea for the McFadden bill and takes exception to several of Secretary Mellon's conclusions. It is Senator Oddie's contention that the industrial consumption of gold should be curtailed forcibly and the production of gold stimulated by the enactment of this legislation. He points out that the bonus which would be paid for new gold would not be paid by the general public but would be paid by the consumers of luxuries who have the ability to pay.

Some such step must be taken or the maintenance of the gold standard will be seriously threatened, Senator Oddie believes. Unless we assist some nations in their effort to recoup their gold stocks, Senator Oddie believes they will adopt some other unit on which to build their currency systems; not that they want to do it, but because they will be forced to do it. Another striking point in Senator Oddie's letter is his contention that the difficulties of the deflation period were enhanced greatly and unnecessarily by the heavy industrial drain upon our gold reserve.

In the preparation of his reply to Secretary Mellon, Senator Oddie worked literally day and night so as to complete it in time to have it read at the Chicago convention of the American Mining Congress. Extracts from the letter follow:

"You have expressed the opinion in your letter of May 9 to the chairman of the Committee on Ways and Means, and in your letter of Sept. 30 to me, that as commodity prices return toward normal and costs become stabilized on a lower level, relief should gradually come in the ordinary course of events from the difficulties of which the gold-mining industry has been complaining. The wholesale index number of the Bureau of Labor Statistics has been recently ascending over the low point established in June and still remains over 50 per cent above the wholesale price level of 1913. This would show that the general price level is rising instead of declining.

"It must be apparent that as the price level increases the economic pressure upon the gold-mining industry will correspondingly increase. The retail price level upon which the purchase of mining materials would be more accurately based has not yet descended proportionately to the level of wholesale prices. No change in the price level has yet taken place which would enable the profitable operation of those gold mines which have discontinued operations during this period of economic stress. In fact, the normal condition of the industry cannot be restored unless the purchasing power of the 1913 dollar is restored. I fully appreciate that over a period of many years there may be a remote possibility that the purchasing power of the 1913 dollar will have returned, but I cannot conceive the possibility that the purchasing power of the dollar, in terms of material and labor utilized in the gold-mining industry, will return in time to save the ore reserves from loss through caving in the mines which have been shut down and filled with water during the period of 1916 to 1921.

"It must also be apparent that we cannot hope to maintain normal production of gold in the United States, which for the decade prior to 1916 annually averaged $95,000,000, unless the purchasing power of the 1913 dollar is reestablished. The object therefore in suggesting that the loss in the purchasing power of the gold ounce be temporarily compensated is to conserve the investment which has been made in the gold-mining industry prior to 1916 from wastage and loss, and thus to conserve the gold-producing power of the nation. The improvement which you indicate has already taken place cannot refer to increased activities in any but those few properties which have under very great difficulties and expense to their ore reserves maintained operations over this critical period.

"You state that 'the monetary gold stock of the world has also increased during the past ten years it has been estimated by as much as $2,000,000,000.' With the enormous increase in the paper currency of the world, the marked decline in gold production, and the increased gold consumption in the industrial arts, the ratio of gold to notes has declined from 66 per cent in 1914 to less than 10 per cent in 1920. The paper currency of the world is now eleven times as much as at the beginning of the war, and the available supply of gold from sources of new production bears an increasingly diminishing ratio to the note circulation. The gold holdings and paper currencies of the fifty principal countries for which figures are available show that the ratio of gold to notes was 66.8 per cent in 1914, 17.9 per cent in 1918, [illegible] per cent in 1919, and 9.8 per cent in 1920.

"During this same period, in addition to these extensive note issues, world national debts expanded from $[illegible],000,000,000 at the beginning of the war to $[illegible],000,000,000 at its close and advanced to about $[illegible] at the end of the first year of peace, and at the end of the second year were approximately $300,000,000,000. The annual interest charges have advanced from $1,750,000,000 in 1913 to $12,000,000,000 in 1920. Both the principal of this debt and interest are payable in gold. It would appear from these facts that the increase of $2,000,000,000 in the world's gold stock, which you have cited, is a very meager addition as compared with the existing obligations arising from the need for currency redemption and the payments of debts and interest.

"The experience gained since the termination of the war indicates that at the earliest opportunity the people of every country will desire to return to their pre-war monetary customs. Those who have sustained losses through the purchase of paper notes which have since depreciated in value are aware that the use of this paper as an economy in the use of gold is a great fallacy. The preference which had developed for the use of paper notes will be replaced by a demand for the actual circulation of gold. The very fact that the banks are expected to discourage the use of gold as currency would seem to be in evidence that they are by no means confident that the people will not demand gold in circulation whenever reserves are released. The world stands bankrupt today for lack of gold.

"The net importation of gold into this country from 1914 to Sept. 20, 1921, has been $1,300,000,000. To this extraordinary extent we have depleted the monetary gold stocks of the countries of the world, which has been one of the fundamental causes for the depreciation of foreign currencies.

"To the depreciation in the European currencies in particular may be attributed the marked decline in our export trade. The present industrial depression in this country is largely due to the falling off in our export trade. The external purchasing power of all foreign countries of the world must be increased in order to restore normal conditions in our export trade. A redistribution of the gold which we have acquired since the beginning of the war is a prerequisite to increasing the external purchasing power of European countries and restoring foreign trade to the balance of the world. Europe's need for part of our excessive supply of gold should not be forced to wait upon her ultimate recovery if we are to consider the dependence of our own nation's prosperity upon the restoration of export trade. As rapidly as our country [illegible] approaches a more stable condition in its currency, an increased demand for gold will occur.

"Such a condition [illegible] a gold policy that will make possible a redistribution of the gold which we have acquired during and since the war as soon as conditions permit. Under such a policy we should not permit that gold to become the base of our credit and currency structure, so it would not then be released for export without forcing a rapid deflation. Under such a policy the United States should occupy the position of trustee for this newly acquired gold.

"The total reserves of the Federal Reserve Banks on Aug. 31, 1921, amounted to $2,790,000,000. If these reserves were to be reduced by the $1,330,000,000 of gold acquired during the war and post-war period, the gold cover of the Federal Reserve notes in circulation on that date would be 34.8 per cent, which is considerably below the minimum of 40 per cent provided in the Federal Reserve Act, and considerably less than half the gold cover reported of 88.5 per cent. This statement indicates that some of this newly acquired gold is already a part of our credit and currency structure and could not be released without a still further contraction in the volume of our credit and currency. This does not indicate that under such a gold policy, we have an excessive amount of gold to accomplish the work which it will be called upon to perform which will be both national and international in character.

"There is a still more important consideration in a gold policy to redistribute this newly acquired gold than that which relates to the revival of our export trade. There is no question that the unstable condition of the foreign exchanges and their depreciation seriously menaces the maintenance of the gold standard. If the influx of gold continues at the present rate, and you state that there are no indications that the influx may end, it will not be long before the United States holds the gold stock of the world. It must be apparent that if foreign exchanges continue to depreciate, with a continued loss of this gold to us, that the increased disparities from the gold standard par would still more seriously jeopardize the security of gold as the international monetary unit and the medium of exchange. It would not seem possible for one nation to maintain a monetary unit as a medium of exchange when that unit could not be utilized in the trade transactions of the balance of the world.

"This gold was purchased by us with very cheap dollars and it will have to be repurchased by these foreign countries with much more expensive dollars in terms of labor and there will naturally arise a great resistance to a monetary system which thus imposes such a great burden upon the peoples of so many countries. Our problem, therefore, is to assist these nations in every way possible to recover their former gold stocks and thus enable them to appreciate their currencies to the gold standard level. If we fail to render them assistance, some other unit will be adopted as a matter not only of convenience but of necessity. As a creditor nation, we have become still more involved in the world's financial structure, and our continued position as such is dependent upon the maintenance of the gold standard.

"From the report of the Director of the Mint which you have submitted, the 'new gold' which was sold by the Treasury Department through the Mint Service to the industrial consumers, principally for the manufacture of jewelry, amounted for the years 1914 to 1919 inclusive, to $232,000.000. The National City Company estimates that the amount of 'new gold' sold by the Mint Service for consumption in the arts in 1920 amounted to $60,000,000. This makes a grand total of $292,000,000 of 'new gold' which was diverted from the monetary reserve for the manufacture of gold articles largely to satisfy the demand for luxuries. This statement excludes the 'old material' in accordance with the differentiation made in your letter, which reduces considerably the total amount of gold consumed in the manufactures and the arts.

"It is interesting to note that during the calendar year 1919 the United States exported an excess of gold over its imports in the amount of $291,600,000. Had this 'new gold' not been withdrawn from the monetary reserve for industrial consumption it would have been sufficient to more than replace the amount of gold lost by excess exportation in 1919, and would have removed, to a large extent, the need for putting into effect the drastic measures of deflation which were adopted by the Federal Reserve Board as a last resort to preserve the gold reserve ratio from declining below the legal minimum prescribed in the Federal Reserve Act. Had this gold been conserved for monetary uses instead of dissipated in satisfying the demands for luxury, the industries of the country would not have become paralyzed by a deflation so rapid and extensive as the one which was imposed.

"In the testimony of Governor Benjamin Strong of the Federal Reserve Bank of New York before the Joint Agricultural Commission of the Senate and House of Representatives he stated that $100,000 in gold in the bank reserves of the Federal Reserve System was equivalent to about $1,800,000 in terms of credit in the country banks of the nation. The $292,000,000 of 'new gold' which was withdrawn from the monetary reserve for industrial consumption during and since the war would have been equivalent to an extension of credit to the country banks of $5,250,000,000. Had this gold been available in September, 1920, a less restrictive policy of deflation could have been adopted with safety, which would not have imposed the burden that the agricultural and other industries of our nation have been forced to bear.

"I am firmly convinced that if our gold reserve had been protected against this extraordinarily heavy industrial drain and a moderate deflation begun within a year after the Armistice, our present difficulties of depression would not only have been minimized but might never have occurred.

"The decline in our governmental revenue receipts is due largely to the falling off in export trade, and yet the gold policy enunciated in your letter and which has been in effect both during and since the war has intensified the difficulties with which the Treasury Department is now confronted.

"While the effect of the lessened gold production over this period has been minimized by the jewelers in their testimony before the Committee on Ways and Means of the House of Representatives in their desire to guard their interests from the payment of this infinitesimal tax, an additional credit of $2,000,000,000 could have been extended to our country banks, making a total credit which might have been extended by a more conservative gold policy of $7,250,000,000. This amount of credit was eliminated through the wasteful practices of our war and post-war periods. The consequences of this policy have not yet ceased to exist.

"Congress, realizing the importance of immediate action in controlling the sales of gold to the trades, whenever the protection of our monetary system demands, enacted the law of March 3, 1901, which not only delegates to the Secretary of the Treasury the authority to control these sales but makes it mandatory that sales shall not be made without his consent.

"In your communication you refer to the fact that the market for gold is international. There could, therefore, have been no embarrassment to the industrial consumers of gold if they had been forced to purchase their gold in the world's market instead of having been allowed to remove it directly from the monetary reserve which serves as the basis of our credit and currency.

"It is important to notice that when the gold reserve ratio of the Federal Reserve System was lowest, interest rates became high and progressed to still higher levels when the policy of the Federal Reserve System to arbitrarily restrict the further extension of credit was put into effect. As soon as the stimulating effect of the additions of newly imported gold to the reserves of the system took place, interest rates become more moderate and the credit tension was considerably lessened, showing what a far-reaching influence under the present banking system of the nation a small amount of gold exerts over the vital instrument of credit.

"The benefits of this newly imported gold were immediately reflected in our domestic financial system, but this was accomplished at the expense of curtailing our export trade by reducing the purchasing power of Europe. The same benefits from a like amount of domestically produced gold in the banking system would have resulted without causing this decline in our export trade. The gold which has been diverted from the gold reserve to the manufacture of luxuries, had it been retained in the banking system, would have had a similarly beneficial effect without depressing our export trade.

"I note your statement that 'it is difficult in these circumstances to see what special equity there is in your claim for a premium when costs are high.'

"The equity lies in the fact that in the case of the gold mining industry the die was cast, the investment was made, and the loss of this investment occasioned by the shutting down of the mines was forced upon the industry because of the lack of governmental foresight in promptly providing a means for compensating the loss in purchasing power of the gold ounce, in accordance with the index number. Whereas, the investment in the jewelry industry would not have been impaired in the least by the payment of the excise imposed upon the manufacture of gold articles which could have been readily passed on to the consumer, as provided for in the legislation upon which your opinion has been asked.

"The enactment of this legislation will protect the public by insuring the quality of the article sold and would enable the public also to appraise the cost of the workmanship as well as the cost of the raw material. The provisions of the McFadden Bill which were referred to in the resolution impose no penalty on the purchase of foreign gold in this market to be used for non-monetary purposes, as the industrial consumers would continue to purchase their gold from the United States Mint at the free gold market price. For this reason a speculative market for gold could not develop.

"Furthermore, the cost of the premium provided in this legislation would not have fallen on the general public as a tax burden but would have been borne directly by the consumers of luxuries who have, it is presumed, the ability to pay.

"On the other hand, the government sold during this entire period of high prices $292,000,000 of 'new gold' to the industrial consumers at the pre-war price. In effect, is this not subsidizing the jewelers and other industrial consumers?

"The objection to employing artificial means to compensate for the lost purchasing power of the gold producers' dollar is answered by recalling that any price fixed by the government is artificial in character.

"I note particularly the paragraph in your letter which begins: 'The tax which the bill would impose upon the use of gold for non-monetary purposes, while in form a tax, would in fact put restrictions upon the free convertibility of the currency into gold. If gold could not be used except under heavy penalties, for anything else than money, its value would be impaired and there would be, in effect, a clog on the convertibility of the currency. One dollar in paper currency, in other words, would not buy one dollar's worth of gold if the gold was to be used in the arts'

"It is difficult for me to understand how such a conclusion could be drawn when the provisions of the bill expressly state that the tax proposed is to be collected only at the time of the sale of the finished product. This tax is, therefore, not imposed upon the bullion to be sold by the mint to the industrial consumers of gold. Under the provisions of this bill the industrial consumers continue to obtain gold from the mint at the monetary price which now prevails. There is no relation now between the sale price of a manufactured article containing gold to the cost of raw material contained therein. Why, therefore, should the addition of this tax, which would be a small fraction of the sale price of the gold article, affect the free flow of gold or its convertibility?

"In France, since 1873, a special excise has been imposed upon the sale of manufactured articles containing gold. No disturbance to the free flow of gold or to the French monetary system has ever resulted. This tax in June, 1920, was greatly increased. No difficulty has been experienced in France in collecting this tax, and there should be no difficulty in collecting the tax here, as it can be readily measured by the amount of gold contained.

"Normally $250,000,000 of the world's total gold production was available for monetary purposes, but during 1919-20 there was less than $60,000,000 per annum available for monetary purposes, the balance having been absorbed by the industrial arts, India and China.

"The production of gold throughout the world is decreasing, and the growing industrial consumption for years to come would be so large as to destroy the amount available for monetary purposes. The [illegible] must be [illegible] of the gold standard is to survive the period of readjustment. The industrial gold consumption of the world should, therefore, be forciby curtailed and gold production stimulated. Both of these conditions should be satisfied by an equitable adjustment in the cost and price equation between the producer of new gold and the industrial consumer. The McFadden Bill provides for such an adjustment.

"This constructive gold policy put into effect at this time will safeguard the maintenance of the gold standard. Such a policy is also prerequisite to a more rapid revival of our domestic industry and export trade upon which the full time employment of our people and the prosperity of the nation depends.

"In view of the great importance of this subject at the present time and because of its vital, far-reaching effects upon all the activities of our national life, I shall await with much interest your answer to this letter."

NEWS BY MINING DISTRICTS

London Letter

Attempted Deal of Russo-Asiatic With Soviet Government Fails—Rio Tinto Passes Dividend

By W. A. Doman

London, Oct. 12—Leslie Urquhart has failed in his negotiations with the Soviet government at Moscow for the return of the properties of the Russo-Asiatic Consolidated to the shareholders. Conditions are impossible. Russia is dominated by communists, who recognize no obligations between individuals, and therefore no contracts between persons can be enforced. "The only obligation recognized and enforced in the communistic state is the absolute subjection of every individual to the state." Mr. Urquhart embodies his views in a circular letter to the shareholders, which covers a lengthy communication to Mr. Krassin. These documents are a telling exposition of the follies and failure of communism.

Conditions were imposed by the Soviet authorities of such a character that the Russo-Asiatic directors prefer to drop negotiations and remain claimants upon the government for damage for unlawful appropriation of properties and working capital. A perusal of the letter proves the impossibility of negotiating, and incidentally affords a good insight into the methods of the Third Internationale, the secret police and other official communist bodies. Had Mr. Urquhart succeeded and he asked for nothing but bare justice for shareholders and workmen—funds might have been forthcoming for the development of other Russian enterprises. As it is, that unfortunate country is now ruled out.

I understand that Hugh F. Marriott is soon to proceed to South Africa to inquire into mining conditions there. It is an open secret that the heads of the big Kaffir finance corporations in London have for a considerable time been dissatisfied or disappointed at the state of affairs on the mines. Some seem to think that substantial economies could be effected, and the view is sometimes expressed that things run too much in a groove and should be altered. Sir Lionel Phillips is already in Johannesburg, so that it would appear that a thorough investigation is to be undertaken.

In London, Rio Tinto shares are regarded only as a speculation; in Paris, on the other hand, they are held as an investment. Holders had an unpleasant shock the other day when the directors announced that no interim dividend would be paid on the ordinary shares. In one sense the position of the company has improved, but taxation has increased to such an extent that the directors prefer to husband the resources of the company.

Although the shareholders of the Champion Reef Gold Mining Co., of India agreed to the reconstruction scheme, it was fairly evident that some of them were not quite satisfied and regarded an assessment of 1/6 on a half-crown share as decidedly heavy. The Champion Reef mine has done well in the past, but present shareholders cannot profit from past operations. A sum of £150,000 is required—£90,000 of it for further development. Hitherto the mine has depended upon one lode; there now seems to be a possibility of parallel lodes. As mining is carried on at greater depths expenses are not likely to be reduced. John Taylor & Sons, who are identified with gold mining on the Kolar field, nevertheless unhesitatingly recommend further exploitation and development, their view being to some extent based upon actual happenings in the adjoining Ooregum mine at similar depths.

During 1920 the Compagnie Aramayo de Mines en Bolivie, formerly the Aramayo Francke Mines, produced [illegible] tons of black tin, compared with [illegible] tons in 1919. It did not pay to produce wolfram, and the output of bismuth was reduced. The production of silver was on a larger scale, [illegible] oz., against [illegible] oz. During the first six months of the current year the production of tin and bismuth has been reduced, but the silver output has gone up about 15 per cent.

BURMA

Bawdwin — The Burma Corporation reports that the lead production at the Bawdwin Mines in September was [illegible] tons gross refined lead production, [illegible] tons refined silver production approximately [illegible] oz., and base bullion produced but not refined during the month [illegible] tons, containing approximately [illegible] oz. of silver.

CANADA

British Columbia

Floods Reported To Have Caused Damage in Salmon River and Alice Arm Districts

Prince Rupert — Floods, following heavy rains, are reported to have done some damage in the Salmon River and Alice Arm mining districts. Several bridges on the Alice Arm-Dolly Varden Railway have been undermined. The railway had just been reopened, after being idle since last December. Bridges over the Salmon and Bear Rivers are reported to have been washed away, and the town of Hyder, the United States entry port to the Salmon River district, is partly under water. It is feared that the floods may have done considerable damage to the eleven and one-half mile aërial tramway that is being constructed between the Premier mine and tidewater.

Quesnel—There is some excitement in the old Cariboo. Gold has again been struck. How important the discovery is cannot be said until more reliable information is received, but first reports are favorable and have started a stampede from the Horsefly and Quesnel Forks districts. The find is said to have been made at Cedar Creek, on Quesnel Lake, about eight miles up the lake from Quesnel Dam.

Smithers—The summer program of development at the Cronin mine has been completed and the property closed down for the winter.

Rossland — R. B. Shelledey and associates, lessees of the I. X. L. mine, have been stoping gold ore, which has in some instances run over $100 per ton. The property is owned by John S. Baker, president of the Fidelity Trust Co., Tacoma, and following the breaking of the Rossland mining boom, the ground was inactive for a number of years.

Trail—Ore shipments received at the Consolidated smelter Oct. 8 to 14 totaled 3,185 tons, coming from the following shippers:

Mine	Locality	Gross Tons
Josie	Rossland, B. C.	98
Republic	Republic, Wash.	36
Whitewater	Retallack, B. C.	33
Company mines		3,018

Ontario

T. & N. O. Ry. Gets Control of New Source of Water Power Near Big Bend

Porcupine — Last spring the Hollinger tried to get control of a water-power source near Big Bend, down the Abitibi River, but permission was refused by the government. It is now understood that the control of this power has been obtained by the T. & N. O. Railway Commission, and that the commission has a proposal before it to develop the power and sell to the public consumer. It is estimated that a total of 30,000 hp. can be developed, and if this were brought into Porcupine, the serious power question in that camp would be solved. The future growth of the district appears to depend upon new sources of power being developed. Without it the present companies cannot increase their capacity, with any degree of security, and no new companies desirous of starting up can contract for a supply of hydro-electric energy.

The Hollinger is now treating 3,700 to 3,800 tons a day, and on certain days when conditions are exceptionally favorable as much as 4,000 tons has been put through in twenty-four hours.

Cobalt—The Nipissing report shows that for September the company mined ore of an estimated value of $197,536 and shipped Nipissing and customs ore of an estimated net value of $164,405. The new vein found in August from 63 shaft has been drifted on for 80 ft., of which 60 ft. shows 3 in. of 2,500 oz. ore. A few small veins of minor importance were also found at Shaft 73. The low-grade mill treated 6,833 tons and the high-grade plant treated only thirty-six tons, being shut down awaiting the completion of the acid-treatment annex.

The Victory property, near the Temiskaming, will sink from the 200 level to 500 ft. A large cobalt vein with low silver values was drifted on at the 200 level, and it is hoped that this vein will improve as depth is gained.

The annual report of the Kerr Lake states that though no important discoveries were made the last year, the results of the exploration campaign were encouraging. It is believed that the diabase-Keewatin contact will warrant much more exploration, and that the chances of finding large and profitable orebodies are good. It is of considerable interest to note that on the 550 level gold assays showed from $1.20 to $28.

The Keeley mine, in South Lorraine, with a long and rather unenviable history, appears at last to have come into its own. This property was the earliest important discovery in South Lorraine, and was financed by funds borrowed from the Farmers' Bank. The property proved to be a failure, with the result that the bank was wrecked and the general manager sent to the penitentiary. A few years ago the property was taken over by the Associated Goldfields of Western Australia, and has been worked in a desultory manner, with indifferent results. A year or more ago a small mill was erected. Recently an important high-grade vein was found, and since June the property has shipped over 200,000 oz., with the prospect that heavy shipments will be made in the future.

Kirkland Lake — The new shaft of the Comfort-Kirkland has reached a depth of 125 ft., and at the 150 level a station will be cut and crosscutting started.

MEXICO

Federal District

October Silver Output Not Expected To Show Increase

Mexico City—Information given out by the Secretary of Industry and Commerce shows a slight increase in the production of gold and silver in Mexico during July and August. The official report for September is not completed. The amount of silver produced in July of this year was 161,989 kg., and in August 162,538 kg. Gold in July totaled 1,640 kg., and for August 1,923 kg.

Regardless of the advance in the price of silver, it is probable that the production in October will not exceed that of the preceding months. A larger quantity of ore may be shipped and treated but the price of silver will admit handling much low-grade material that has been left in the mine or on the dumps. More laborers will be employed at both the mines and smelters, and it is probable that a great many of the idle low-grade mines will resume operations.

Zacatecas

La Plomoso Smelter Resumes

Mazapil—After a prolonged shutdown, La Plomoso smelter, at Mazapil, has resumed operations. This plant belongs to the Mazapil Copper Co. The blowing in of the smelter has given employment to about 800 men and has caused considerable renewed activity in the camp.

Durango

Rumored Asarco Smelter and Velardeña Mines May Resume Operations Soon

Durango—The Peñoles company is moving its smelter from Mapimi, Dgo., to Torreon, Coah., and by thus enlarging the Torreon plant it is said that it will become one of the largest in Mexico. Should the construction work continue as planned, the report is that operations may be expected by Jan. 1.

There has been no official announcement from the American Smelting & Refining Co. regarding the near opening of the Asarco smelter and the mines at Velardeña which supply the tonnage for their plant, but rumors are insistent that the plant will be in operation within another month. Its operation is always looked upon as an indication of increased activity in the smaller mines, as a much shorter freight haul is an attractive feature with those who hesitate. The rainy season in this country has passed, and with the increase in silver prices it is expected that the mining industry will pick up materially, and many small companies will resume operations.

The Promontorio company continues small but regular shipments of about three cars per month. The Topia and Guanacevi districts are doing nothing, but now that the rainy season is over they should soon be in operation again. The Chalchihuites and Sombrerete districts are sending fair shipments to the Aguescalientes smelter.

ARIZONA

All Shovels Stopped on Sacramento Hill Work—United Verde To Start on New Crushing Plant

Bisbee—Steam-shovel operations on the Sacramento Hill division of the Copper Queen property at Bisbee were suspended indefinitely Oct. 21. The force was thus reduced by 150 men.

Jerome—Following a visit to Jerome of Charles W. Clark, general manager of the United Verde Copper Co., announcement has been made locally that work is to be started immediately on the new crushing plant which is expected to take two years to complete and to cost $1,000,000. There is to be provision of much more storage capacity than now is available. The necessary grading will be done by the steam shovels that have been taken from the upper level, back of the old slag dump. About 200 men are employed at the smelter, which is declared to be in condition for work, and 275 are engaged underground.

Phoenix—The Marquis de Gerin, of Paris, is representing in Arizona the interests of French and Belgian stockholders in the Swansea mines, with especial reference to the question whether the ten-year lease on the property held by the bankrupt Consolidated Arizona Smelting Co. shall be extended to the reorganized corporation, the Southwest Metals Co.

Application again has been made to the Arizona Corporation Commission for permission to dismantle the Arizona-Swansea railroad, which connects Bouse, on the Arizona-California railroad, with the mining camp of Swansea, 21 miles distant. The road is owned by the Mitchell interests of Los Angeles. It is claimed that no revenue has been had from the property in two years. Its main traffic was from operation of the Swansea mine, under bond to the Consolidated Arizona Smelting Co. of Humboldt, a corporation now undergoing reorganization. Ores and concentrates were shipped to the Humboldt plant to the extent of about 200 tons daily.

NEW MEXICO

C. & A. Co.'s 85 Mine Only Copper Property Operating in State—Silver-Lead Properties in Demand

By James P. Porteus

Mining conditions throughout New Mexico remain quiet, though skeleton organizations at the big copper properties are being maintained. There is a hopeful optimism in evidence that copper properties will become more active in the next six months. Considerable interest is shown by mining "scouts" in silver-lead prospects. A group of ten claims of this type on Bitter Creek, in the Steeple Rock district, was recently taken over by the Calumet & Arizona Mining Co., and an option has just been closed on the Waterloo property in the Tres Hermanas district. Another big block of claims surrounding this property is under negotiation, as are several properties near Lordsburg.

At Steins Pass a number of claims have been grouped with the old Volcano mine, and an effort is being made to float a company by the sale of stock. The territory between Silver City and Mogollon has been getting attention from prospectors, with the result that properties on both Rain and Dry creeks are working about thirty men and are showing some high-grade silver ores.

Chloride Flat, near Silver City, is working about seventy-five men on leases in the old workings in the properties of the Amory Stevens estate and the Bohemian Mining Co. About ten carloads of ore has been going weekly to the El Paso smelter, which on account of its good fluxing qualities has been accorded a treatment charge that allows the shipping of low-grade ores from old dumps and fills.

The Co-operative mine, at Lordsburg, has been making a good showing, shipping about three carloads of silver-lead per month that averages over 100 oz. silver per ton, and the Last Chance mine is working with an increased force. The management is installing a 175-hp. water tube boiler and a 90-hp. Corliss engine in the new power house. An estimate of the ore reserves has been completed, showing 30,000 tons of silver ores that will average 12 oz. blocked out since John H. White took over the property last April.

The 85 mine of the C. & A. Mining Co., at Lordsburg, is the only copper mine working in the state. Its monthly shipments for the year have averaged about 1,250 tons of siliceous ores, gained solely from development work. These have been going into stockpiles at Douglas, Ariz. Development work is being pushed and a depth of 1,327 ft. in the main shaft has been reached. The orebody on the 1,050 level has been opened for about 1,500 ft.

The Hanover-Fierro district is quiet, only twenty men being reported as working.

The only operation in the Mogollon district is the Mogollon Mines Co., which continues to turn out a restricted tonnage of gold ores.

A moderate demand for fluorspar continues, and shipments of both ground and lump material are moving from Las Cruces and vicinity. The Great Eagle mine, near Lordsburg, has begun hauling 90 per cent grade ores on contracts made in Chicago territory.

COLORADO

Alma Camp More Active Than in Fifteen Years

Alma—The resumption of mining activity in the Alma district still continues, and the last month has shown a decided improvement both as to the number of men employed and the amount of ore being opened up and extracted. There is more real and permanent activity in the camp at present than there has been in the last fifteen years.

The London Co. has completed the preliminary work necessary to start the air compressor. A new hydro-electric plant has been installed, using the flow of water from the new tunnel. The work of extending the lower tunnel a distance of 2,500 ft. is progressing well.

The lessees on the South London are producing about 100 tons monthly of a siliceous lead ore carrying about 8 oz. gold and 6 oz. silver.

Engineers are engaged in a complete examination of the North London mine, mill and tramway. The mill and tram are to be rebuilt and modernized, and a new plant is to be installed at the mine.

The Gold Wave property on Mount Loveland has been leased to Leadville people, who have opened up a streak of 8-oz. gold ore, a shipment of which will be made soon.

A Nebraska company has taken a lease and bond on the old Sultana group of claims on Mount Loveland and has a force of men opening up and retimbering the old workings. The management plans to start mining operations in the early spring and the construction of a concentration plant during the summer.

The orebody recently opened at the Dolly Varden, on Mount Bross, is surpassing expectations. It is about 2 ft. thick, has been developed for about 30 ft. in length, and is assaying from 100 to 1,000 oz. silver per ton. The property is being operated by the Louisiana & Colorado Mining Co.

The Calumet & Hecla property on Mount Lincoln is to be thoroughly exploited this winter, contracts having been let for driving the crosscut tunnels to open the orebodies lying adjacent to the two porphyry dikes which cross the claims.

The Yuba Construction Co. is rushing the work on the 9-ft. dredge being installed on the Platte River near Fairplay for the Platte River Dredging Co. The company expects to have the boat under cover within thirty days at the latest.

The Hoil property on Mount Bross is to resume operations at once.

High-grade gold ore was discovered on the Hard To Beat claim, in the North Mosquito district, early in September, but the find was kept secret until more development could be done. The ore streak is about 18 in. wide, occurring on a bedding plane between two quartzites, and is a honeycomb quartz carrying from 10 to 100 oz. gold and from [illegible] to [illegible] oz. silver per ton. An average sample from the outcrop gave gold 59.90 oz. and silver 10.40 oz. The lessees have about ten tons ready to ship.

The Mount Lincoln Consolidated Co. has established three camps between Alma and the Russia mine, and is rebuilding the old Mount Lincoln wagon road. A large force is employed in an effort to get this road completed and the new electric air compressor on the ground and installed before snow falls.

The Colorado Power Co. has moved its camp to the Russia mine, and is rushing the work of installing the new line from Quartzville to the Russia, in an effort to get the same completed before the bad weather sets in.

Cripple Creek—Forty-two sets of lessees are operating in the Ajax property between the surface and the 18th level. The output of the mine is about sixty tons daily. The ore averages about $10 a ton. The product is shipped to the Golden Cycle plant at Colorado Springs for treatment. The Ajax dump, estimated to contain more than 200,000 tons of material that will assay about $8 a ton, has been leased to Fred Jones, who will make trial shipments to the Portland mill.

Shaft No. 2 of the Portland Gold Mining Co. is being sunk from the 2,450 level, and will probably reach the 2.600 level by the end of October. A drift will be advanced on the new bottom level to open the rich ore shoot disclosed on the level above. The concrete foundation is being laid for the new hoist at Shaft No. 2. Several sets of lessees in the Portland mine are shipping to the Independence mill.

Prospecting by diamond drill is progressing at the Cresson mine, and some encouraging results are being obtained in heretofore undeveloped territory.

UTAH

Tintic Standard's Shipments Increase—Silver King Coalition Opens New Ore

Eureka—Shipments of ore from the Tintic district for the week ended Oct. 15 amounted to 142 cars. Shippers were: Tintic Standard, 61 cars; Chief Consolidated, 33; Iron King, 10; Eagle & Blue Bell, 8; Iron Blossom, 7; Victoria, 4; Swansea, 4; Centennial Eureka, 3; Colorado, 2; Bullion Beck, 1; Eureka Mines, 1; Alaska, 1; Sunbeam, 1.

The Tintic Standard has had some trouble with its transformer during the week. The rise in the price of lead is reflected in the larger shipments from this property, which shipped sixty-one cars the week ended Oct. 15. Underground conditions are such that this rate will probably continue.

Park City—At the Silver King Coalition new ore has been opened on the 1,450 level, 600 ft. farther to the southwest than other ore encountered on this level. This gives a large stoping area. The ore is high-grade silver lead.

Salt Lake City—The first shipment from the recent strike at the Alta Tunnel & Transportation in Big Cottonwood Canyon ran $57.15 per ton, and a car of forty-three tons netted the company about $2,000.

IDAHO

Talache—The Armstead mines will start its mill on Jan. 1. The mill structure has been completed, and machinery is arriving. Work in the mine is being advanced as rapidly as possible.

Featherville—About 75 men are employed on dredge construction work here for the first large dredge being put in by the Hammon Dredging Co.

Hope—Much outside work is being done this fall at Auxer Gold property, in preparation for a steady winter's development. A small compressor was recently installed at the property.

MONTANA

Anaconda May Open Part of Washoe Smelter To Handle Silver Ores—Barnes-King Leases Gold Prospect Near Waterloo

Butte—The Anaconda Copper Mining Co. is unofficially reported to have under consideration the reopening of a section of its Washoe smelter for the treatment of silver ore from lessees and probably one or two of its silver properties, such as the Emma, which has been kept clear of water and is ready to resume.

The company has applied for a patent, in connection with its new shingle product, on a connecting device which joints the shingles so closely that a hose playing on a copper-zinc roofing fails to disclose leakage. This device also serves to conceal the nails. Anaconda will construct a sheet mill at Great Falls, according to those believed to be informed. This mill is also to be used for the rolling of shingles. The company, it is said, is planning a number of improvements at its Great Falls zinc plant, which will be made when metal conditions are more normal.

The Barnes-King Development Co. has secured control of a gold prospect near Waterloo, Mont., under a bond and lease for $150,000, which it is believed carries much promise as judged from the gold values in evidence at the surface. Thus far only a trench has been run, opening the vein, this trench disclosing attractive ore. Until a road is constructed to the claim, no development will be undertaken, as the country is very rough. Drilling of the Kansas-Montana well, in the Winnifred field, near Lewiston, Mont., will be resumed. The Barnes-King is interested in this well.

Butte & Superior has started crosscutting on the 2,600 level for the copper vein uncovered on the 2,000 and the 2,200 levels of the Black Rock mine. The persistency of the copper showing on both the levels where this vein has been cut has encouraged the belief that it will be found to be similar at greater depth.

North Butte is encouraged with the ore showing disclosed on the 3,600 level of the Edith May vein, according to what is regarded as dependable information. Robert Linton, president of the company, inspected the North Butte properties recently, consulting with the local officials.

Troy—Official word is had of the opening of a body of lead-silver ore in the Montana-Morning company's property. It is described by the superintendent as large and of high grade.

Elkhorn—Completion of the power line from the Big Hole station of the Montana Power Co. to the Elkhorn concentrator of the Boston & Montana Development Co., together with some interior wiring, is all that is holding up milling operations.

Cooke City—Five companies are pushing development work in the Cooke City district, and a further increase of activity is expected.

NEVADA

Silver Hills Nevada Unsuccessful in Finding Commercial Ore

Reno—A letter to stockholders of the Silver Hills Nevada Mines Co., which operates a property at Tule Canyon, Esmeralda County, Nev., frankly states that efforts to find a body of commercial ore have been unsuccessful, and the recommendation is made that the company seek to discover and acquire a new property. A report by F. C. Merritt is also published in the circular letter, giving in detail the result of his examination of the property. Mr. Merritt says: "The work done so far seems to prove that the orebodies cannot be expected to extend downward to any appreciable depth. They are co-existent only with the zone of altered granite, bottoming in the fresh unaltered material. This zone of altered granite extends for about 6,000 ft. and varies from 20 to 150 ft. wide. Throughout this zone, scattered irregularly, orebodies of varying size and value, some of them very rich, have been extracted. Much of this zone is still unprospected, and I have no doubt that many lenses of ore remain undiscovered; but in the eighteen months of operation it has been proved that the value of the ore extracted does not recompense the company for the expense necessary to find and extract it, and I recommend that further prospecting be abandoned."

Divide—The Tonopah Divide and Divide Extension companies report regular production and development, with no new discoveries of importance. At the Brougher Divide development is being done on the 175 and 505 levels. Ore of milling grade is being blocked out, and conditions are said to be good.

Silver Peak.—The management of the Western Chemical Co. has announced that the final payment on the anhydrous sodium sulphate deposit near Clarkdale, Ariz., has been made. At the Silver Peak property two leaching tanks are now in use, and the mill is treating thirty tons of potash-alum ore daily. The present grade of ore yields a saving of 20 per cent alum and 15 per cent sulphur. It is expected that tonnage will soon be increased to ninety tons per day. It is reported that a five-year contract has been entered into for the purchase of the entire product, consisting of potash alum, flowers of sulphur, and sodium sulphate. The report should be welcome news to stockholders of the Western Chemical Co., which has had many difficulties, both financial and mechanical, and within the last year many optimistic reports of future operations have been issued which later proved to be premature and unfounded on fact. This is the first report issued of actual, and not prophetic, operations.

The Mary mine, at one time the principal gold producer of the Silver Peak district, has been leased, and subleases are being granted. There was at one time a sixty-stamp mill on the property, but this has been torn down, and only ten stamps remain. Recovery is by the amalgamation and cyanidation processes.

MICHIGAN

The Copper Country

Arcadian Drift Remains in Good Ground—Rail Strike Not To Affect Roads Serving Mines—Mohawk Sues Government — State Tax Rate Reduced

By M. W. Youngs

Houghton — Arcadian continues in good copper bearing ground in its drift, which is proceeding south from the 9th level of the New Baltic shaft toward the 900 level drift of the New Arcadian shaft at the rate of about 180 ft. per month. The vein varies from 5 to 20 ft., averaging 12 ft. of milling rock. The drift, now close to 700 ft. long, has encountered three minor faults, the vein being picked up each time after crosscutting only a short distance. The drift has approximately 1,800 ft. to go before it establishes contact with the north drift, 1,000 ft. long, from the 900 level of the New Arcadian. The work will be pushed as rapidly as possible throughout the winter.

Gratiot No. 2 shaft is being kept dry down to the 13th or bottom level in preparation for a resumption of sinking, which will be started as soon as a new hoist is installed. Gratiot values have been proved from the 13th level up to the 11th, and as Seneca continues in commercial ground at a considerably greater depth, it is assumed that the vein at the Gratiot end of the property will assay equally as well in copper content as the shaft is deepened. The extension of the Seneca drifts toward Gratiot indicate that the values in the intervening ground will be found uniformly good. The shafts are approximately 3,500 ft. apart and the proving and opening up of this vast territory is the object of the further sinking of the Gratiot and its connection, at a depth of 4,000 ft., with the Seneca's 3d level drift. It is believed the new Gratiot hoist will be delivered and installed within the next two months.

A railroad strike would not affect any of the railroads serving producing mines in this district and production would continue as usual. Quincy is served by its own railroad, and the Copper Range serves the Champion, Baltic, Trimountain, Mohawk, and Wolverine mines. Copper Range is not affected by the strike order, as it already has satisfactorily adjusted wages with its employees and the 12½c. reduction and the proposed additional 10 per cent reduction, which lies at the bottom of the present trouble, is applicable only to trunk line roads. Copper Range employees were never paid the trunk line scale.

The Mohawk Mining Co. has brought suit for $[illegible],000 for the use of its fourteen miles of railroad between mine and mill during the period of Federal control and operation of the Copper Range railroad from June 25, 1918, to March 1, 1920. It holds this amount a fair and reasonable rental of its railroad facilities, having paid for rock haulage during that period more than $350,000. The suit has been filed in Houghton County and will be tried in circuit court here. It is brought against James C. Davis, agent of the Railroad Administration, under the provisions of the Transportation Act of 1920, authorizing suits against the Federal agent for causes of action arising during the period of control.

Prior to the outbreak of the war, Mohawk entered into a contract with Copper Range to serve its railroad needs, using the Mohawk tracks. When the Copper Range was taken over by the Railroad Administration, the new general rate order, greatly increasing rates on rock haulage, abrogated the contract existing between the Mohawk and the Copper Range.

A total of 4,793 men are employed in the mines of Houghton and Keweenaw counties, 3,910 in Houghton County and 883 in Keweenaw, according to the reports of the mine inspectors for the year ended Sept. 30.

The mining companies of the district, which pay the bulk of the taxes, will benefit by a greatly reduced state tax rate the coming year. The amount to be raised in Houghton County for state purposes will be $274,576.17, a decided drop from the present year's total of $383,867.96. The decrease is due to the fact that Houghton County's equalized valuation was reduced from its former total, whereas the figures for the state as a whole were increased.

Gogebic Range

Colby and Ironton Mines May Resume Soon—Decision Favoring N. Masse Reversed

Ironwood — Recent news from the steel districts seems to warrant optimism in regard to the ore business, but as yet the mines of this range have not increased their operations. However, it is probable that the Colby and Ironton mines will soon reopen with fair-sized forces and reduced wages, as the McKinney Steel Co. mines on other ranges are doing. The Townsite mine, though not operating for several months, has shipped practically all of its stockpile, and should be able to operate through the winter.

At some of the Steel Corporation shafts shipping from stock has evidently ceased for the season, as new trestles have been erected and some ore is being dumped on the stockpiles. Damage suits for a total of $9,000 have been brought against the company for impairment of farm land alleged to have been caused by water from the mines.

The State Supreme Court has reversed the decision and ordered a new trial in the case of Houghton County vs. N. Masse, of Bessemer, over title to a valuable piece of mining land, adjoining the Palms-Anvil Keweenaw mine. The original decision in favor of Masse was too obviously inconsistent with the evidence submitted.

JOPLIN-MIAMI DISTRICT

Activity Increasing as Ore Prices Strengthen—Several Discoveries of Good Ore Reported

By P. R. Coldren

Joplin — Strengthening zinc ore prices, coupled with [illegible] for lead ore, have resulted in increased activity in the Tri-State zinc and lead field during the last few weeks. A number of the larger companies have increased their output by placing in operation mills that have been down for some months, among these being the [illegible] Lead & Zinc Co., the Underwriters' Land Co., the Admiralty Zinc Co., the Commonwealth Co., and the Kanok Metal Co. Other companies that plan increased activity and production in the immediate future include the Lucky O. K. and Brewster, the Chanute Spelter, the Lucky Jew, and the Commerce Mining & Royalty.

Despite these instances of increased activity, prominent operators declare that increased production to anything like the peak attained in 1918 and 1919 is highly improbable, if not actually impossible. There is a shortage of efficient labor, for one thing, many of the best of the district's mining men having become discouraged during the last six months and moved to other fields or engaged in other work. In addition, there is the fact that the cream of the richest ores has been taken from many of the biggest mines in the field and there has been no development in recent months to discover new mines to take their places.

Though there are many tons of surplus ore in the field, it is in strong hands, and when the probability of only slightly increased production is taken into consideration, along with the fact of greatly curtailed production from the Western zinc-production mines, local producers seem to be justified in their belief that zinc ore prices are almost certain to show substantial advancement in the months ahead.

The Chanute Spelter Co., a subsidiary of the American Metal Co., has recently opened up a new deep shaft and mine on a tract of land to the west of its Hartley mine, east of Baxter Springs, Kan. The new shaft is connected with the Hartley mill by a surface railroad, and development to date indicates it [illegible]. The Chanute company has not yet started on its new Brewster mill, on a tract about three-quarters of a mile to the northeast of the Hartley, but D. F. Haley, the manager, [illegible] New York recently to talk over with the American Metal management the desirability of opening [illegible] at this time. The mill, which is virtually completed, is one of the [illegible].

Announcement of recent [illegible] strikes of lead ore [illegible] in the old Webb City-Carterville field in Missouri has led to a demand for a [illegible] mill in this district, and it is understood that one will be [illegible]. The strikes have been made on the [illegible] land on the [illegible], part of the Missouri Zinc Fields land.

THE MARKET REPORT

Daily Prices of Metals

Oct.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
20	12.75	28.00	28.50	4.65@4.70	4.40@4.45	4.65
21	12.625@12.75	28.00	28.50	4.65@4.70	4.40	4.60@4.65
22	12.625@12.75	28.00	28.50	4.65@4.70	4.40	4.60
24	12.625@12.75	28.00	28.50	4.65@4.70	4.40	4.60
25	12.625@12.75	28.00	28.50	4.65@4 70	4.40	4.60
26	12.625@12.75	27.75	28.25	4.65@4.70	4.40	4.55@4.60

*These prices correspond to the following quotations for copper delivered: Oct. 20, 13c.; Oct. 21 to 26 inc., 12.875c.@13c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Oct.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
20	66¼	67½	73	157¼	159⅝	23¾	23⅜	26⅜	26¾
21	66	67⅛	73	158¼	160½	24	23¾	26⅜	26¾
22		..	...	...	..	...	...	.	..
24	66¼	67⅛	72½	158	160½	24⅛	23¾	26¼	26½
25	66	67	72½	156½	158¾	24⅛	23⅞	25⅞	26¼
26	65¼	66¼	72	155½	158	24⅛	23¾	25¾	26¼

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver			Oct.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York, Foreign Origin	London
20	393⅜	99¼	71½	40⅞	24	392⅜	99¼	70⅛	40⅛
21	393¾	99¼	71½	40⅞	25	395¾	99¼	68⅝	39⅛
22	392½	99¼	70⅞	40¾	26	394¼	99¼	69⅜	39⅝

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, Oct. 26, 1921

Conditions have been generally quiet during the last week. This has been the result partly of the buying wave of some weeks ago, which it was expected would be followed by a reaction, and to some extent by uncertain transportation conditions. The railroad strike is still set for the first of November, but an increasing number of employees seem disposed to remain at their work, and no general tie-up of transportation is expected. However, consumers have preferred to await the outcome before contracting for their regular advance requirements. The demand, of course, is only deferred

Copper

A fair business was done on Thursday and Friday, but since then the inquiry has been exceedingly slight. The larger producers are generally holding to the 13c. delivered price, although the tonnage sold at this figure has not been large, and has been mostly for December delivery. Some of the consumers have been anxious to obtain cut prices and have succeeded in doing so in certain quarters. In fact, yesterday there were rumors of sales as low as 12.75c. delivered for spot metal, but we have had no actual reports of sales at that price. The demand for prompt metal is virtually non-existent, and were one compelled to sell a small tonnage of spot metal he might not be able to obtain more than 12.75c. for it. It is generally felt that the present reaction is only temporary and that in a week or two weeks the price will again be firm, provided the railroad strike does not result seriously. Demand for copper is now well diversified. Wire drawers are the chief consumers, but this is a normal condition. Brass makers are gradually coming into the market as their stocks of scrap are exhausted; by the first of the year practically all stocks of scrap are expected to be cleaned up.

Export demand has also been quiet, a few sales having been made of from 100 to 500 tons to the usual destinations.

Lead

The official contract price of the American Smelting & Refining Co. continues at 4.70c. The outside market has fallen slightly under this level, however, producers being unable to secure more than 4.65 and 4.675c. for New York delivery. The decreased demand is probably only temporary, for manufacturers have not in general curtailed operations. In Chicago, business has been done all week at 4.50c. and in St. Louis the market has weakened to 4.40c. In fact, some business has been done at 4.375c., though other producers of favored brands have been able to secure 4.45c. Some lots which have been offered in the St. Louis district for some time have now been cleaned up, and there is but little metal pressing on the market. The London price has shown a stronger tendency, and fundamental conditions in the lead industry continue excellent. Demand for forward deliveries is only nominal. Corroding lead commands a premium of from 7½ to 10 points.

Zinc

The zinc market has weakened somewhat, owing to pressure to sell on the part of some of the smaller producers, who felt that the present price is very satisfactory compared with recent levels, and who did not care to take the chance of a depression during unsettled railroad conditions. Galvanizing interests, which have been the chief buyers recently, are well supplied for current requirements, and no great demand is expected for two or three weeks. Some brass special has been sold at the usual 10 points premium, but it has in general gone to galvanizers who wanted a better grade of zinc than usual, rather than to brass makers. High-grade remains at 6c. delivered in Eastern districts.

Tin

The New York price of tin has remained more constant than for some time, it so happening that fluctuations in London have been offset by variations in sterling exchange. Manufacturers of tin plate continue to operate at about the same capacity as during recent weeks, but fundamental conditions are slowly improving among tin-producing interests. In addition to the curtailment of South American production, which has been mentioned before, Chinese tin is scarce and the Straits supplies seem to be more firmly held than ever. There is also a tendency to cut down the production in the Far East.

Tin for forward delivery: Oct. 20th, 28.75c.; 21st, 28.625c.; 22d, 28.625c.; 24th, 28.50c.; 25th, 28.625c.; and 26th, 28.625c.

Arrivals of tin, in long tons: Oct. 18th, Straits, 5.

Gold

Gold in London: Oct. 20th, 104s. 9d.; 21st, 104s.; 24th, 104s. 8d.; 25th, 104s. 4d.; 26th, 104s. 2d.

Foreign Exchange

The strength which has characterized sterling lately is unusual at this time of the year, when dollars are in demand for grain and cotton bills, and is no doubt caused by the fact that speculative trading in sterling has taken place to a greater extent than usual in recent months, in anticipation of a decline. Sterling cables continue to be quoted at one-half cent premium over demand. Continental exchanges have improved slightly. On Tuesday, Oct. 25th, francs were 7.29c.; lire, 3.93c.; and marks, 0.6125c. New York funds in Montreal are now at the lowest premium for some time, and the tendency continues downward. The quotation yesterday was 9$\frac{1}{16}$ per cent premium.

Silver

The market has been quiet of late, the demand from all quarters being limited. Eastern exchange rates have declined, the fall being sharp on occasions, owing to speculative operations. China is buying, but only moderately.

Mexican Dollars—Oct. 20th, 55; 21st, 55; 22d, 54¾; 24th, 53¾; 25th, 52¾; 26th, 53¾.

Other Metals

Quotations cover wholesale lots unless otherwise specified.

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 17.50@18c. with practically no sales.

Antimony—Chinese and Japanese brands, 4.90@5.25c.; W. C. C. brand, [illegible]@5.75c. per lb. Cookson's "C" grade, spot, 9c. per lb. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $3@$3.25 per lb.; black oxide, $2@$2.10 per lb. in bbls.

Iridium—Nominal, $150@$170 per oz.

Molybdenum Metal—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominal, $55@$60 per oz.

Platinum—$82@$85 per oz.

Quicksilver—$39@$41 per flask. San Francisco wires $42. Market improving.

The prices of the following metals remain unchanged from the figures published in these columns on Oct. 15: Rhodium, Selenium, Thallium, and Tungsten.

Metallic Ores

The market is generally exceedingly quiet, and prices on the following ores remain unchanged from the figures published in the Market Report in the Oct. 15 issue: Chrome, Iron, Magnetite, Manganese, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, Zircon, and Zirkite ores.

Zinc and Lead Ore Markets

Joplin, Mo., Oct. 22—Zinc blende, per ton, high, $26.30; basis 60 per cent zinc, premium, $25; Prime Western, $24; fines and slimes, $23@$20; average settling price, all grades of blende, $23.04.

Lead, high, $63.55; basis 80 per cent lead, $60; average settling price, all grades of lead, $59.58 per ton.

Shipments for the week: Blende, 8,113; lead, 1,308 tons. Value, all ores the week, $265,880.

Naming as a reason the possible tie-up of transportation by the threatened strike, some buyers lowered their purchases at the week end, and cut the price offering $2.50 per ton. Sales were practically all made on $25 basis, with a small tonnage bought today on $24.

A survey indicates that a few large mills recently closed down have reduced the production to a greater degree than has been compensated for by the ten or a dozen mines long idle that have resumed work, principally for the production of lead. As low as 5,500 tons output per week is shown by one survey, and none exceed 6,000 tons. The duction of lead. As low as 5,500 tons per week. Those closed were producing no lead and could no longer produce zinc ore on the market offerings, owing to the mine faces showing a lower grade of ore.

Platteville, Wis., Oct. 22—Blende, basis 60 per cent zinc, $30. Lead ore, basis 80 per cent lead, [illegible] per ton. Shipments for the week: Blende, [illegible] tons. Shipments for the year: Blende, [illegible]; lead, 1,505 tons. Shipped during the week to separating plants, [illegible] tons.

Non Metallic Minerals

Generally dull markets also exist for the non-metallic minerals, and there is no quotable change in the following from the prices published in our Oct. 15 issue: Asbestos, Barytes, Bauxite, Borax, Chalk, China Clay, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Kaolin, Limestone, Magnesite, Mica, Monazite, Phosphate Rock, Pumice Stone, Pyrites, Silica, Sulphur, Feldspar, and Talc.

Mineral Products

The prices of Arsenic, Sodium Nitrate, Sodium Sulphate, and Potassium Sulphate are unchanged from the quotations published in these columns Oct. 15.

Ferro-Alloys

No quotable changes have taken place in the following ferro-alloys from the prices quoted in the Oct. 15 issue: Ferrotitanium, Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotungsten, Ferro-Uranium, and Ferrovanadium.

Metal Products

Yellow Metal — Dimension sheets, 17.25c. per lb.; sheathing, 16.25c.; and rods, ⅜ to 3 in., 14.25c.

Copper Sheets and Wire, Lead Sheets, Nickel Silver, and Zinc Sheets are unchanged from the quotations given in the Oct. 15 issue.

Refractories

Prices on the following are unchanged from the figures published in the Oct. 15 issue: Bauxite Brick, Chrome Cement, Chrome Brick, Fire Brick, Magnesite Brick, and Silica Brick.

The Iron Trade

Pittsburgh, Oct. 25, 1921

The steel market shows no signs of having increased in activity in the last week or two, and the prospect now is that there will be no material change in the near future. Production, measured by steel ingot output, continues at the rate of 35 per cent, or a trifle more, of capacity, this representing an increase of about 75 per cent from the lowest rate, struck at the middle of last July.

Steel prices are showing no material change. Bars, shapes, and plates can be bought from some mills at about 1.60c., if the order is attractive, though the Carnegie Steel Co. and some independents adhere to 1.70c. for bars and 1.75c. for shapes and plates. Tubular goods are fairly steady at the Sept. 16 lists. Wire products in small lots go at the advanced prices of Sept. 22, but on large orders there seems to be some tendency to the previous prices. In sheets [illegible] advance, but purchases can easily be made at [illegible], and [illegible] for galvanized.

Pig Iron—The market has continued dull. Prices are quotable at: Bessemer, [illegible]; basic, [illegible]; foundry, [illegible], Valley furnaces, freight to Pittsburgh being [illegible].

Coke

Connellsville Furnace, $3.35@$3.50; foundry, [illegible] per ton.

The Anglo-American Corporation of South Africa

Its Organization, Resources, and Operations*

THE ANGLO-AMERICAN CORPORATION of South Africa was organized in the latter part of 1917, with an authorized capital of £2,000,000, subsequently increased to £4,000,000, in shares of £1 each, of which 3,194,028 shares, fully paid, have been issued. The corporation is chiefly interested in gold mines on the Rand and diamond mines in Southwest Africa. Generally speaking, its holdings are in companies of which it is either directly or indirectly the largest shareholder and in whose direction it has a corresponding voice. In administration and technical matters the corporation works in conjunction with the Consolidated Mines Selection Co., Ltd., whose interests are essentially identical, thus constituting a "group" and thereby still further strengthening its position.

The officers of the Anglo-American Corporation, Ltd., are as follows: Permanent directors, Sir Ernest Oppenheimer and W. L. Honnold; directorate, Sir Ernest Oppenheimer (chairman), F. R. Lynch, the Hon. H. Crawford, Walter McDermott, W. L. Honnold, W. J. O'Brien, W. E. Hudson, C. H. Sabin, the Hon. H. C. Hull, and W. B. Thompson; New York committee, E. R. Stettinius (chairman), C. H. Sabin, W. L. Honnold, and W. B. Thompson.

At the beginning of 1921, the chief holdings of the corporation and its position in relation to the companies concerned were as follows:

	Capital Stock in Ordinary Shares of £1 Each		Shares Owned by Anglo-American Corporation Dec. 31, 1920	Shares Owned by Rand Selection Corporation Dec. 31, 1920
	Authorized	Issued		
Rand Selection Corporation	650,000	600,000	542,740	....
Brakpan Mines	850,000	850,000	....	277,000
Springs Mines	1,500,000	1,267,236	13,044	292,722
West Springs	1,400,000	446,949 fully paid 953,051 8s. paid	21,176 fully paid 280,500 8s. paid	3,493 fully paid 100,000 8s. paid
Daggafontein Mines	980,000	948,033		85,445
Consolidated Diamond Mines of Southwest Africa	4,500,000	2,633,600	468,610 £972,200 debentures	....

THE MINES

The mines of the Rand occur along the northern rim of a synclinal fold or basin, and extend in almost unbroken continuity for a distance of about sixty miles. As boundaries are defined by vertical planes, there are both "outcrop" and "deep-level" properties, all differing more or less in size and technical features.

All the mines of the corporation are in the Far Eastern Rand district, where the basin is relatively shallow and the ore as a rule is confined to a single reef lying on a flatly dipping slate foot wall.

The ore takes the form of clearly segregated orebodies, irregular as to occurrence and shape, generally elongated in the direction of dip but with a common tendency as to pitch, of good thickness, and large enough to be stoped separately, some measuring over 2,000 ft. along the strike and more than 5,000 ft. on dip. They vary in the degree of their enrichment, both internally and comparatively, but their average tenor is fully one-third better than that of the Rand today and is approximately in accordance with the relatively high standard of the district.

At both Brakpan and Springs, about 50 per cent of the development sampled from year to year has been of profitable grade. Brakpan at a vertical depth of about 4,000 ft. is mining reef fully four miles from its outcrop, and Springs at a similar depth is mining reef about seven miles from the outcrop. As the bottom of the basin has been reached in the latter mine, a large measure of confidence is permissible in respect of future developments.

Regarding operating factors, it is to be stated that there is little water underground and on the whole mining conditions are good. The price of supplies is high, but water for power and for milling, as well as for domestic consumption, is comparatively cheap. Coal and electric power are obtainable at unusually low cost. Labor conditions have been somewhat upset by the after effects of the war, which is more true of white than of colored labor, but in both classes of labor a more reasonable attitude is to be noted.

Taxation laws are not burdensome on the corporation, as no tax is paid on income from companies already taxed. Both the normal tax and the dividend tax on the mines is at the ate of 1s. 6d. per pound sterling.

For the present, the gold mines benefit through the premium on gold, which in the corporation mines roughly offsets the increase in working costs due to the war. The premium, of course, will disappear with the return of normal exchange, but apart from this being a remote contingency, it is expected that its disappearance will be accompanied by a decrease in working costs and an increase in earnings.

THE RAND SELECTION CORPORATION

The holdings of the Rand Selection Corporation, Ltd., include 277,000 shares in Brakpan Mines and 292,722 shares in Springs Mines, thus making it the largest shareholder in these companies; 3,493 fully paid and 100,000 partly paid shares in West Springs, and 85,445 fully paid shares in Daggafontein Mines, both of which are still in the development stage. Also, the freehold of the farms Brakpan and De Reitfontein, as well as Brakpan and Springs townships.

The dividends paid during the last five years have been as follows: 1916, 27½ per cent, or 5s. 6d. per share; 1917, 30 per cent, or 6s. per share; 1918, 35 per cent, or 7s. per share; 1919, 10 per cent, or 2s. per share; also eight enemy shares per 100 shares legally held; 1920, 27½ per cent, or 5s. 6d. per share; 1921, 15 per cent, or 3s. per share for the first half year.

BRAKPAN MINES, LTD.

The total area of the Brakpan Mines property is 3,387 claims, about 5,000 acres, all of which is underlain by the reef formation. Of this area, 1,812 claims were acquired under lease from the government in 1916 and incorporated in the company on the following terms:

1. The company to pay the government 5 per cent of the annual profits of the amalgamated property during a period of five years from Jan. 1, 1917.
2. Thereafter, a percentage of the profit according to the formula $Y = 50 - \frac{1,150}{x}$, the minimum percentage payable being 12½ per cent. In this formula "Y" represents the ratio of profit to recovery expressed as a percentage, and "x" the percentage of the profit accruing to the government.

Brakpan is now crushing above 50,000 tons per month, and its remaining life is estimated at about twenty years. This estimate contemplates an increase in the rate of crushing as soon as ore can be drawn in sufficient quantity from two new shafts which have already reached the reef.

The developed ore in reserve, in combination with that normally obtained from current development and other incidental sources, is equivalent to about five years' supply at the present rate of crushing.

The recovery value of the ore reserve, after including the ore normally obtained from current development and other incidental sources, and allowing for sorting and loss in treatment, is estimated at 8.18 dwt. per ton milled, equivalent to 34s. 6d., plus such gold premium as may be realized.

In 1920, the average recovery per ton was 35s. 11d., plus 11s. 6d. on account of gold premium. Working costs in the same year averaged 29s. 5d. per ton, which was 11s. 5d. above the average of 1915.

---

*The information was obtained by *Engineering and Mining Journal* directly through the kindness of Mr. W. L. Honnold, director in the corporation.

The dividends paid during the last five years have been as follows: 1916, 45 per cent, or 9s. per share; 1917, 47½ per cent, or 9s. 6d. per share; 1918, 32½ per cent, or 6s. 6d. per share; 1919, 27½ per cent, or 5s. 6d. per share; 1920, 45 per cent, or 9s. per share; 1921, 15 per cent, or 3s. per share for the first half year. No increase of capital is contemplated, as the milling plant has already been enlarged to 75,000 tons per month capacity, and the capital expenditure due to opening the new areas is being met out of profits.

SPRINGS MINES

The area of Springs Mines, Ltd., is [illegible] claims, about 3,350 acres, all underlain by the reef formation. Of this area, 2,235 claims were leased from the government in 1917 and incorporated in the company on the following terms:

1. The company to pay the government 5 per cent of the annual profits of the amalgamated property during a period of five years from Jan. 1, 1918.

2. Thereafter, a percentage of the profit according to the formula $Y = 55 - \frac{1{,}175}{x}$, the minimum percentage payable being 12½ per cent, and the unknown quantities of the same significance as in the Brakpan formula.

The company is crushing about 40,000 tons per month, which will be increased to 50,000 tons per month as soon as additional plant now under construction is completed. The remaining life of the mine is estimated at about twenty years, and this estimate contemplates increasing the crushing rate from time to time as ore can be taken from the two new shafts, one of which has already reached the reef.

The developed ore in reserve, in combination with that normally obtained from current development and other incidental sources, is equivalent to about six years' supply at the present rate of crushing. The recovery value of this ore, allowing for sorting and loss in treatment, is estimated at 8.81 dwt. per ton milled, equivalent to 37s. 2d., plus such gold premium as may be realized. In 1920 the average recovery per ton was 37s. 10d., plus 11s. 10d. gold premium. Working costs in 1920 averaged 30s. 9d. per ton, which was 8s. ½d. above the average of 1917.

The dividends paid since milling was started are as follows: 1918, 12½ per cent, or 2s. 6d. per share, also one West Springs share to every holder of ten Springs Mines shares; 1919, no dividend, but £349,272 appropriated to working capital; 1920, 20 per cent, or 4s. per share; 1921, 7½ per cent, or 1s. 6d. per share for the first half year.

WEST SPRINGS, LTD.

The property of this company includes 2,235 claims, about 3,350 acres, all underlain by reef formation. The whole of this area is operated under a lease from the government which provides that the government's percentage of the profit will be calculated according to the formula $Y = 65 - \frac{650}{x}$, the unknown quantities having the same significance as in the Brakpan formula. Under this arrangement, if the ratio of profit to recovery does not exceed 10 per cent, nothing is payable to the government. This, after allowing for amortization and ordinary taxation, is equivalent to about 8 per cent free of income tax for the shareholders before anything is payable to the government.

Two shafts are being sunk, one of which has already reached the reef, and connecting headings are being driven from Springs Mines. Good ore has been encountered, and, generally speaking, conditions so far disclosed conform with those in the adjoining mines. It is expected that crushing will begin about two years hence. The company's ground lies between Brakpan Mines and Springs Mines. The life of the mine promises to approximate that of its neighbors.

DAGGAFONTEIN MINES, LTD.

As noted in the tabulation of holdings, the Anglo American Corporation holds no shares in Daggafontein Mines, Ltd., but has recently become indirectly interested through the Rand Selection Corporation. The property includes [illegible] claims, about 3,100 acres, all underlain by reef. The work first undertaken was unfortunately located, but a new shaft situated nearer to Springs Mines has recently cut the reef and encountered good ore. Further development promises to improve the position, it is stated, but it will first be necessary to reorganize the company, pending which step work has been suspended.

CONSOLIDATED DIAMOND MINES OF SOUTHWEST AFRICA, LTD.

The company owns practically all the known diamond mines of Southwest Africa, as well as important rights in respect of new discoveries that may be made. The diamonds occur in alluvial deposits, and the ground has been thoroughly tested. The estimates made assure a long life, say forty years, under what would now be termed average conditions.

In size, the diamonds, though small, are of desirable dimensions. They are of unusually fine quality and cut to good advantage. The fields lie mainly in valleys close to and roughly parallel to the coast, and the principal ones occur within an area extending longitudinally about sixty miles. The country generally is bare and rugged. The basal rock is generally gneissic in character and of Archean age, though further south ancient sedimentary rocks come increasingly into evidence. In the Pomona district, flat-topped hills, or "tafelberg," standing 300 ft. above the surrounding valleys, are features of the landscape. These hills are clearly uneroded portions of a former table land. Diamonds in payable quantity are found on them, in a capping of cemented rubble. On one of them there is an ancient river bed containing cemented river gravel, carrying diamonds in payable quantity to a depth of about eight feet. These occurrences are of relatively minor importance, but are interesting as bearing on the question of the original source of the diamonds in the valleys below.

The known workable deposits occur mainly in the valleys, and fortunately are of such extent and richness that the question of original source is not of importance, since the official estimates of the quantity of diamonds developed show a total of about 15,000,000 carats.

Broadly speaking, it is probable that the diamond-bearing gravels will average about ¼ of a carat of diamonds per cubic yard of raw material. In working the gravel, the usual procedure in the case of shallow deposits is to dry screen in the field with hand trommels, and then to transport the [illegible] to wet-treatment plants to be jigged and hand-picked for diamonds. Secondary picking may follow in combination with magnetic separation of the associated minerals. The treatment is not necessarily complete, for the material eliminated may possibly carry diamonds. Secondary washing, therefore, is often justified, and, in fact, certain sections have been worked over as many as five times. Sea water is used where required for concentration, and electric power is supplied by a central generating plant at Luderitzbucht. The water for drinking and domestic requirements is either condensed from sea water or transported by rail from inland wells. These fields, however, will soon be supplied from wells nearer by. With a view to improving the position as to the sale of diamonds, a conference of the four large South African producers was held during the latter part of 1919. This conference resulted in an intermediary agreement, fixing the quantity of diamonds to be marketed and the quota to be allotted to the respective producers and a sales agreement with the London Diamond Syndicate. In 1920 this arrangement was worked out as follows for the Consolidated Diamond Mines of Southwest Africa, Ltd.

	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Working costs vary under different conditions. The production cost [illegible] in 1920 was approximately [illegible] [illegible] so that [illegible] would otherwise have been. Under the scheme of taxation the government takes 60 per cent of the working profits.

MINING STOCKS

Week Ended October 22, 1921

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Ahmeek	Boston	53	48	53	Sept. '20, Q	$0 50
Alaska-Br. Col.	N. Y. Curb	*40	*36	*38		
Allouez	Boston	21	20½	21	Mar. '19	1 00
Anaconda	New York	39½	38⅞	39½	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2½	2	2		
Ariz. Com'l	Boston	8¾	8½	8½	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*35	*29	*34		
Bingham Mines	Boston	13¾	15½	13½	Sept. '19, Q	.25
Calumet & Arizona	Boston	49¾	48½	48¾	Sept. '21 Q	.50
Calumet & Hecla	Boston	240½	236	236	June '20, Q	5.00
Canada Copper	N. Y. Curb	*31	*28	*29		
Centennial	Boston	9	9	9	Dec. '18, SA	1.00
Cerro de Pasco	New York	29⅞	28	29	Mar. '21, Q	.50
Chile Copper	New York	11¾	11⅛	11⅛		
Chino	New York	24⅞	24	24⅝	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*15½	*14	*14		
Con. Arizona	N. Y. Curb	....	....	*1	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1¼	1	1¼		
Copper Range	Boston	34	33⅞	33⅞	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*35	*22	*32		
Davis-Daly	Boston	7	6⅞	6⅝	Mar. '20, Q	.25
East Butte	Boston	9¼	9	9¼	Dec. '19, A	.50
First National	Boston Curb	*80	*75	*75	Feb. '19, SA	.15
Franklin	Boston	2¼	2	2		
Gadsden Copper	Boston Curb	*45	*40	*40		
Granby Consol	New York	19½	18	18	May '19, Q	1.25
Greene-Cananea	New York	22½	22½	22½	Nov. '20, Q	.50
Hancock	Boston	2¾	2¾	2¾		
Howe Sound	N. Y. Curb	2⅞	2⅞	2⅞	Jan. '21, Q	.05
Inspiration Consol.	New York	34½	33½	34½	Oct. '20, Q	1.00
Iron Cap	Boston Curb	5¾	5½	5½	Sept. '20, K	.25
Isle Royale	Boston	21½	20	20	Sept. '19, SA	.50
Kennecott	New York	21¼	20⅞	21¼	Dec. '20, Q	.50
Keweenaw	Boston	1	1	1		
Lake Copper	Boston	....	....	2¼		
La Salle	Boston	....	....	1½		
Magma Chief	N. Y. Curb	....	....	*8		
Magma Copper	N. Y. Curb	*22	*21½	*21½	Jan. '19, Q	.50
Majestic	Boston Curb	†*7	†*6	*6		
Mason Valley	Boston	1½	1½	1½		
Mass Consolidated	Boston	2⅞	2¼	2⅞	Nov. '17, Q	1.00
Miami Copper	New York	22⅝	21⅞	22⅜	Aug. '21, Q	.50
Michigan	Boston	2⅞	2⅞	2¾		
Mohawk	Boston	51	50	50	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	6	5	5¼		
Nevada Consol.	New York	11¾	11⅞	11¾	Sept. '20, Q	.25
New Baltic	Boston Curb	....	....	3		
New Cornelia	Boston	14¾	14½	14½	Aug. '20, K	25
North Butte	Boston	10¾	10	10	Oct. '18, Q	.25
North Lake	Boston	....	....	*30		
Ohio Copper	N. Y. Curb	*6	*6	*6		
Old Dominion	Boston	23½	23¼	23½	Dec. '18, Q	1.00
Osceola	Boston	27½	27¼	27¼	June '20, Q	.50
Phelps Dodge	Open Mar.	‡....	....	....	Oct. '21, Q	1 00
Quincy	Boston	38	36	36	Mar. '20, Q	1.00
Ray Consolidated	New York	13	12½	12½	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*27	*20	*25		
St. Mary's Min. Ld.	Boston	36½	36½	36½	June '20, K	2.00
Seneca Copper	Boston	...	...	13½		
Shannon	Boston			1½	Nov. '17, Q	.25
Shattuck Arizona	New York	6¾	6½	6½	Jan. '20, Q	.25
South Lake	Boston	..	...	1		
Superior & Boston	Boston	1¾	1½	1½		
Tenn. C. & C. cfs.	New York	7⅜	7⅛	7¼	May '18, I	1 00
Tuolumne	Boston	*42	*37	*38	May '13	.10
United Verde Ex.	Boston Curb	27	25	27	May '21, Q	25
Utah Consol.	Boston	3	3	3	Sept. '18,	.25
Utah Copper	New York	52¾	50⅞	52¾	June '21 Q	.50
Utah Metal & T.	Boston	1½	1⅜	1½	Dec. '17,	.30
Victoria	Boston	...	...	1⅜		
Winona	Boston	..	...	*50		
Wolverine	Boston	..	..	11		
NICKEL-COPPER						
Internat. Nickel	New York	13¾	13⅛	13¾	Mar. '19,	.50
Internat. Nickel, pf.	New York	..		74¾	Aug. '21, Q	1 50
LEAD						
National Lead	New York	75	74½	74½	Sept. '21, Q	1 50
National Lead, pfd.	New York	104	103	103	Sept. '21, Q	1 75
St. Joseph Lead	New York	12¾	12¼	12½	Sept. '21, Q	.25
QUICKSILVER						
New Idria	Boston		..	*50		
ZINC						
Am. Z. L. & S.	New York	9¾	9	9⅞	May '20,	1 00
Am. Z. L. & S. pfd.	New York	32	32	32	Nov. '20, Q	1 50
Butte C. & Z.	New York	4¾	4½	4½	June '18,	50
Butte & Superior	New York	14	13½	13½	Sept. '20,	1 25
Callahan Zn-Ld	New York	4	3¾	4	Dec. '20, Q	50
New Jersey Zn.	N. Y. Curb	126	124	126	Aug. '21 Q	2 00
[illegible]	N. Y. Curb			2	Feb. '16,	03
Yellow Pine	Los Angeles			*55	Sept. '20, Q	03

*Cents per share. †Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills, Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The [illegible], N. Y.

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	New York	½	⅜	⅜		
Alaska Juneau	New York	¾	⅝	⅝		
Carson Hill	Boston	14½	13½	13½		
Cresson Consol. G.	N. Y. Curb	1 13/16	1¾	1¾	June '20, Q	$0.10
Dome Extension	Toronto	*65	....	....		
Dome Mines	New York	18½	17¾	18½	Oct. '21, Q	.25
Florence Goldfield	N.Y. Curb	*50	*40	*42		
Golden Cycle	Colo. Springs	*69	*67	*67	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	....	....	*3	Dec. '19,	.05
Hollinger Consol.	Toronto	7.45	7.36	7.40	Oct., '21, 4 wks.	.05
Homestake Mining	New York	56	55½	56	Sept. '21, M	.25
Kirkland Lake	Toronto	*37	*30	*34		
Lake Shore	Toronto	1 25	1 14	1 21	Aug. '21, K	.02
McIntyre-Porcupine	Toronto	1.92	1.91	1.90	Sept. '21, K	.05
Porcupine Crown	Toronto	*14	*10	*11½	July '17,	.03
Porcupine V. N. T.	Toronto	*19	*16	*16½		
Portland	Colo. Springs	*38	*38	*38	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	....	....	*4	May '19,	.05
Schumacher	Toronto	*26	*20	*24		
Silver Pick	N. Y. Curb	..	.	*8		
Teck Hughes	Toronto	*16¾	*15	*16		
Tom Reed	Los Angeles	*61	*50	*50	Dec. '19,	.02
United Eastern	N. Y. Curb	2 5/16	2¼	2 5/16	July '21, Q	.15
Vindicator Consol.	Colo. Springs	*24	*22	*24	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	.	.	*7		
Yukon Gold	N. Y. Curb	1⅝	1¼	1⅝	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*19	*19	*19	Apr. '20, M	.03
Batopilas Mining	New York	.	.	⅜	Dec. '07, I	.12½
Beaver Consol.	Toronto	*25½	*23½	*25¼	May '20, K	.03
Coniagas	Toronto	1.50	1.00	1.50	May '21, Q	.12½
Crown Reserve	Toronto	*13	*11	*13	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3⅞	3½	3½	Oct. '21, Q	.12½
La Rose	Toronto	*37	*33¾	*34¼	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*23	*20	*20	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.15	1 12	1 15	Sept '20, Q	.12½
Nipissing	N. Y. Curb	5½	5	5⅛	Oct. '21, Q	.03
Ontario Silver	New York	4¼	4½	4¼	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	....	....	*11	Jan. '12,	.10
Temiskaming	Toronto	*22	*21	*22	Jan. '20, K	.04
Trethewey	Toronto	*12½	*11	*12½	Jan. '19,	.05
GOLD AND SILVER						
Barnes-King	Butte	....	....	*60	Aug. '20, Q	.05
Boston & Montana	N. Y. Curb	1⅛	*92	*98		
Cash Boy	N. Y. Curb	*5	*5	*5		
Consol. Virginia	San Francisco	† 36	†*34	*36		
Dolores Esperanza	N. Y. Curb	1⅛	1⅛	1⅛		
El Salvador	N. Y. Curb	*18	*16	*17		
Jim Butler	N. Y. Curb	.	....	*7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	..	....	*3	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	⅛		
MacNamara M.& M.	N. Y. Curb	*15	*12	*14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	....	....	4	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 5/16	1 3/16	1 5/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*73	*67	*70		
Tonopah-Extension	N. Y. Curb	1⅛	1⅛	1 1/16	Oct. '21, Q	.05
Tonopah Mining	N. Y. Curb	1⅛	1 1/16	1 1/16	Oct. '21, SA	.05
West End Consol.	N. Y. Curb	*96	*89	*95	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb			*7	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1.05	1.02½	1 02½	Dec. '20,	.15
Chief Consol.	Boston Curb	3½	2½	3½	Aug. '21, Q	05
Consol. M. & S.	Montreal	19⅞	19	19	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†3 00	†1 00	..	July '20, Q	.10
Daly-West	Boston	2	1¾	2	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†3	†2½	2	Apr. '21, K	.05
Electric Point	Spokane	*7	*6	*6	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*40	*36	*39		
Federal M. & S.	New York			7½	Jan. '09,	1 50
Federal M. & S., pfd	New York	25	25	24½	Sept. '21, Q	1.00
Florence Silver	Spokane	*8	*8	*8	Apr. '19,	.01¼
Grand Central	Salt Lake	....	†*10	.	June '20, K	.03
Hecla Mining	N. Y. Curb	4¼	4	4¼	Sept. '21, Q	.10
Iron Blossom Con.	N. Y. Curb	17	17	*17	Apr. '20, Q	02½
Judge M. & S.	Salt Lake	†3 00	†1 65		Sept. '20, Q	12½
Marsh Mines	N. Y. Curb	*4	*3	3	June '21, I	02
Prince Consol.	Salt Lake	*7	*7	*7½	Nov. '17,	02½
Rambler-Cariboo	Spokane	*2	*2	2	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*10	*8	*9		
South Hecla	Salt Lake	†*40	†*20		Sept. '19, K	15
Standard Silver-Ld.	N. Y. Curb	*10	*10	*10	Oct. '17,	.05
Stewart Mining	N. Y. Curb	*4	*4	*4	Dec. '15	.05
Tamarack-Custer	Spokane	1 90	1 85	1 90	Jan. '21 K	.04
Tintic Standard	Salt Lake	1 92½	1 87½	1 90	July '21, Q	05
Utah Apex	Boston	2½	2¼	2¼	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*2	*2	*2	Nov. '17,	.01
VANADIUM						
Vanadium Corp.	New York	30⅞	29¾	30½	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	53	47	53	Oct. '21, Q	1.50
Asbestos Corp., pfd.	Montreal		.	70½	Oct. '21, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	36	[illegible]	36½	Mar. '21, Q	1 00
Amer. Sm. & Ref. pf.	New York	75	[illegible]	[illegible]	Sept. '21, Q	1.75
Am. Sm. pf. A	New York	78	77½	77½	Oct. '21, Q	1 50
U. S. Sm. R. & M.	New York	32	31½	32	Jan. '21, Q	.50
U. S. Sm. R. & M. pf.	New York	42½	39¾	39¾	July '21, Q	87

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
[illegible] M. HAIG
J. VOLNEY LEWIS
[illegible]
[illegible] Editors

Volume 112 New York, November 5, 1921 Number 19

The Marketing of Metals and Minerals

ARE OUR SCHOOLS where mining engineers are prepared schools of engineering, or are they schools of mining? Has this puzzling question ever presented itself to the boards of control and the faculties? Are there any schools which intend or pretend to teach mining as an industry, with all the technical and economic aspects given the proper weight?

In considering a mining enterprise there are several main departments. The first question is, how much ore there is or is likely to be, and of what grade. The second is, how it shall be extracted from the earth. The third is, how it shall be treated to produce the metal. The fourth is, where are you going to sell your metal, and whether the market is likely to be steady or unreliable. Four main factors. The first is the peculiar province of the geologist, the second of the mining engineer, the third of the metallurgist. But the fourth —the problem of marketing? Unless the ore can be sold to advantage, there is no use in planning to find it, mine it, beneficiate it. Yet this equally important phase of marketing is not taught in our mining schools; and the mining engineers, metallurgists, and geologists continue to know little about it, to the end of the chapter.

Except for special experts in each mineral or metal trade, most of whom have not been trained in mining, and know or care little about it, there are few who comprehend or have studied the marketing problem of their own product. This is even true of the common metals, and of great organizations; but in the case of the less common mineral products, still less is generally known.

An experienced mining engineer and mine manager some time ago investigated a mine of mixed ores, which contained, among several ingredients, cobalt. At the quoted price for cobalt, and with the other ingredients—such as arsenic—at their quoted prices, he figured a very handsome profit. He had sampled the market qualitatively. He was advised, before going further, to sample it quantitatively, and to try to gage the market's absorbing powers by tonnage as accurately as he had tried to diagnose the ore reserves of the mine. He soon found that, whatever the quoted price, based on actual sales, of cobalt, the mine in question would at once break such prices, for it would produce in one year enough to last the whole United States for many years. Similarly, with arsenic he found that there was much to the science of marketing it, and that, regardless of quoted prices, there were many factors that would actually enter not only into the price that could be obtained but concerning the amount that could be disposed of at the price. In short, the mine was not, marketwise considered, a profitable proposition.

Producers of metals and minerals should understand that quoted prices vary in stability somewhat like the quotations for stocks in the New York market. For some the quotations yield little to small individual sales or purchases, on account of the magnitude of the whole business transacted; but there are others, in which the dealings are small, where a moderate-sized selling order will break the market.

We believe there is no matter on which it is more important to educate the mining engineer than on the facts and principles of marketing—and merchandising, we are tempted to add. And by the last term we mean following the problem of marketing, as far as practicable, toward the ultimate consumer. We purpose devoting to this work such time and space as we can afford.

In the projected Department of Mines, which is now before Congress, there is provided the establishment of a Bureau of Mineral Markets, which would be devoted to this problem, so essential to our industry. This, of itself, is sufficient reason why the Nicholson bill should be passed. The agricultural industry is provided with such a potent aid, in the Bureau of Markets of the Department of Agriculture.

More About Those Copper and Brass Stores

OUR EDITORIAL in the Oct. 15 issue, in which we made a plea for the establishment of retail stores handling copper and brass products at reasonable prices, has elicited a letter from the Rome Brass & Copper Co. Mr. H. J. Rowland, sales manager of that organization, calls our attention to the fact that it has maintained a store at 115-119 North Market St., Chicago, for about twenty years. We are glad to mention this fact, and also to make it clear that similar stores or warehouses are maintained by several other fabricators of semi-manufactured copper and brass products. However, these stores are not exactly what we had in mind. The Rome establishment in Chicago, for instance, is in a district largely occupied by warehouses and buildings used for manufacturing. It is designed to supply the trade rather than the retail buying public. Only a limited variety of products are sold, such as sheet brass and copper, brass rods, brazed and seamless tubes, moulding, [illegible], angles and channels, electrical copper, and [illegible] copper, and rivets and burrs. We understand that copper screening, nails and tacks, wash boilers, kitchen utensils, hot water tanks and other more highly manufactured products are not carried. We are glad to know, however, that at this store one may buy as little as one sheet of copper for 20 or 25c. per lb., or one length of a rod or tube. That such retail business had accrued to these manufacturers' outlet stores was unknown to us, and we think to many of our readers, especially to those who have complained to us of being obliged to pay four or five times as much when purchasing from their general supply stores. Apparently no effort is being made to solicit this small consumer or to make known to the general public that semi-manufactured copper is available in small quantities at reasonable prices.

The kind of store which we had in mind would be situated in the retail shopping district with attractive show windows to attract the pubic. These show windows, the salesmen inside, and newspaper and magazine advertising would gradually eliminate the public impression that copper is a luxury. The store would sell either wholesale or retail, the retail prices representing a fair advance over the wholesale cost, but not an inordinate one, as they now often do. What is needed is to persuade Mr. Average Man that copper is something which he should use more of. After paying $1 for some copper article worth 50c. or less, he feels, without further investigation, that a copper roof for his house is out of the question. The basis of this impression must be removed, and one way to do it is to sell a few thousand stamped copper trays, boxes of tacks, and cast candlesticks at cost.

Let the public get used to the color.

The Railroads and the Trucks

THE EASTERN RAILROADS, running through the most populated portion of the United States, enjoyed not so very many years ago great prosperity, while the Western railroads, serving the long thinly populated stretches, had hard times and small pickings. New Haven stock was the "safe" investment of the old ladies and solid conservatives of New England; Pennsylvania stock, a little later, was regarded as in the same investment class as Government bonds. Today the situation has changed: New Haven stock has not the remotest chance of a dividend, even the bonds are of doubtful nature, and an impending receivership continually hangs over the road that serves the densest population of the country. Even the security of Pennsylvania stock has been shaken, and its dividends have been decreased. But the long lonesome roads of the West, like Southern Pacific and Northern Pacific, have become sound and steady dividend payers.

It is, in fact, the dense population which makes railroading in the East, especially in New England, a difficult financial problem. It is a region of short hauls, "one continuous terminal," as has been exaggeratedly but trenchantly stated; and this means great expense to the railroads, and a difficulty in covering the cost of hauling freight at so much per ton mile.

The most important development, hinging upon the dense population, is that of good roads and the motor truck. Especially at night, the excellent main highways carry almost continuous lines of great freight trucks, thundering along at thirty or forty miles an hour. Without having access to figures, we do not doubt, from observation, that more freight is hauled by truck between New York and New Haven than by rail.

In the United States in general it is stated that in 1920 motor trucks transported 480,000,000 tons; and naturally most of this is in the short-haul populous districts.

Latin-American Maps

WE CALL SPECIAL ATTENTION to the plans announced in our issue of last week, of the American Geographical Society of New York, for collecting, compiling, and publishing geographic data concerning the countries of Latin America. Those who have traveled in these countries have been astonished at the almost total lack of accurate geographical knowledge or of even approximately correct large-scale maps, which obtains over great areas. In the United States and Canada we have many surveys, of varying degrees of accuracy; but in general the maps are fair, and sometimes excellent. Lastly, comes the topographical map of the United States, in process of being finely executed in individual small sheets by the U. S. Geological Survey.

In Alaska and in the remoter parts of Canada, determined work by explorers, geologists, and surveyors has steadily attacked the unknown, and persistently hewn the way to better knowledge of geography. Some very excellent cartographic work has been done in some of the states of Mexico, but the surveying and the engineering accuracy fall short of the distinguished delineation skill which characterizes the Mexican draughtsmen. In general, around the shores of the Caribbean Sea, for example, the only worth-while maps are those of the U. S. Coast and Geodetic Survey, which has surveyed the shores and sounded the littoral seas. But back of these shores the rivers are often sketched from the memory of some mahogany cruiser, and the relief is an unknown element. Any mining engineer, traveling in a pitpan, with a few instrumental observations, can produce a sketch map of the average Central American river which is a great improvement over anything recorded or published; and location of latitude and longitude, partial triangulations, even compass traverses tied in to some known point, will be invaluable data for the compiling geographer.

Mining engineers are the most exploratory of the species, and the most competent to make sketch maps and general geographic and topographic observations. We urge them to bear in mind, now and definitely, the work that the American Geographical Society is undertaking, and to constitute themselves members of its army of volunteer scouts. Such a work could really only be undertaken by this one organization, whose contributions to cartography have already been so valuable. Our Federal surveys can, of course, not go outside of the United States; nor can our Coast and Geodetic Survey leave the shores.

Get into correspondence at once with Allan G. Ogilvie, American Geographical Society, 3755 Broadway, New York, and enroll in this foreign legion of cartographic scouts. You will receive in return information, when you need it, which will more than repay you; and eventually at least reconnaissance maps of those backwoods which we have yet to develop.

The Least Advertised Commercial Earth Product

POSSIBLY among the many mineral products which are produced in the United States our readers know the least about helium. Yet there is a large plant in Fort Worth, Tex., built by the Government at a cost of $2,000,000, which has recently been completed; and the Government has in storage over $2,000,000 worth of this material.

Helium is a gas, obtained from natural gas, of which it forms a minor ingredient. It is lighter than air, like hydrogen, and its value is for balloons—war dirigibles specifically—and its unique advantage consists in this, that unlike hydrogen, it is not inflammable.

The history of our knowledge of this element is fascinating—one of the wonders of science. There was no such thing as helium when you and I were boys, any more than there were airplanes or wireless—at least, there existed no such thing within our world of knowledge. Helium was first found—not in Europe or in America, but in the sun—as a new strange line in the sun's spectrum, in 1868. At least this is one thing for which the prospector will not claim credit, at the expense of the scientist. In 1888, Dr. Hillebrand, of the U. S. Geological Survey, noted a strange gas evolved from certain uranium minerals; and, following this clue, Sir William Crookes finally established the identity of this gas with helium.

Dr. Richard B. Moore, of the U. S. Bureau of Mines, has told the helium story with comprehensive accuracy in the *Journal of the Franklin Institute*, of Philadelphia.

In 1895, helium was detected in the atmosphere, and was later found in mineral springs and in volcanic gases; and ultimately it was found in natural gas, particularly in North America. It is from this last-named source that the gas is being collected in immense quantities by the Government.

It is generally believed that helium cannot long be retained in the atmosphere—that on account of its lightness it must be thrown off into space; and that, therefore, its presence in the atmosphere in constant proportions indicates a steady earth-supply to compensate the continual loss.

Rocks and minerals have been found to contain helium. Its amount, in rocks, is frequently too small to be directly measured; but it is usually found in measurable quantity in those minerals which contain uranium or thorium, such as carnotite, thorianite, and pitchblende. Beryl contains a considerable amount of the element. The saline minerals of Stassfurt, in Germany, such as sodium chloride (rock salt), potassium chloride, carnallite, and kieserite, contain it. Most abundantly is it found in potassium chloride, and it is remarkable that it appears to be nearly eighty times as abundant in the potassium chloride mineral as in the sodium chloride, while the uranium content, with which the helium content of minerals has been supposed to be very closely connected, is relatively reversed, being three times as great in the sodium chloride. In fact, in the saline minerals, there is no evident interrelation whatever between uranium and helium.

In studies of natural gas from Kansas, it has been found that there is a rough ratio of quantity of helium present to that of nitrogen. These researches formed the first foundation for the belief that an adequate supply of helium could be obtained from natural gas, for the filling of dirigibles.

It has been concluded by Rutherford that the helium atom is the alpha particle which is one of the three disintegration products of radium; and this has been proved by experimentation. It has accordingly become generally believed that to radioactive changes has been due the helium of nature, both in the atmosphere, in natural gases in the earth, and elsewhere. But a theoretical difficulty presents itself. The period of radioactive changes has been definitely determined, and the relative quantity of products obtained. Two thousand pounds of uranium will produce only 110 cubic millimeters of helium per year. Therefore, the accepted origin does not seem to be at all sufficient quantitatively. The total amount of helium already produced by the gas wells of the Petrolia field, in Texas, from which the Government reduction plant draws its supplies, is more than sixty million cubic feet; and the area of the field is only eight or ten square miles. Dr. Moore is of the opinion that it is inconceivable that so much helium could have been produced by radioactive changes within this limited area; and adds that in any event this explanation assumes large quantities of uranium or thorium minerals more or less localized, an assumption for which we have no evidence whatever. This doubt is further strengthened by the presence of helium in non-radioactive minerals, and by the observations in the Stassfurt saline minerals above noted. Dr. Moore significently remarks, "Are changes going on in nature about which we know nothing, and are these changes as radical and important as radioactive changes, about which we knew nothing twenty-five years ago?"

The amount of helium in the gas at Petrolia, Tex., is 0.93 per cent, among the highest found in the United States. Is it not possible that the amount of this gas will serve as an index of the relative amount of other elements in that portion of the crust whence it is derived? The current theory supposes helium to be an index of the relative quantity of thorium and uranium, in the undercrust; but the considerations stated by Dr. Moore render this doubtful. Do the remarkable relations found in the Stassfurt salts hold good as a rule, or are they exceptional? Is there any connection between potash and helium? We have no doubt that experimental work, in the Bureau of Mines laboratory and elsewhere, may unfold new and marvelous mysteries.

HELIUM REDUCTION PLANT, FORT WORTH, TEX.

WHAT OTHERS THINK

Reasonable Prices for Copper Products

A short time ago an article appeared in *Engineering and Mining Journal* stating that you would like to see stores started in New York, Chicago, San Francisco, and New Orleans, where copper and brass products could be sold in large or small quantities at reasonable prices. Permit us to say that we have our own stores in New York and Chicago and sell our sheet copper and copper products at reasonable prices. In fact, we charge no more for copper out of New York or Chicago than we do from the mill at Pittsburgh.

We have heard at times of sheet copper being sold at 75c. or $1 a pound, but personally we have never been able to find anyone who paid that price. We have always advocated selling our goods at a reasonable price, and have done so; even during the war, when it was possible to get almost any price for copper, we kept strictly to the published prices, no matter whether the copper which we were obtaining came from Pittsburgh or our stores.

The article states that you are going to give a lot of free advertising to the first copper or brass company to start a retail store with common-sense prices. We are not looking for any great amount of advertising that is free, but we do think that a statement in your column to the effect that we operate stores of the character you advocate, and are willing to sell to anyone at the lowest market prices, would be of service in advertising the fact among your dealers.

In order to help those who are not skilled in the laying of sheet copper roofs, eaves trough, conductor pipe, flashing, and similar material, we have issued a number of booklets which are free to all who write for them.

C. G. HUSSEY & Co.

Pittsburgh, Pa.

[Further discussion of this matter appears on our editorial pages this week. C. G. Hussey & Co. manufacture copper in sheets, plates and rolls, crimped copper, copper bottoms, conductor pipe, eaves trough, rivets, nails, gaskets, ferrules, soldering coppers, elbows and shoes. The New York Store is at 504 W. 24th St.—EDITOR.]

Nomination vs. Realization

If you remember the thrills of standing on the side lines and watching your football team give its foes a sound trouncing you will understand my enjoyment of your editorial on the methods used by the National Geographic Society in its quest for new members. You said in a most satisfying manner what I have wanted to say for some time.

I had the "honor" of being "nominated for membership in the National Geographic Society by a Member of the Society" about fifteen years ago at the guileless and hopeful age when, diploma in hand, I fared forth for conquest. I recall the warm feeling of gratification at having so soon attained national prominence and honor. The membership fee, then $2.50, was a trivial formality incident to entering this great fellowship of distinguished Americans.

Disillusionment came a few years afterward. When I had just moved to Washington I received a letter from a pharmacist in Chicago whom I had once coached in crystallography. He said that he had just been notified of his nomination to membership in the National Geographic Society, and as I was the only person he knew in Washington he assumed that I was responsible and tendered his heartfelt thanks for the honor. I did not have the heart to tell him that he had probably been nominated by the stenographer and clerk to the assistant secretary of the society after a catalog of the Medical School had been consulted. But then and there I resigned from a society that dishonored itself by such methods.

Years afterward I subscribed to the magazine, but I have never renewed my membership and never will as long as such Wallingford methods are in vogue. The National Geographic Society has done splendid work. It is the old, old question whether a good end justifies bad means in its attainment. I am old fashioned enough to think that it does not.

S. B. E.

Chicago.

The Origin of Petroleum

In *Engineering and Mining Journal* of Oct. 15 you publish an article by Hiram W. Hixon on "The Inorganic Origin of Petroleum." I can scarcely understand how the article in its present form passed the critical eye of the editor.

I am not one who adheres thoughtlessly to the principles of organic origin—the organic theory is not unassailable—but Mr. Hixon's arguments are not convincing. In fact, most of them may be refuted by one who has but an elementary knowledge of the facts and principles of geology. For instance, he says, "If petroleum were of organic origin it would have some of the properties of organic oils." Do fossils have any of properties of the organisms by which *they* were formed? Another of his sentences reads, "The salt, petroleum and sulphur are confined to the domes or their immediate flanks." Can any geologist interpret this statement? As a geologist, are you ready to confirm "an absence of 'sands' in the Gulf Coast section?"

Mr. Hixon refers to the foremost work in American geologic literature, but in his hypothesis he neglects one of the fundamental principles discussed in that work, namely a zone of flowage beneath the zone of fracture. And in his final statement he says the "domes and anticlines are not the cause of the accumulation of oil and gas but the effect of that accumulation." How shall we account for the domes and anticlines that are not and never could have been associated with oil or gas?

I think you will agree with me that geologists will always welcome any facts or arguments that will throw new light on the origin or accumulation of petroleum; but the facts must be completely established and the arguments must be well-nigh invulnerable to withstand the bombardment of criticism that is certain to be directed against them.

W. N. THAYER.

Cincinnati.

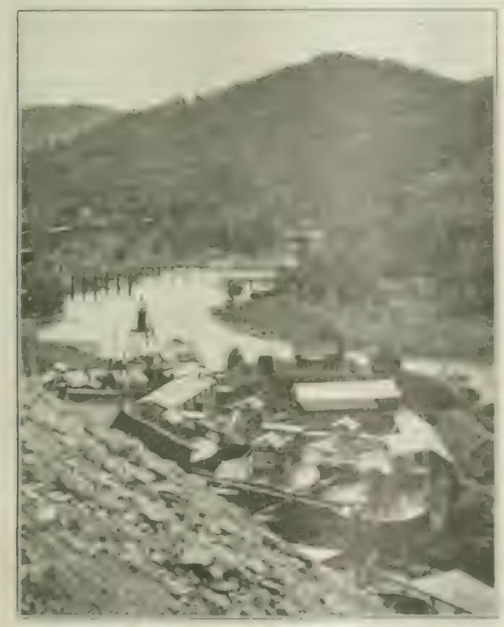
Gold Mining at Carson Hill, California

Important Ore Shoots Discovered in Much Prospected and Mined Region of the State Mine Operated Through Adit Electric Haulage System –Wide Stopes Ore Treated By Amalgamation, Concentration, and Cyanidation Efficient Working Organization

BY GEORGE J. YOUNG
[illegible] *Engineering and Mining Journal*

IN APRIL, 1899, F. L. Ransome, in the "Mother Lode Folio," published by the U. S. Geological Survey, made the following statement concerning the Carson Hill district:

"On the south slope of Carson Hill there are at least three strong and distinct veins, all more or less curved. They lie chiefly within fissile amphibolite-schists, although some of the orebodies are accompanied by small dikes and streaks of black slate. The Carson Hill mines were extensively worked in early days, and the orebodies were found to be very rich in their upper portions. There is at present, however, no deep mine in paying operation, although prospecting on an extensive scale is in progress, and it is likely that one or more large mines may soon be working in this noted locality, treating low-grade ores by modern processes."



MELONES CYANIDE PLANT

In 1914, the "County Reports" of the State Mineralogist of California state that the Morgan mine had been idle since 1898. At the time of this report there was a 900-ft. crosscut adit, 400 ft. of drifting on the adit level, and a winze 100 ft. deep. According to the report, in early times a $200,000 pocket was taken out of the Morgan mine, and as it was the largest single piece of vein gold ever found. During the early 50's gold estimated to amount to $3,000,000 was taken from pockets in this mine. The Calaveras Consolidated, according to the same authority, was being reopened in 1914. There was at this time an adit 1,400 ft. long and a shaft 600 ft. deep. The Finnigan, on the northeast slope of Carson Hill, was also being worked in 1914.

WAR CLOSES MELONES MINE

The Melones Mining Co. owns ground extending from the summit of Carson Hill to the Stanislaus River. It had been steadily operated since 1898, but in October, 1918, the mine was shut down, and in February, 1919, the mill also, owing to war conditions. A 100-stamp mill, for cyanide and concentrates; a treatment plant, 1,200-hp. water-power, a 5,000-ft. adit, electrical haulage system and an underground shaft to the 2,550 level were the principal features of its equipment. Low operating costs as well as low-grade ore characterized its operations. The practical exhaustion of the profitable ore within the developed lead caused the shutdown probably as much as the economic disturbance engendered by the war.

The Carson Hill Gold Mines, Inc., was incorporated in 1917, absorbing the Calaveras Consolidated Syndicate, a close corporation formed by W. J. Loring and his associates. The Carson Hill Gold Mining Co. was later formed to take over the Carson Hill Gold Mines, Inc. These successive company changes were due to the absorption of additional mining properties, which eventually included the old Calaveras Consolidated group of claims at Melones, the Iron Rock and Relief Gold mining claims, the Irvine properties, and several additional newly located claims, together with the Morgan, Union, and Kentucky. The mining ground thus brought together includes in the aggregate two miles northerly along the Mother Lode from the Stanislaus River on the south. The Melones property is held under option, and the use of the plant and facilities of this company has been obtained by an independent agreement.

CALAVERAS SECTION ADIT 2,600 FT. LONG

The Calaveras section is opened by an adit 2,600 ft. long, the portal of which is on the south side of Carson Hill a short distance from the Stanislaus River. The adit develops several ore shoots, one of which is stated to contain 600,000 tons of ore capable of yielding, under conditions prevailing in 1914, a profit of $1 per ton. Northward of this shoot, which is said to reach a maximum width of 30 ft., another shoot occurs, said to average $5 to $6 per ton. This shoot is at the 1,800-ft. point in the adit and 600 ft. below the surface. Northward of this are the old English workings opened up in the early 90's, by an English company called the Calaveras Consolidated Gold Mines, Ltd. The adit has been extended to the English shaft, 2,600 ft. north of the portal and 600 ft. below the surface. This section of the property has not been fully developed, and its possibilities are in consequence [illegible] of some technical and speculative [illegible].

The Brown mine is the next claim on the north. In early days, Mexicans worked this ground, but the present company has done nothing except to trench the surface, with the result of finding favorable indications of an ore shoot. North of the Brown mine is the Relief mine, purchased recently by the company. This includes the Iron Rock, upon which a considerable amount of development has been done. A large tonnage of low-grade ore is said to be in sight.

MORGAN CLAIM DISCLOSES FAVORABLE LEAD

The most important discovery, and the one which vitalized the group of mines as a whole, was made upon the Morgan claim. When W. J. Loring secured the option to purchase the Morgan property he was confronted by an adverse report, and his first endeavor was to find indications that might lead to a valuable orebody, as the purchase price, $600,000, made it necessary to find something out of the ordinary, for otherwise the property could not have been taken over. A careful search of the upper levels of the Morgan resulted in the discovery of a favorable lead in the Morgan adit on the hanging-wall side of the large quartz vein known as the Bull vein. Sections sampling over $6 per ton were found on the north side of the crosscut and were drifted on.

At 28 ft. north of the Morgan adit, ore was encountered assaying $22 per ton. This was the discovery of the high-grade hanging-wall shoot of the Morgan mine. On stoping at this level the orebody proved to be 22 ft. wide and approximately 100 ft. long. The stope was extended to the 200 level and subsequently to the surface. At the surface and lying on top of the Bull vein, ore assaying from $8 to $12 per ton was stoped. In the meantime, the ore shoot was picked up on the 550 level, the length of the shoot being 150 ft. and of higher-grade ore. A winze was sunk to the 675 level and still higher-grade ore encountered. Subsequently the shoot was opened up on the 865, 985, 1,100, and 1,350 levels. It maintained practically the same grade and horizontal area at each level. Since then additional levels have been driven.

DEVELOPMENT SHOWS ADDITIONAL OREBODIES

It is of interest that the ore shoot lies wholly within the Morgan end line a short distance from the Melones claim. It pitches downward approximately parallel to the end-line plane and consistently maintains its relation to the Bull vein. It occupies the concave side of a curve in the Bull vein.

In the development work a number of ore shoots in addition to the hanging-wall orebody have been discovered. One known as the 1,100 flat vein was opened up on the 1,200 level, and a stope of maximum width of 26 ft. and a length of 260 ft. along the level has produced ore of $12 per ton. The same vein has been encountered on the 1,300 level, with practically the same assays as on the 1,200 level. This vein strikes N. 75 deg. W. and dips 28 deg. to the S. E. Another flat vein known as the 1,600 flat vein has been developed.

In addition, a foot-wall orebody (lying underneath the Bull vein) which was mined by the Melones Mining Co. many years ago, extends into the Morgan claim, and although low-grade as compared with the hanging-wall orebody, it can be cheaply stoped and will yield a profit. This orebody is said to be from 12 to 20 ft. thick.

Although many points of attack in the form of low-grade orebodies present themselves at different places in the group of claims, the present work has been restricted to the hanging-wall orebody, the two flat veins, and other ore shoots in the Morgan, Union, and Kentucky claims, the work on the Calaveras and other claims being reserved for future operations and better economic conditions.

The Morgan property was purchased in 1918, and mining began on Dec. 28, 1918. In the first year, 72,387 tons was milled, and in the second 105,152 tons. Production for the first two years approximated $1,000,000 per year. Mining is at present at the rate of approximately 180,000 tons per year. A large ore reserve has been developed. This has been made possible by the contiguous working in the Melones property, which permitted drifts to be quickly extended on the different levels.

MILL AND CRUSHER HOUSE ON THE MOKELUMNE RIVER

MINE OPERATION

The mine is operated in two divisions, the Melones adit level at 1,100 ft. marking the dividing level. Above this level the work on the Morgan mine is conducted through a single-compartment inclined skipway and an adit extending to the surface at Morgan Hill. Below the Melones adit level, development and operation are effected through an underground shaft, formerly used by the Melones Mining Co., and leased to the company. The shaft is a three-compartment incline, sunk in the foot wall to the 3,000 level. The hoisting equipment is a double-drum geared hoist, operated by a 250-hp. motor, with maximum hoisting speed of 1,000 ft. per minute, on the main adit level approximately 5,000 ft. from the portal on the south side of Morgan Hill.

The Melones shaft is in a favorable position for the development of the Morgan claim, and it is principally due to this favorable condition that the rapid opening up of the various orebodies has been accomplished.

There is comparatively little water, and the ground does not require heavy timbering. Stopes are wide, and the ore is mined by shrinkage or over-hand stoping and filling. Stopers and jackhammers are used for drilling, and 30 per cent powder used in breaking in the stopes. In drifting and crosscutting Turbros and Ingersoll-Rand No. 148 are used for drilling and 40 per cent powder for breaking. Drifts, raises, crosscuts and shafts are contracted, the contractors buying their powder and the company supplying timbers. Wherever the ore can be measured it is also contracted. Tramming distances are short, and levels are equipped with station pockets for loading the skips.

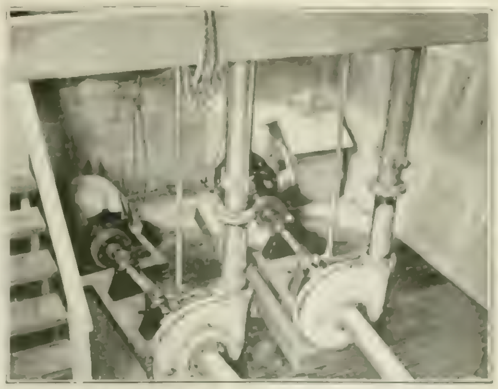
The hanging-wall orebody has been opened up to the surface, and the two adits provide adequate ventilation. On the lower levels ventilating fans and flexible air pipe supply the ventilation for development workings. Power cables supply current for lighting and power purposes on the working levels. A system of mine telephones connects stations on both shafts to the surface.

ELECTRICALLY DRIVEN EQUIPMENT

Compressed air is supplied by the compressor plant of the Melones Mining Co. on the Stanislaus River. A Laidlaw-Dunn Gordon and an Imperial compressor driven by a 250-hp. motor supply 1,800 cu.ft. of air per minute to the mine. Two additional compressors, both driven by motors, are available at the mine. A 100-hp. direct-current generator supplies current for the trolley locomotive operated in the Melones adit, the machine shop, and sawmill. Electrical power is purchased from the Utica Mining Co.

Tool sharpening, timber framing, blacksmith and machine shops and a storehouse are close to the portal of the Melones adit. Drill steel is hauled through the adit upon a flat car, side-boarded by 6-in. timbers, and distributed to the various levels. At each station drill-steel racks are placed so that an adequate supply can be maintained. Drills are kept in repair by a "machine doctor," who has a repair shop underground and during his shift inspects all drills in operation. A supply of repair parts is kept in the shop, and after repairs are made the drills are tested on the roof and sides of the shop. Both superintendent and foreman were enthusiastic over the success of this system in eliminating delays in drill repairs and the maintenance of the drilling equipment in a high state of efficiency.

CONVEYOR SYSTEM AND MILL BINS AT CARSON HILL GOLD MINING CO.



TAILINGS PUMPS ELEVATE TAILINGS TO [illegible]

Transportation from the shaft pockets and chutes to the thirty-stamp mill is by trolley locomotive. The ore is hauled in trains of six to eight nine-ton steel cars. All cars pass over a track scale and are weighed both full and empty. A recording beam is a novel feature of the weighing, the record cards being slipped into a slot in the beam and the weight printed upon them. This reduces the personal factor to a minimum.

During 1920, mining costs were $2.10 per ton milled for extraction and $1.03 per ton milled for development. Drifting cost $15.74, crosscutting $15.17, and raising $14.27 per foot. During the first three months of 1921 the costs were $13.68 for drifts, $14.42 for crosscuts, and $13.89 per foot for raises. In 1920, 7,031 ft. of development cost $19.40 per foot gross and after crediting for ore produced $15.21 net. Power used in the mine cost 5.9c. per ton for drilling, hoisting, and miscellaneous purposes. The power required is approximately 7.14 kw.-hr. per ton of ore produced. Drill-steel cost was 14c. per lb. for 1¼-in. cruciform, used for the stopers, and 18.5c. for 1¼-in. hollow-round, used for the drifters. Approximately 1 lb. of drill steel is used for six tons of ore.

Powder cost 20.78c. per lb. for 40 per cent and 19.28c. per lb. for 30 per cent. For ore extraction, powder, caps, and fuse cost [illegible] per ton. It is estimated that the cost per stick of [illegible] powder, with proportionate cost of caps and fuse, is [illegible]. Powder is counted out in sticks and is approximately estimated at one stick per foot drilled. During April, [illegible] ft. of drilling required [illegible] sticks of powder for blasting. The development footage was [illegible] ft., and ore, filling, and waste totaled [illegible] tons. This gives a powder ratio of [illegible] lb. to 1 ton. It is of interest to note that [illegible] is not used. Timber costs are [illegible] per ton extracted and [illegible] per foot of drift.

Transportation from ore pockets to mill cost [illegible] for power, labor, and rental of equipment. The power cost for transportation, crushing, and conveying was [illegible] per ton. The approximate total power required equals [illegible] kw.-hr. per ton milled for mining, transportation, crushing, conveying, and milling.

The ore consists of quartz and schist in varying proportions, containing free gold and between 3 and 4 per cent auriferous sulphides. It is received in the crusher bins and fed through gates to two 11 x 26 Sturtevant crushers (steel-plate construction) and discharged upon a conveyor which is equipped with a magnetic head pulley. This conveyor discharges upon a second conveyor, which is equipped with a tripper by means of which the ore is distributed in the mill bin. The amount of iron refuse (tramp iron) removed by the magnetic pulley offers testimony to the efficiency of modern appliances. Drill bits, pieces of broken drill steel, spikes and miscellaneous pieces of iron accumulate in considerable quantity. Mr. Stevenot, the superintendent, said that the stoppages and breakages in one month due to tramp iron were estimated to amount to $1,400 in lost running time and repairs before the installation of the magnetic pulley. Wood in the shape of wedges, blocking, and broken timbers in surprising amount gets into the mine ore as well as iron. This is removed by the crushermen from the feed chutes and the two conveyor belts.

Crushing is done by means of thirty 1,250-lb. stamps and with approximately 3¾ of water to 1 of ore. The battery product is passed through an 18-in. 60 deg. cone and thence to two 4-ft. cones, spigot products from all three cones going to three Hardinge conical mills (8 x 22, 8 x 30, 8 x 30). These are driven at 35 r.p.m. by a 100-hp. motor belted to a line-shaft placed directly over the conical mill drive shafts, belt tighteners being required on each belt. The main drive is a 16-in. 6-ply belt, and each mill is driven by a 14-in. 6-ply belt. Over each tube mill is a light traveling, hand-operated crane. Cobblestones obtained locally are used in the conical mills. Three-inch white iron liners obtained from a local foundry are used in the mills. Hardinge amalgamators are used on the discharge outlets of the mills.

The overflow from the 4-ft. cones and the discharge from the conical mills are distributed over three sets of 30 in. x 6 ft. silver-plated copper amalgamating plates (1¾ in. per foot slope, 2½ oz. silver per square foot) and then flow over twelve sets of plates 24 in. x 12 ft.

The pulp from the lower amalgamating plates is sent to three Diester roughers (5 hp. motor driving tables at 230, ⅞-in. strokes per minute). Concentrates are laundered to the settling bins and tailings pass to six Deister tables (290 ⅜-in. strokes per minute). These tables produce concentrates which are laundered to the bins, middlings which are elevated by a 6-in. bucket elevator to a Wilfley table, and tailings. The Wilfley table produces concentrates which are laundered to the bin, middlings which are pumped by a 2-in. centrifugal back to the conical mills, and tailings which are discharged along with the Deister tailing into a large galvanized-iron surge tank. Two 6-in. sand pumps elevate the tailings 50 ft. to the head of the launder leading to the cyanide plant. One pump is operated, the other being in reserve. In addition, two 4-in. sand pumps and another tank are available in emergencies for the same service. All sand pumps are provided with water inlets at the journal boxes.

A 10-hp. motor drives the six Deisters, the Wilfley, and the bucket elevator; a 5-hp. motor the 2-in. middlings-return pump, and a 35-hp. motor the two 4-in. sand pumps. An 8¼ x 10-in. triplex pump driven by a 30-hp. constant-speed motor supplies water from the Stanislaus River for the mill. The launder to the cyanide plant is 1,400 ft. long and placed on a grade ½ in. per foot.

Upper amalgamating, plates are dressed once per shift, the plates being arranged in pairs so that the pulp can be plugged off one plate while dressing down. The lower plates are dressed once a day. The entire mill is cleaned up three times a month, and plates are steamed once a month. An amalgamating barrel, grinding pan, amalgam press, and the usual clean-up equipment are provided.

The squeezed amalgam is 40 per cent bullion. It is broken up and placed in semi-cylindrical trays 9½ x 9½ x 4¾ in. deep, each tray holding 1,100 oz. The usual retort charge is 3,300 oz. The trays are chalked, and the retort is heated for three hours with a wood fire and five hours with a coke fire. The mercury loss in distillation is 1.2 per cent. The retorted metal is melted down in graphite crucibles in a gasoline-fired tilting furnace, sodium carbonate and borax being used for fluxes. The molds are heated and smoked. The bars are approximately 2,000 oz. and run 895 fine. They are sampled by four 3/32-in. holes drilled at opposite ends, two on the top and two on the bottom of the bar.

Shoes last from sixty to seventy-four days; liners forty-four to ninety; dies thirty days; conical mill liners seven months. Cobblestones are supplied locally at $4.50 per ton and are used at the rate of 8¾ lb. per ton of ore. Average cost of treatment in 1920 was as follows:

	Per Ton, Milled
Crushing	$0.07
Conveying and transportation	0.29
Stamping	0.16
Amalgamation	0.06
Concentration—Deister	0.07
Regrinding conical mills	0.14
	$0.79
Concentrate treatment	0.28
Tailings treatment	0.49
Bullion marketing	0.02
	$1.58

The treatment costs for 1921 are somewhat lower than the figures given in the table.

The tailings from the thirty-stamp mill are pumped to a sand and slime plant at the old milling plant of the Melones Mining Co. This plant is operated by Hamilton, Beauchamp, Woodworth, Inc., under contract with the Carson Hill Gold Mining Co.

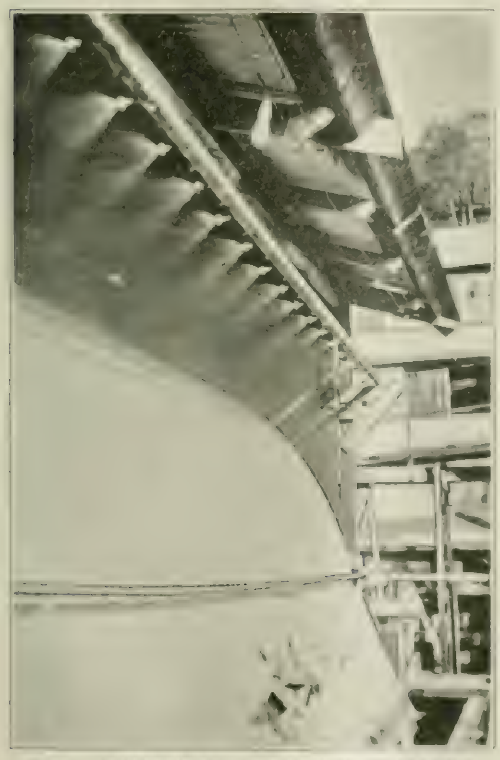
Approximately 500 tons per day at a dilution of 1 to 8 is received and handled by two duplex and two simplex Dorr classifiers. Sands and slimes are separated, the sands being about equal in weight to the slimes. The sands are laundered to sand-leaching vats (seven vats, 38 ft. diameter x 12 ft. deep) and charged by Butters and Meins distributors. They are given an eight- to ten-day treatment, and then sluiced out by means of sluicing water discharged through the distributors, the bottoms of the vats being made with a slope to a central discharge (slope 9 in. in 19 ft.).

The slimes are thickened to a 1 to 1 pulp and pumped by diaphragm pumps to launders, which discharge into Devereux propeller agitators. Aero brand cyanide is used, and two pounds of lead acetate per ton are added to counteract the effect of the soluble sulphides. Air lifts are used upon the agitators. The pulp is pumped and discharged to a 12 x 16-ft. Oliver filter without preliminary washing. It is washed on the filter. The solutions are precipitated by zinc thread in zinc boxes. The Crowe vacuum process is used. The precipitate is cut by sulphuric acid and melted in a pot furnace with the usual fluxes. The final bars are 425 fine, the base metal being principally lead.

The concentrates from the mill are hauled in trucks to a small concentrate plate near the cyanide plant. They are ground in cyanide solution in a tube mill to pass a 200-mesh screen, lime being added to the tube mill. The concentrates are agitated twelve hours in Devereux agitators and washed five times by decantation and settled to 40 per cent moisture and after decantation sluiced out of the agitator. The soluble loss is low.

WORKING FORCE

During April, 1921, the ore extraction totaled 12,800 tons, and ore from development 1,321 tons, or a total of 14,178 tons. There were employed 172.52 men for twenty-eight shifts. This equals 2.93 tons per man shift. Excluding construction workers, the mine output equaled 3.94 tons per man shift. Transportation is effected at the rate of 112 tons per man shift (five men per day); milling at the rate of forty-seven tons per man shift (twelve in mill crew), and ore breaking and conveying at the rate of 281.5 tons per man shift (two men).



WASHING SLIME OFF FILTER AT [illegible] CYANIDE PLANT

Considering that the average tonnage per shift during April was [illegible] tons, the tons per man shift for each division of the work is high as compared with other California mines, but giving the management due credit for its efficiency, the favorable conditions both underground and on the surface are such as to lead to a higher labor efficiency than in other mines operating in narrow veins and under less favorable conditions.

W. J. Loring, to whose initiative much of the success of this important property is due, is president and general manager. A. D. Stevenot is superintendent in direct charge of operations. Frank Wagoner is mine foreman and Charles Darroh mill foreman. Acknowledgment is made of the courtesy of Mr. Stevenot and the members of his staff who assisted me in gathering the material for this article.

The Problem of Mining Brazilian Iron Ore

BY HENRY L. GEISSEL

Written for *Engineering and Mining Journal*

The Brazilian iron-ore deposits are at present attracting greatest attention in Europe. Some time ago one of the largest Luxemburg metallurgical corporations (Burbach-Eich-Dudelingen) acquired extensive deposits of iron ore in Brazil, and several other important European concerns are also said to have been granted considerable concessions recently.

The most important Brazilian iron-ore formation extends in a north-southern direction from the states of Goyaz and Matto Grasso across the states of Minas Geraes, Sãn Paulo, Paranà, and Santa Catharina, up to the State of Rio Grande do Sul. In the State of Minas Geraes, in which some of the leading German concerns have been granted concessions, the foremost ore region, bounded by the heights of Itacolomey, Itabira, and Sierra do Cocaes, extends in an altitude of from 1,000 to 1,500 m. above the level of the sea and in a district of about 480 km. from the port of Rio de Janeiro, over an area which is of no less than 8,500 sq.km.

Up to the outbreak of the war the Brazilian government objected to the exportation of iron ores. For this reason the then (1914) formed powerful German-English-French syndicate, which intended mining and exporting iron ores on a large scale, had to be dissolved. Since the close of the war, however, the attitude of the Brazilian government has undergone considerable change, so that besides German and Luxemburg concerns American, English, French, and Belgian corporations have also acquired concessions.

A great drawback to the exportation of Brazilian iron ores is the lack of proper railroad connections. The only railway line that runs right through the ore fields of Minas Geraes is the Central of Brazil, from the trunk line of which several standard gage branch lines run to Ouro Preto and Bello Horizonte. An extension of these lines is being considered, but encounters great engineering difficulties, especially on the section running through the Sierra de Mar and Sierra de Mantiqueira. The Central of Brazil is not able properly to handle the mere regular traffic, so that the transportation of the manganese ores (in 19[illegible] [illegible] tons) was much hampered for a time. The Leopoldina Railway also intends extending its system into the interior of the State of Minas Geraes. A third possible line for the transportation of the ores is the Victoria-Minas ([illegible]) Railway, the shares of which are almost entirely in the hands of the English Itabira Iron Ore Co. This company has under consideration the connection of Itabira, the center of the iron-ore fields of Minas Geraes, with the port of Victoria (Espirito Santo), so as to be able to export the ores on a large scale.

War Problems in Minerals

IV—War Minerals Relief Commission, 1919-1921

By Philip N. Moore

THE HISTORY of the attempts to stimulate domestic production of minerals needed by the Government during the war, which minerals had been hitherto chiefly supplied from foreign sources, has been given in *Engineering and Mining Journal* by Messrs. Westervelt, Spurr, and Leith, who were among the most influential participants in such work. The comparatively small proportion of the national consumption of such minerals produced domestically was due to their scarcity in the United States contrasted with their abundance or cheapness in other lands. Many of the home deposits worked during the war have been long known and bear records marked by failures. Obviously, it was necessary to offer prices high enough to overcome the handicaps which had prevented continuous production in the past.

The War Minerals Committee, of which Mr. Westervelt, chairman, has furnished the record, had no official authority. No power existed in any department of Government to establish prices of minerals in advance. To create such power was the chief object of the proposed War Minerals Bill. It was intended to establish a Mineral Administration, with authority to contract for and fix prices of the needed minerals, to increase output, and to take such measures as would render their production assured under the difficult conditions then obtaining.

Unexpected Opposition to Original War Minerals Bill

This measure met opposition in unexpected centers. Not only did some of the great mining organizations of the country antagonize it under the impression that it would interfere with the orderly conduct of their business, but the so-called exponent of the mining industry of the country not only refused support, but opposed it. This body now figures as the friend of claimants under the War Minerals Relief Act, ostensibly in the interest of no one individual, but actually permitting its representative to appear as advocate in appeals for claimants and to conduct propaganda against rulings of the officers intrusted with the construction and execution of the statute.

There can be little doubt that had the proposed War Minerals Bill been enacted promptly at the time it was first offered, none of the unfortunate results ending in the enactment of the War Minerals Relief Bill would have occurred, because there would have been definite Government commitments which would have protected the market and made the situation clear.

The history of the failure of attempts to control the market by indirection, which ended in diverse rulings by different committees, with a practical annulment of an agreement made by one board through importation permits authorized by another committee, has been detailed by Mr. Spurr. The result was to break the market for both chrome and manganese several months before the Armistice, with a loss to producers who had prepared to increase output on the faith of assured limited importation.

To this extent exists moral claim upon the Government for reimbursement of loss, since only by promise of import restrictions was any governmental protection of price attempted.

In the late summer of 1918, the Bureau of Mines, recognizing the pending collapse of the market, endeavored to check development of additional manganese mines, and through its agents advised producers to proceed with caution. With the end of the war, all prices collapsed and producers faced losses where great profit had been expected.

History of the War Minerals Relief Measure

Quickly following, the larger producers of the stimulated minerals, chiefly chrome and manganese, organized to urge upon Congress their claims for relief. Asserting that the Government propaganda which urged increase of mineral output carried an implied contract to absorb production, the organization began an energetic effort to secure legislation to compensate the losses of its members. The campaign for the increase of production had been directed to other minerals than those whose producers initiated this campaign. These had suffered corresponding losses, but the producers of chrome, manganese, and pyrite were in evidence. It is related that in the difficult days when the fate of the relief measure hung in the balance, a Senator demanded that losses for tungsten be included in the list, under an implied threat of such opposition as would probably have defeated the bill. It was included.

The proposed measure followed the ordinary procedure of private or semi-private relief bills. An active lobby was sent to Washington, which energetically sought publicity for the claims and enlarged upon the distressed condition of the producers, for which they held the Government responsible.

The bill, as originally drawn, authorized the Secretary of the Interior to pay net losses in acquiring property or in producing or preparing to produce manganese, pyrite, chrome, or tungsten, in consequence of the published request or demand of certain governmental agencies. In the debates which followed, objection was made to the clause authorizing payment for the purchase of property, or including losses through published request. These were ultimately stricken out, and the bill was passed without them. The law also forbade payment of merely speculative losses or unless they had been incurred upon property carrying ore in sufficient quantities to be of commercial importance.

Bill Finally Passed as Rider to Informal Contracts Act

In its course through Congress, the measure followed the usual procedure of claim bills. It met the support of representatives from the mining states, whose constituents were most interested and were the proponents of the measure. These representatives in turn gathered to their help those with similar interests from other states. The measure as drawn was as liberal as they desired. Still following the common path, it met opposition from those representatives who were uninterested and naturally indifferent or antagonistic. This was abated by one and another amendment limiting the scope of the measure, which amendments were accepted by proponents' representatives as the only course under the circumstances. Its progress through the two houses of Congress met serious opposition. Almost certainly the majority were indifferent or antagonistic, and only by the parliamentary maneuver of attaching it as a section of, or rider to, the Informal Contracts Act, an important and generally desired measure, which was seriously demanded by public opinion, was its passage secured.

Opposition to it at the time would, in all probability, have brought defeat had the measure been squarely before Congress, as a bill offered on its own merits. As passed, it differed radically from that originally written in accordance with the wishes of the claimants. Restrictions had been inserted which materially limited its intended benefactions.

Bureau of Mines Selects Commission

The act placed authority to compensate for loss in the Secretary of the Interior, without appeal, expressly denying jurisdiction to any court. The Secretary could, of course, give no personal attention to investigation of claims. He determined upon the appointment of a commission of three. The Bureau of Mines, intrusted with the selection of the staff of engineers and auditors to examine properties and accounts of claimants, placed the responsibility upon Mr. J. E. Spurr, as Chief Engineer, who chose the able and diligent body of men comprising nearly twenty engineers and half as many auditors.

This commission, at first appalled by the indefiniteness of the statute, by the fact that it contemplated relief for very ill-defined and non-definable conditions where absolutely no contract existed, and where plaintiff's testimony as to motive and unwritten plan must necessarily have consideration, sought advice from the Solicitor's Department, the legal adviser to the Secretary, concerning the meaning of the statute. The earliest and most important request was for construction of the words: "in compliance with the request or demand of the Secretary of the Interior." It will be recalled that originally the bill included the words: "published request," which were stricken out.

The Solicitor of the Interior Department rendered an opinion to the Secretary, which, referred at once to the Attorney General, was confirmed by him.

Attorney General Defines Status of "Request"

The Attorney General, in his opinion, mandatory upon the commission, construed the words to mean a specific request, which in turn necessarily meant a personal request, and therefore rejected advertisements and public propaganda. How it would have been possible to have entertained any other construction is difficult to understand. It has been asserted, although the report is without strict corroboration, that after the passage of the act, a certain producers' association in a Western state sought from its distinguished counsel an interpretation of the law, which was rendered before the opinion of the Attorney General above quoted. It is said to have been almost exactly to the same effect.

Though this construction has been criticized as narrow, technical, and in no sense conveying the intent of Congress, it has not been successfully attacked by any legal authority equally distinguished.

It is to be noted also that the statute used the words: "in compliance with." It is clear, therefore, it was incumbent upon the claimant to prove affirmatively that he followed some policy, or made some development, which was in compliance with the request of Government authority, and that his losses resulted therefrom. If he only carried to completion a plan previously formed, making no change in his operations as the result of governmental request, he had, under the statute, no claim.

Claims for Speculative Losses Invalid

The law also forbade payment of merely speculative losses and of losses upon properties which did not carry ore in sufficient quantities to be of commercial importance. This phrase offered opportunity for much debate as to the meaning of the term "commercial importance." In its earlier rulings, the commission, with the Secretary's approval, defined a property of commercial importance as one carrying ore in sufficient quantity and of high enough grade to have afforded a reasonable probability of profitable operation during the expected time of the war; holding, further, that at the time most of the operations which resulted in claims were undertaken, the general expectation of the war was for two years.

This definition gave the claimant the benefit of war prices, charging operating expenses with war-time costs, and held it to be a commercial proposition if the evidence indicated that within two years under such conditions its operation could have been profitable. This definition was never seriously attacked by any claimant, but later, through a ruling of the Solicitor's Department, which was accepted by the Secretary, the commission was practically constrained to hold as of commercial importance any property which had produced a ponderable body of commercial ore during the war, no matter whether this had been shipped, whether it could have paid expenses, or whether the tonnage mined had exhausted the property. It will be conceded that this definition was liberal.

The prohibition of payment for merely speculative losses was not of great importance in the work of the commission. Though undoubtedly many claims presented whose payment for purposes [illegible] were largely inspired by speculative motives, these were nearly all dealt with upon different lines. Only two claims were denied because of speculative character. These, in both cases, asked compensation for the purchase of several properties on which claimant did practically no productive work, it being held by the commission, from all available testimony, that whatever work had been done was for the purpose of development, opening up for sale. Practically no ore was produced from them.

Commission [illegible]

A large percentage of claims asked compensation for the purchase of property as well as for losses in developing and operating. It was held that no authority to compensate for property was given by the statute, but payment was repeatedly made for new construction, less salvage value, as well as for other expenses. Some claims, really speculative, for purchase of properties, followed by a little prospecting but no production, were denied for this reason, which might have been rejected for their speculative character.

If the cases submitted by the claimants, either in their original file or at hearings, showed that claimant had received a specific request for production which led to his loss, or if his statements were not complete and full, his property and accounts were examined by engineers and auditors. Opportunity was given to the claimants to read and answer the reports of these officers and to furnish rebutting evidence if so desired. Claimant was allowed to appear in person or by attorney, or both. The utmost latitude of appeal was given to him, and time after time cases were delayed for months, waiting for claimant to say his last word. Appeals were heard by the commission against its own findings, appeals were taken from the commission to the Secretary, referred by the Secretary back to the commission for further testimony, and again heard by the Secretary; in fact one conspicuous case was heard by the commission three times, by the Solicitor twice, by the Secretary three times formally, together with many informal discussions which were not recorded.

HEARINGS IN THE WEST

That access to the commission might be facilitated and made less costly, the commission made a journey to the Pacific Coast, involving nearly three months' time, at which hearings were held at St. Louis, Little Rock, Tucson, Los Angeles, San Francisco, Medford, Portland, Baker, Spokane, Butte, Salt Lake City, and Denver.

At all times the door was open to the claimants to present testimony. It was not closed until the Secretary had made his recommendation. Great liberality was exercised by the commission as to what constituted a Government representative. Under the construction of the law by the Solicitor of the Department, the commission held that any one who had attended a meeting called by Government officials for the purpose of stimulating the production of minerals, who had there been asked to go back home and spread the gospel of production, and subsequently urged individuals to increase their production, was a representative of the Government, and the claim of any one receiving from him request to increase production could be considered by the commission. It was further held that a member of an audience at a public meeting addressed by a representative of the Geological Survey or the Bureau of Mines, although he had no other personal contact, had received request which entitled his claim to consideration. It was also ruled that members of state geological surveys which were co-operating with the U. S. Geological Survey were representatives of the Government for the purpose of increasing production of minerals, and that their requests should be recognized.

Many claims were presented where claimants admitted that they had received no specific request from any Government representative. Necessarily, such were rejected. Other claims were brought before the commission where, in the original presentation of claim, applicant stated that he had received no Government request or demand; and yet, on appeal, under the constructions above noted, he was allowed to abandon his own sworn statement, to present new proof, and on the strength of it, to reverse himself and be given compensation.

Promptly after the enactment of the law, claimants were solicited by claims attorneys, seeking representation of claimants for a fixed percentage of recoveries. The members of the commission were frequently asked for their advice concerning employment of attorneys. Great caution was exercised in reply, but where the direct question was put, asking if attorneys were necessary, the reply was frank. A very large proportion employed none. Many of the larger claimants naturally did so, but in few instances only is it believed that their services were worth the cost. On the contrary, a large part of work done by them was absolutely wasted, as it consisted of arguments addressed to the commission controverting the legal opinions of the Attorney General, the Secretary of the Interior, or the Solicitor of the Department, all of which were mandatory upon the commission. Such arguments were a waste of time, and many hours were lost through them.

In a few of the larger cases attorneys' services were clearly resultful, but it was the endeavor of the commission to give as detailed study to the claim of the un-attornied prospector as to that of the great corporation. Some of these even suffered from too much legal assistance, and following awards there came disagreements with their representatives. In one instance the corporation employed an old constitutional lawyer, who haunted the offices of the commission for days at a time, buttonholing engineers and examiners and making to the commission constitutional arguments and definitions of ore based upon the "Encyclopedia Britannica," until the staff dreaded his coming. An award of about $40,000 was made in the case. Some weeks later, a member of the staff received a request from the claimant, asking if he would be willing to testify concerning the value of the attorney's services in the issue, as, after collecting the award, that gentleman had not only deducted an expense account of about $2,500, but had withheld one-half of the remainder as his fee.

COMMISSION HANDICAPPED BY PROVISIONS OF RELIEF ACT

Throughout, the measure made the common record of claim bills, a story familiar to old departmental employees who have seen claims come and claimants go for many years. The act, as amended against the wishes of the proponents, passed to an administrative body for execution; that body, bound by the wording of the law, was powerless to reinsert into the measure the much-desired terms which had marked its writing by the claimants, and which many of them, at least those who were not present at Washington, did not realize had been eliminated by Congressional amendment.

The auditors and engineers who remained in the service longer than a probation term were all men of maturity and experience, skilled in their respective lines. In the course of their work, about six hundred properties were examined by engineers, and practically the same number of audits made. In cases where the statements of the technical staff were disputed, audits were not infrequently repeated, and on occasion second examinations were made. Engineers and auditors were instructed to convey to the commission all facts favorable or unfavorable with regard to the properties examined. In the large number of cases, claimants accepted without protest the statements of both.

Claimants submitting their losses to the commission for adjudication may be roughly divided into classes as follows:

First, and the great majority, were small operators or prospectors—men who either had never been engaged in the production of these particular minerals before the war, or who undertook production anew after the Government request. Though this class embraced much the largest number of individual claimants, the average of their claims was relatively small, although a few very large ones were presented. The aggregate of their claims was also less than the total of the other two classes. Many cases of this kind occurred where men, who had begun their operations, incited by the active demand, high prices and chance for profit, meeting some Government representative, received a request to increase production. These naturally were difficult to adjudicate for lack of any measure of the plans of the claimant before he received Government stimulation. In most cases, however, where there was plain evidence of Government request, claimant's losses were considered with liberality, if he could show any increase whatever resulting therefrom. There were also within this class a few large operations, some of which were unmistakably instigated by personal request and even insistence of Government officials.

The second class included producers established in the business before the entry of the United States into the war. These were naturally familiar with the industry and could make no claim of patriotism for entering the business. Having acquired the idea that the Government was in some way responsible for and was ready to compensate their losses, their memories naturally minimized the extent of their earlier operations and stressed the increase brought about through Government stimulation.

Only such portion of their losses in excess of the rate of their operations before receipt of Government request could properly be considered by the commission. The justice of this position has been accepted by the large majority of claimants, but, in some cases, it was stoutly maintained that entire losses after Government request should be considered, upon the theory that had they not received such request they might have ceased operations.

DEALERS AND BROKERS' CLAIMS DIFFICULT TO ADJUST

A third class of claimants, not only numerous but difficult to deal with equitably, was composed of those who were primarily dealers or brokers in the minerals in question—men who were thoroughly familiar with the market, who endeavored to increase their tonnage of ore handled, by mining. Cases were before the commission where the only risk that the claimant assumed was that which came through advances to prospectors and small miners, who took the mining chances themselves, but contracted to deliver the ore to claimants at fixed prices. More than a few of these developed where claimants had made handsome profits in their trading operations, but, losing money in their mining ventures, asked payment of losses by the Government. Equitably, such have no merit, because the production was subsidiary to the trading and the whole earnings of both should have been taken into consideration. Unfortunately for the Government, however, it was ruled that the commission could deal only with losses from "producing or preparing to produce." Therefore, some recommendations for award were made to claimants whose trading operations had been largely profitable. These, of course, only served to increase the total gains already made.

The commission held throughout, that the entire producing operations of claimants should be taken into consideration, and that they should not be allowed to select from their various operations those which were unprofitable, and ask compensation from the Government. This position also brought loud protests, but it was affirmed by two Secretaries. The commission also ruled that it could go behind the corporate alias of any claimants and deal with the losses of the individuals forming the corporation or firm, adjusting as the total results of the enterprises in which they were interested demanded.

AN EXAMPLE OF WAR-MINERAL FINANCE

One interesting example in which this principle was asserted was where four individuals were joined in a venture which undoubtedly lost money. The story runs thus: A certain owner of an idle mill which had been built to concentrate zinc ore procured a lease on a property in another district, containing one of the classes of mineral covered by the statute. He undertook to move his mill to the other property, to be used in concentrating the ore of the new lease. To secure funds, he sold a one-eighth interest in the joint enterprise to another man for $1,000. This did not last long, and additional funds were sought. Another eighth was sold for $2,000. This sum soon proving insufficient, and, the prospects of the enterprise improving, one-fourth of the joint enterprise was sold to another for $6,250. The end of the war brought the enterprise to a collapse. A claim for about $15,000 was presented. Only three of the partners presented claim for losses. The purchaser of the one-eighth for $2,000, having, in other enterprises in the same district, earned profits greater than that amount, felt that he could not conscientiously present a claim, and therefore the commission should not consider his share of the loss. The commission, hearing the case in open council with claimants, took the position that as the gentleman owning the mill and the lease had not contributed any of the money which was lost, he was no worse off with his nearly completed mill and the lease than at the beginning. It was therefore suggested that compensation of $6,250 and $1,000 be made to those who had furnished money for the enterprise and that he receive back his mill and lease. He demurred to this, insisting that the mill was of no value where located and that he should at least receive enough to move it back to its original situs. The commission thereupon recommended an award of $1,500 to him, $1,000 to his first partner, and $6,250 to the fourth, which awards were accepted. It is reported that the gentleman sold his lease and mill for several thousand dollars a few months after the award was made to him.

1,20[illegible] CLAIMS PRESENTED

The 1,20[illegible] claims which actually reached the commission were of interesting diversity. A common quality was that of including every item which indirectly or remotely might be construed as an obligation of the Government. This was true in numerous cases, and frankly stated [illegible] communications by claimants, because they thought it was incumbent upon the commission to decide what was allowable; therefore they put every item in, leaving it to the commission to make eliminations.

A great variety of claims, on the face of them outside of the law, were presented, such as claims for metallurgical losses. Commercial losses were also sometimes asked. In one instance the city manager of a beautiful small Western city presented a claim for $10,000 for loss on manganese ore taken from the city park, which had been sold and shipped to a customer, who failed after the shipment was made. Justice to this claimant demands the added fact be stated that he later apparently thought differently of the matter. The claim was not pushed.

Many cases came before the commission where the total operations had been profitable, but in which individual properties had made losses. For these compensation was sought. Promoters sought compensation for loss of time engaged in unsuccessful endeavors to finance properties which were expected to produce but were never sold. Operators apparently in doubt as to the latitude permitted to the commission asked for adjustment of losses made before the entry of the United States into the war. Claims were made for traveling expenses, other money expended, and for personal compensation at very liberal rates while engaged in securing options upon property which was never purchased and which made no production.

One claimant, engaging in the spring another, whom he called his foreman, procured an automobile, traveled unsuccessfully a large part of California, across the continent, and finally settled upon a property in Arkansas, twenty miles from the railroad, from which no shipments were made. This gentleman sought full-time compensation for his companion under the title of foreman, at the rate of $6 per day, and also asked for payment for an automobile worn out in the search.

"CLAIM HABIT" RESPONSIBLE FOR GROTESQUE DEMANDS

The claim habit of mind takes on most unexpected phases. It would seem that once the idea of governmental responsibility entered the brain of one who has made a loss, sense of proportion vanished. Some of the claims asking payment for the purchase of property illustrate this. In one, over half a million dollars was asked as the purchase price in 1918 of a well-known old mine, which had been on the market for years without purchaser. The mine today is again idle.

In one case compensation for construction of a railroad was insisted upon, the rails for which had been purchased before the receipt of any Government request or demand.

The attitude of claimants was also interesting psychologically. The majority of those disallowed were, of course, dissatisfied. Their responses to denial or reduction were as variant as their natures. In some, the criticism was bitter and personal, the commission apparently being held responsible for the law and the construction thereof. In others, keen appreciation of the courtesy and evident desire of the commission to deal fairly was expressed. In one instance where claimant had asked for $19,000 and received an award of $6,482 he replied, as follows:

"I will say that we will accept the award without comment or protest of any kind, as we feel that the award is entirely just and most fair in every respect. Speaking for Mr. ——— and myself, I wish to say that our treatment from the commission has been most considerate and courteous and gentlemanly in every way, and we wish, at this time, to express our appreciation of this fact."

In another case, denied *in toto*, claimant replied as follows:

"The ——— Company in operating its property during the years 1917-1918 was not performing work in compliance with any specific request or demand from any department of the Government. Although loss was sustained as mentioned in the claim, there was never any disposition on the part of the company to hold the Government liable for any part of said loss. The purpose in filing the claim was merely to protect the company's rights, if any, to participate in the distribution of the relief fund. The ——— Company does not see that it has any ground for taking exception to the commission's decision to grant no award and wishes to take this opportunity to thank the commission for its careful consideration of the claim and the full explanation contained in the above acknowledged letter.

——— ———

President."

Another claimant who had been refused wrote at length. A portion of his letter is as follows:

"Under the law, as worded, it is hard to see how the Attorney General could rule otherwise; the law which called for such a ruling is a humbug and should never have been enacted, for the following reasons: . . . So self-interest and patriotism both impelled us not only to mine known deposits, but to go out and hunt others and supply the demand.

"Now, the same law of supply and demand which speeded up the mineral production was felt in all other basic products; hence it was a bad law and against public policy to make fish of one and flesh of another after close of hostilities.

"But the discrimination in this case was even worse, for the law not only discriminates in favor of certain minerals, but selects certain firms and individuals already engaged in production as the beneficiaries of an eight million dollar appropriation as against those who went in to supply the demand, discover and open new mines, and met, or prepared to meet, the emergency with far greater risk of loss than those who were already in the business and had only the risk of oversupply to encounter, which risk finally overtook all alike. Hence, any law enacted for relief should have been so drawn as to be fair to all interests involved, but it should never have been on the statute books in any event.

"So this was somewhat the spirit in which we were taking hold of this manganese proposition; one must be able to show prospective profit in these things or capital cannot be interested; furthermore, these enterprises must realize enough to carry themselves or they become more or less a dead weight on other producers. I have no doubt my associates felt pretty much as I did, but some felt that so long as the Government was generous enough to offer relief where losses had been sustained, we would state our case fairly and accept cheerfully any decision that might be made.

"Of course, we saw the joker in the bill for relief, but took chances, much on the principle of the fellow who, accused by his friend of 'drawing the long bow' when he stated that he had seen buffaloes climb trees after grapes, replied that he knew it is not generally understood that buffaloes climb trees, but when a buffalo is after grapes, the Lord only knows what he will do, and so with Congress in a Presidential year."

Another claimant who had been refused, after writing his acceptance of the rejection and his entire disapproval of the law, upon the ground that it was discriminatory, inclosed the following copy of a letter to a Washington attorney, who had sought to represent him before the commission:

"Dear Sir:

"Your favor of April 29 inclosing amended Bill for Relief of Producers of War Minerals is at hand; also your offer to look after our interest for a retainer of $25 and 20 per cent of recovery, is before us, for which we thank you. In reply will say that your proposition does not appeal to us, for the following reasons:

"Both the original bill of March 2, 1919, and the proposed bill (S. 4259) amending the same, are based on the fact of an existing *contract* or understanding with the U. S. Government, either direct or implied, by the claimant for the production of war minerals, etc. We had no such contract or understanding, and so stated in our papers, and on these papers we must be judged [illegible] assuming that our claim was entirely just, and that we had a contract with the Government—which for some reason had been ruled out—by those administering the act of March 2, 1919, the so-called amendment provides no relief except in *words*; for it is generally understood by the public that the U. S. Court of Claims, to which it would be assigned, is merely the Limbo to which Congressmen send claims of persistent constituents, well knowing that to be the last of them, and the said constituent may, thereby, also have the grim satisfaction of being a man who has a *claim against the Government* which he can pass on down to his descendants, and give him the excuse also to pat his Congressman on the back and vote for him as long as said Congressman is available. No—we want none of this nonsense, and feel quite sure our so-called claim was very properly ruled out under the law."

MANY APPEALS TO SECRETARY

In many cases claimants who were denied responded with complaint or appeal to the Secretary direct. Some of these were reproachful or abusive, some were fairly pathetic in expression of disappointment which was clearly genuine, revealing an absolute misunderstanding of the terms of the law on the part of claimant; and some were so persistent and unintelligent that they only worked harm to the authors.

One notable case was that of a foreign-born citizen, who accompanied his papers with letters direct to President Wilson and Secretary Lane. In both of these his loyalty and service to the Democratic Party were stressed. When the opinion of the Attorney General was announced he addressed an appeal to that officer, reproaching him with the disastrous effect such opinion would have upon the Democratic Party.

Examination by engineer and auditor developed that it was doubtful whether he had ever received any Government request, and, in any event, he had suffered no operating loss. The only loss, if any, was involved in the purchase of his property. Following refusal, he, at intervals, addressed letters to the Secretary, suggesting in one that if his claim could not be paid, the Government might lend him $25,000 to develop a silver mine; in another, that he might have the use of some of the unused Government machinery, and, finally, that he be appointed Minister to his native land, on the strength of the fact that he understood the language. When the new administration came into office, he appealed to the Secretary, referring him to certain well-known Congressmen for evidence of his standing in the Republican Party.

These various letters carried intermittent criticisms of the commission itself, of the commissioner who had heard him personally, and especially of the commission's auditor.

COMMISSION'S DECISIONS GENERALLY ACCEPTED GRACEFULLY

It is due the great mass of claimants to state that few of the "kicks" against the decisions of the commission were as voluminous or unintelligent. The complaints and even reproaches with which the commission felt sympathy were those of the real prospectors who told of their efforts to discover and develop the desired minerals. Some of these were clearly genuine. In numerous cases the commission was able to make awards to such men, and a few grateful letters from old prospectors who were really in need of their small awards were welcome episodes. Few prospectors really appreciated the limitations of the statute, and therefore when denied, reproached the commission as if it had written the law, or could read into it conditions not existant.

Reviewing the more than twelve hundred claims before the commission, the conclusion is reasonable that despite possible moral obligation toward some, where the Government request was direct and effective, the legislation was, on the whole, inequitable and unwise. It was inequitable because it did not include the producers of all the scarce materials, and other needed non-mineral staples, production of which various Government agencies attempted to increase. It was unwise in that it attempted to compensate for losses not covered by contract and impossible to consider with fairness both to the Government and the claimant, on account of the impossibility of strictly limiting in words, so as to protect the Government, the conditions under which claimant should be entitled to relief. No contracts existed. The rule of construction is that remedial statutes shall be liberally construed. This being so, the unscrupulous claimant had a great advantage of the Government in pressing his claim, because he stressed patriotic motive and made statements which it was impossible to controvert.

"FIFTY-FIFTY" PATRIOTISM

Of the total number there was a share of claims absolutely inequitable. Of course these commonly attempted to get the utmost possible from the Government. Claimants were often asked at hearings what portion of their loss was due to business motive and what to patriotism. There was often unwillingness to answer, but, pressed to reply, the majority acknowledged that motives were mixed, and if it were necessary to value them, they should be about fifty-fifty.

To my knowledge no similar remedial statute has ever passed. If it be not possible to establish some absolute measure of indebtedness, or to show some contract, it were better, for the sake of the public purse and national morality, that no such law be enacted.

This brings up the pending proposal, instigated by some of the same interests which urged the first, to "liberalize" the law; throwing open, in the words of the proposed measure, which has already passed the Senate, "relief to all those who in response to any personal, written, or published request, demand, solicitation or appeal, from any of the governmental agencies mentioned in said act," complied with said governmental request.

It would make for the ease of adjudication if the proposed measure were simply to say that every claimant who has already filed shall be entitled to [illegible] the auditors and engineers, working under a commission, shall determine him to have suffered. With the gate thrown wide open to those presented above, there will be no means of disproving a claimant's statement. His affidavit to the fact that he had seen a poster on a tree in the Siskiyou Mountains, which proclaimed the Government's need for chrome ore, or the appeal of Secretary Lane to "Discover America" and, having read, embarked upon a prospecting or developing enterprise which resulted in loss, must be accepted, because the contrary cannot be proved.

Under the present statute, whatever claimant has asserted request or demand from a Government representative, which induced his loss, a definite date has been called for, and such Government representative has been asked to confirm his statement. In most cases, if true, he has done so. This has been possible, because both the Bureau of Mines and Geological Survey representatives keep record of their daily journeyings, from which exact dates can be secured. If claimant on that date received such a request, his losses previous to that time cannot be considered, and an exact starting point is established from which the accountants may determine loss. With the so-called liberalized wording no such process will be possible. It will involve payment, in addition to some worthy claims which have been denied under the present statute, of many hundreds of thousands of dollars of losses which have no equity whatever, for which only ordinary business motives were responsible, and which should be carried by the miner who knew the risk and really undertook it independent of any Government appeal.

The commission appointed by Secretary Lane to act as his advisers in the execution of this law consisted of Ex-Senator Shafroth, of Colorado; Ex-Representative Foster, of Illinois, and the writer of this paper, mining engineer. None of these solicited the appointment. In two cases at least it came as a matter of absolute surprise.

Within a few months after appointment, Mr. Foster died, and Mr. Horace Pomeroy, of San Francisco, mining engineer, was appointed; also without his own initiative.

To the best of my knowledge and belief, question of political faith had no influence; certainly it had none in the selection of the two engineers, as, oddly enough, it developed that both of them were Republicans; and the much-criticized commission therefore, acting under a Democratic administration, was in majority Republican.

"POLITICS NOT RIGHT"

An amusing incident in this line happened when a mountain Republican from the South appeared before the commission in support of a claim for losses upon two little non-commercial properties, when the evidence before the commission showed that he had conducted a large and profitable operation upon another. Being denied, he protested that he knew the reason to be that his politics were not right. I sent word to him that I, the only Republican member of the commission at that time, had written the disallowance.

Political appeals were of course constantly made, influence of Representatives and Senators was freely sought, and more or less—generally less—cordially supplied.

Commonly it was easy to read that the service was rendered to constituents more from sense of political duty than from real sympathy. In fact, a Senator replied to a commissioner who offered sympathy over the many calls upon his crowded time, that, "if they did not do it, they would not come back." One claimant incautiously wrote an associate that if they did not bring political influence to bear he feared "they would never get anywhere with their claim." The associate gave a copy of this letter to one of the commission's engineers, which in due time appeared in the official files of the case.

At the hearing the letter was read to claimant, and he was asked to explain.

Another claimant, a power in politics in his own domain, receiving and accepting, with the statement that he would make no appeal, an award of nearly $60,000, in the presence of his Senator, an influential Democrat, returned home and wrote his Senator a long letter of criticism of the commission, closing: "Of course, the commission could not get away with it if one could get at them. The commission is pretty well entrenched in Washington. It takes courage, money, energy and time to fight, even if you get to Washington. They seem to have the backing of the administration. It would be good politics if the Democratic administration threw them out."

The commission, at time of its resignation, in May, 1921, had made recommendations upon all claims before it. If these be approved by the Secretary there should remain from the original appropriation of $8,500,000 for awards and administration, a balance of about $4,750,000, which can be turned back into the Treasury. The amount asked in the claims was over $18,000,000. Administration expenses were less than 2½ per cent of the amount considered, but, of course, a larger percentage figured on the awards.

SURVEY AND BUREAU OF MINES OF GREAT ASSISTANCE TO THE WORK

In cases where awards were made the average amount recommended was about 38 per cent of the amounts asked.

The officers and staff of the Geological Survey and the Bureau of Mines were at all times ready to assist the commission. They rendered priceless service to it by accurate testimony as to incidents and dates. As impartial witnesses, their testimony and records often established facts in the absence of which awards otherwise would have been long pre-dated. Also, they disproved claims which would have involved many hundreds of thousands of dollars. In many other cases, perhaps the majority, they confirmed and gave exactness to the statements of stimulation made by claimants, thereby rendering award possible.

It has been a pleasure to me to work with them, and by personal contact, almost within the organization, to appreciate the conditions and problems of their work and to realize the high character of the personnel.

Minneapolis Station Studying Drill Steel

At the U. S. Bureau of Mines North Central Experiment Station, in Minneapolis, investigations are being conducted regarding drill steel and carbon steel and the reduction of iron oxide. At this station, the problem of the flow of heat from the walls into the charge of a byproduct coke oven has been solved analytically, and the rather tedious numerical solution of the values of the Fourier's series involved is nearly complete.

Experimental Work on Zinc Concentrates

Encouraging results have been obtained at the Mississippi Valley Experiment Station of the U. S. Bureau of Mines in the flotation of sludge table concentrates from the Wisconsin zinc district. Work is being done on the distillation and fractionation of certain crude pine-wood oils in the hope of finding a substitute for the oil used in the Wisconsin zinc flotation work.

Mining Engineers of Note

Chester Wells Purington

IN 1880 OR THEREABOUTS Mr. Purington remembers having become interested in geology to the extent of breaking up pieces of Maine granite on one of the barren hill farms of Sidney, to see what was inside. Being at the age of nine, the damage done was not considerable. Why a training in classical languages at the Boston Latin School should have led to an attempt to learn petrographic geology at Harvard, and why this in turn should have eventually landed him in eastern Siberia, engaged in gold gravel mining, are matters which the education specialist can puzzle out for himself. Born within hearing distance of the big bell on the Rice Grammar School in Boston, in 1871, Chester Wells Purington left Harvard in the class of '93. From 1894 to 1897 he served on the economic staff of the U. S. Geological Survey, first as assistant to the late George F. Becker. In 1895 Mr. Purington was a member of the Survey expedition to the coast of Alaska and the Aleutian Islands, and visited the Alaska Treadwell gold mine. Here he was first impressed with the importance of mining costs and the economies which could be attained by careful organization and unflagging attention to detail. It was the impression produced by this experience which inclined future activities to the examination of gold deposits and the mining of gold.

[illegible]

In 1896, as associate of Whitman Cross, Mr. Purington mapped the precious-metal veins of the Telluride district in Colorado. In 1897, a first trip to eastern Russia was made, following his resignation from the Survey. Then followed professional examinations in South America, and in the Perm, Orenburg, and Yenesei districts of Russia and Siberia until 1900, when two years were spent in work as a mining laborer, first at a hydraulic mine in southern Oregon and then at Camp Bird, in Colorado. When Beatty and Harold Titcomb were examining the Camp Bird for sale, Mr. Purington was battery man in the sixty-stamp mill.

From 1902 to 1907 Mr. Purington was consulting engineer in Denver, in partnership with Godfrey Doveton. During this time the firm made examinations in Mexico, the principal one of these being the Cananea Consolidated, where, as assistant to John Farish, Mr. Purington made a complete geological examination of the property, with the object of determining the position of further orebodies in Capote and adjoining mines. In 1904 he was engaged on special report work by the U. S. Geological Survey on the costs and methods of alluvial mining in Alaska. He made an examination of hydraulic workings in the Crow Creek district of Alaska in 1905, followed by the examination in 1906-07 of the extensive phosphate deposits of Wyoming, Idaho and Utah for Edward Harriman. In 1907 Mr. Purington began a series of examinations in eastern Siberia for British companies. He made an examination in 1911 of the Pioneer Mining Co., property at Nome, Alaska; in 1912, gold and tin properties in the Trans-Baikal district of Siberia for the Russo-Asiatic Bank of St. Petersburg, and during 1913-15 installed Alaskan methods of mining and washing gravel at the property of the Lenskoie Gold Mining Co., in the Witim district of the Yakutak government. During 1914-18 he was consulting engineer to the Lena Goldfields, Ltd., in the Irkutsk province of Siberia.

During 1917 in association with other engineers familiar with Russian conditions, Mr. Purington furnished to the Government evidence of the necessity of dispatching an expeditionary force to Siberia in December, 1917, to save the Russian commonwealth. The efforts to convince President Wilson failed, with the result now apparent.

In 1918 Mr. Purington served with the Military Intelligence staff at Washington, and was also in the service of the U. S. Bureau of Mines in England and at Paris, in the preparation of a report on ferro-hardening metals. From 1918 to the present he has been engaged in the exploration of the northwest Pacific littoral region, mostly in the Kamchatka-Okhotsk districts of Siberia. He is on the directorate of two British companies, namely the Ayan Corporation, Ltd., and the Far Eastern Development Co., Ltd., and is a director of the Aian Gyosei Kaisha, a Japanese company. In 1920 he visited the Toi and Taho gold mines in Japan.

CONSULTATION

Graphite Marketing

"Is there a graphite refining plant in the United States, where is it located, and what is its name?

"Where is the market for graphite in the United States?

"How do you distinguish between crucible and lubricating grades of graphite?

"What are the present quotations on prices of graphite?

"If you know of a concern handling graphite in the crude please give us the address of same."

The only graphite cleaning and refining plants we are aware of in this country are the mills of the producers in Alabama, New York, Pennsylvania and other states, and the factories of the various manufacturers of graphite products. We know of no plant that makes a practice of handling the product of domestic miners, refining and selling it, to the exclusion of other graphite business. The domestic graphite industry is practically dormant at the present time, but when operating, producers endeavor to turn out as pure a product as possible and generally have a mill to aid them. Producing a finished product at the mill makes for a saving in the present heavy freight charges.

The market for graphite is divided into five large classes: crucible manufacturers, who are estimated to consume 45 per cent of the entire consumption of foreign and domestic graphite used in the United States; foundry facings, accounting for about 25 per cent, lubricants, 10 per cent; pencils and paints, 5 per cent; stove polishes, 5 to 10 per cent, and other uses the remainder. A large amount of cheap graphite imported from Ceylon, Mexico, Korea, Bohemia, and other places furnishes strong competition to the relatively high cost domestic product. In 1920 a net importation of about 20,000 tons of graphite was made compared with a total domestic production of 8,610 tons.

Graphite suitable for making crucibles should be of the crystalline variety and high in purity. Specifications vary widely but the standard of purity ranges between 85 and 90 per cent graphite carbon, and from 125 mesh to 86 mesh for the lower limit of size. During the war it was recommended that a screen analysis of No. 1 flake should show 3 per cent over 35 mesh, 50 per cent over 65 mesh, and 100 per cent over 100 mesh.

Lubricating graphite must be free from abrasive materials. The particular variety of graphite used is not of prime importance, flake, amorphous, and artificial all being used. Frequently it is combined with oil. The crystalline and amorphous grades of the mineral are, with the exception of crucible manufacture, rivals. The U. S. Geological Survey states that in a dull market the advantage goes largely to crystalline or flake graphite, much of which is purer than the amorphous variety. Moreover, for several uses the fines and dust of crystalline graphite that are produced in the preparation of crucible flake may be sold as a byproduct at prices with which amorphous graphite cannot profitably compete.

Graphite quotations are given in the market section of *Engineering and Mining Journal*. A list of graphite consumers will be gladly furnished subscribers who ask for it.

Commercial Shapes of Copper

"Your opinion is requested as to what constitutes the usual commercial shapes of copper.

"What are 'bowl cakes' and is this a commercial shape; in what way does a 'bowl cake' differ from a 'cake'?

"Would you consider copper billed as 'round bars' or 'rolled bars' (not 'ingot bars' or 'wire bars') as commercial shapes? The bars in question average about 300 lb. each. The 'bowl cakes' vary in weight from 60 to 190 lb. each. What are 'cathodes'?"

The most common shapes of copper sold to consumers are wire bars, ingots, cakes, and ingot bars. Wire bars are about 3 to 4 in. square and vary in weight from 135 to 500 lb. They are tapered at the ends to facilitate drawing and are used in the manufacture of copper wire. Ingots are relatively light notched shapes of copper used for casting purposes and weighing about 18 to 22 lb. Ingot bars are similar to ingots and weigh from 55 to 110 lb.

Cakes are made in three shapes, square, round and bowl shaped. They weigh upwards of 100 lb. The square cake is the commonest and is furnished by producers without premium. The round cake is demanded occasionally by consumers and commands a premium. The bowl cake was manufactured in considerable quantities during the war but sales have been infrequent since then. It has always been considered an unusual shape and premiums are charged for its manufacture.

The terms "round bars" and "rolled bars" are unfamiliar. They are not generally applied to copper cast by a copper refinery. It may be that the designations cover billets or cylindrical shapes of copper used in the manufacture of copper tubes or perhaps bars which have been rounded in the rolling mill.

Cathodes are essentially rectangular flat shapes of refined copper taken from electrolytic refining tanks. They are generally melted into one of the ordinary shapes mentioned above. Anodes are the unrefined shapes placed into the tanks. Cathodes are usually sold at a small discount under the price for the commonest grades of electrolytic copper.

Water-Cooled Pipes for Blowing Copper

"We are using a magnesite-line reverberatory furnace for converting our high-grade matte (55 to 65 per cent copper) to 'Best Select' copper. The matte is brought forward to pure copper by the use of a Welsh process which takes advantage of the fact that raw and oxidized matte, when mixed and heated, react to produce metallic copper. We have been considering the substitution of the blowing process for the mixing of raw and oxidized matte. As this blowing would necessitate a much longer time of treatment than is required in ordinary refining, we thought it might be advisable to water-jacket the pipes used for this purpose, in order to make them last longer and thus reduce the cost. It occurred to me that although water-jacketed pipes are not now used, they may have been at some previous time, and it would be interesting to discover why they were abandoned."

Having had no experience in the use of water-jacketed pipes for the purpose mentioned, we refer the inquiry to our readers.

HANDY KNOWLEDGE

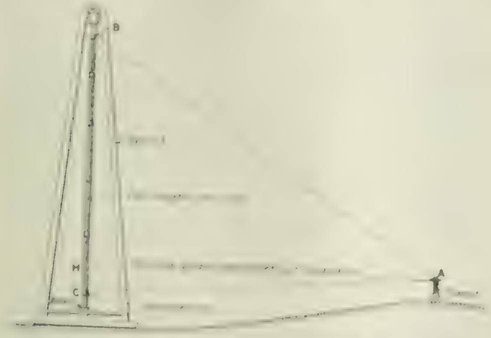
Measuring Depth of Well With Transit

BY A. G. WOLF

Written for Engineering and Mining Journal

A wrinkle in surveying which may be of interest to oil men in fields where drilling by the rotary method is practiced is that of determining the depth of a well by means of a transit. There is no advantage in applying this method to any well where direct measurement is permitted. Many times, however—in fact more often than not—permission is not granted. This is especially true where one company desires to know accurately the depth of an oil-bearing stratum in an adjoining property.

Of course, the number of lengths of drill stem can be counted with the aid of field glasses if the well is at some distance from the nearest property line, and a fair approximation of the depth obtained. But there is no way to tell how many lengths of 20-ft. and how many of 21-ft. or 22-ft. drill stem there are in the string. A much closer measurement can be obtained with a transit.



MEASURING DEPTH OF WELL WITH TRANSIT

First, a base line must be established. Then, knowing the length of the base line, the distance from either end to the well can be determined by triangulation. Also the exact location of the well can be determined if the co-ordinates of the base line monuments have been obtained.

The transit work in determining the depth of the well is best done while the drill stem is being drawn from the hole. Make the set-up over one of the bench marks. Read the vertical angle to the top of the rotary, and then to the top of the kelly-joint (or groove-stem or grief stem, as it is variously called) at the time drilling stops. The length of "kelly" out of the hole can then be calculated from the horizontal distance to the well and the vertical angles. When the kelly joint is elevated and while it is being unscrewed the vertical angles to its top and bottom must be read to determine its full length. Then the stem will be hoisted so that four lengths are clear of the rotary, provided the usual 112-ft. derrick is used. A shot must then be taken at the top of the collar or top of tool joint on the topmost length, the vertical angle recorded, and a second shot at the corresponding point on the length of stem in the rotary. These shots must be taken in this order, for there is plenty of time to catch the second sight while the set of four lengths of drill stem (a "fourble" in the driller's vernacular) is being unscrewed.

This operation is repeated on each "fourble" as it is drawn from the well, the last shot being taken on the bottom of the bit. To calculate the depth, then, there are two sets of right triangles to solve in which one oblique angle is known, angle HAC and angle HAB (see sketch) and the length of one side HA, is known.

The vertical distance is in error if the vertical angles have been incorrectly measured, and this error varies directly as the horizontal distance of the transit from the well. It is, therefore, necessary to get as close as possible. It is also necessary to get on the side of the derrick opposite the draw works or the pumps, or else the top of the rotary will be invisible. With careful work the depth of the well can be determined to within a foot.

Weights for the Drafting Room

BY ROY H. POSTON

Written for Engineering and Mining Journal

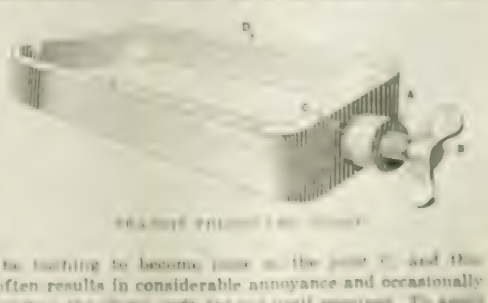
A good weight for holding down large drawings, maps, and the like, that cannot be held in place with tacks because of the resulting holes, may be made from a 3-in. length of standard 1¼ x 1¼-in. square iron with the edges rounded. This should be covered with white adhesive tape wrapped diagonally. Such weights are small enough not to be in the way of the draftsman and are big enough to answer all requirements.

A Transit Tripod Leg Clamp

BY ROY H. POSTON

Written for Engineering and Mining Journal

In the illustration presented herewith a clamp of a transit tripod leg is shown. A is a brass bushing which is tapped into *D* and threaded inside to receive the thumbscrew *B*. Constant use of the thumbscrew causes the bushing to become loose at the joint C, and this often results in considerable annoyance and occasionally renders the clamp unfit for use until repaired. To avoid this, solder or braze the joint C and oil the thumbscrew often, and this condition will not occur.



TRANSIT TRIPOD LEG CLAMP

THE PETROLEUM INDUSTRY

California Shows Decreased Production During September, Due to Strike

Production of petroleum in the United States in September, according to the U. S. Geological Survey, decreased more than 3,000,000 bbl. as compared with a thirty-day period in August, the daily average for the month being less than for any month since May, 1920. The greatest falling off was in California, where the daily average production was reduced more than 60,000 bbl. by the strike in the oil fields. Daily average production also decreased in all the other states, except Louisiana, Montana, New York, Colorado and Tennessee, in which slight increases are reported. This reduction in production was accompanied by a decrease of 164 producing oil wells completed during the month, which numbered only 788, as contrasted with 2,185 oil wells completed during September, 1920.

Imports of crude oil during September, amounting to 9,138,456 bbl., increased more than 5,500,000 bbl. over the abnormally low imports in August, owing to changed conditions in Mexico in regard to taxes. Exports of crude oil amounting to 880,573 bbl. were normal. Stocks of Mexican petroleum held in the United States by importers increased 2,000,000 bbl., and net pipe-line and tank-farm stocks east of California increased a little more than 1,000,000 bbl., and California stocks decreased about 180,000 bbl.

The estimated daily average consumption of domestic and imported petroleum, 1,389,667 bbl., increased slightly more than 15,000 bbl., so that the net result for the month was an increase in stocks of 3,000,000 bbl.

The accompanying figures, compiled from company reports, show the quantity of petroleum removed from producing properties. Oil consumed at the leases is not included.

The Pasquai Hills, Manitoba, Oil Field

SPECIAL CORRESPONDENCE

Several new companies and syndicates are preparing to operate in the Pasquai Hills oil field, in northern Manitoba. G. E. Ames, representing a syndicate of Minneapolis capitalists, has staked a large area, and a rig will be sent in immediately. The Brunne Oil & Gas Co., organized by J. A. Anderson, of Minneapolis, has taken up a lease on the Crackling River, some distance from the Man River, but showing the same shale formation which extends throughout the district. The North Battleford Oil & Gas Co. has installed an electric-light plant at its camp and will put on two shifts of drillers at an early date.

Cat Creek Zone Extended

SPECIAL CORRESPONDENCE

The Frantz Corporation, a subsidiary of the Elk Basin Consolidated, recently brought in what is known as its "River" well, at a depth of 1,041 ft. in the second sands of the Cat Creek field, extending the proved productive zone of the structure a mile and half further east. The well is showing a flow of 350 bbl. Cat Creek field last month topped all its production records, pipe-line measurement of the Elk Basin showing output through its line along of 131,724 bbl. October is expected further to improve upon these figures.

Refinery Statistics for August 1921

The Bureau of Mines' report of refinery statistics for the month of August, compiled by H. F. Mason, shows a total of 299 petroleum refineries in operation, with a daily capacity of 1,706,800 bbl. of oil. The number of plants operating is the same as in July, but the daily capacity was less by 14,750 bbl.

PETROLEUM PRODUCED IN THE UNITED STATES IN AUGUST, 1921, SEPTEMBER, 1921, AND SEPTEMBER, 1920

Barrels of 42 U. S. Gallons

State	August, 1921 (a) Total	August, 1921 (a) Daily Average	September, 1921 Total	September, 1921 Daily Average	September, 1920 Total	September, 1920 Daily Average
Oklahoma	10,226,000	329,871	9,714,000	323,800	9,093,000	303,100
California (b)	10,026,000	323,419	7,894,000	263,133	9,128,000	304,267
Central and Northern Texas	5,265,000	169,839	4,710,000	157,000	5,743,000	191,433
Coastal Texas	2,873,000	92,677	2,796,000	93,200	2,144,000	71,467
Kansas	3,332,000	107,484	3,005,000	100,167	3,615,000	120,050
Northern Louisiana	1,807,000	58,291	1,793,000	59,766	2,644,000	88,133
Coastal Louisiana....	133,000	4,290	128,000	4,267	132,000	4,400
Arkansas (c)	1,900,000	61,290	(c) 1,400,000	46,667	. .	
Wyoming:						
Salt Creek	1,001,000	32,290	826,000	27,534	929,000	30,967
Big Muddy	148,000	4,774	136,000	4,533	184,000	6,133
Rock Creek	88,000	2,839	106,000	3,533	147,000	4,900
Grass Creek	99,000	3,194	93,000	3,100	129,000	4,300
Elk Basin	45,000	1,452	47,000	1,567	66,000	2,200
Other districts	91,000	2,935	156,000	5,200	118,000	3,933
Total Wyoming	1,472,000	47,484	1,364,000	45,467	1,573,000	52,433
Illinois	846,000	27,291	806,000	26,867	903,000	30,100
Kentucky	786,000	25,355	725,900	24,197	765,000	25,500
West Virginia.........	681,000	21,968	613,000	20,433	672,000	22,400
Pennsylvania	675,000	21,774	602,000	20,066	626,000	20,867
Central and Eastern Ohio	444,000	14,323	417,000	13,900	453,000	15,100
Northwestern Ohio	183,000	5,903	172,000	5,733	187,000	6,233
Montana	119,000	3,839	137,000	4,567	37,000	1,233
Southwestern Indiana....	78,000	2,516	73,000	2,433	60,000	2,000
Northeastern Indiana	24,000	774	21,000	700	26,000	867
New York	86,000	2,774	88,000	2,933	78,000	2,600
Colorado	9,000	290	9,000	300	9,000	300
Tennessee	1,000	32	1,100	37	1,000	33
Totals	40,966,000	1,321,484	36,469,000	1,215,633	37,889,000	1,262,966

(a) Revised. (b) Average figures [illegible] Independent Oil Producers Agency. (c) Estimated in part.

Technical Papers

Metallurgy on the Rand—*The Mining Journal* (15 George St., Mansion House, London, E. C. 4; price 8d.) is running a series of articles by Denny Brothers on "The New Developments in Ore Treatment on the Rand." The first article appeared in the Oct. 1 issue. Present practice on the Rand includes the following operations: 1. Coarse crushing. 2. Sorting. 3. Fine crushing. 4. Stamp milling. 5. Amalgamation process, taking the entire pulp from stamp mill. 6. Classification and separation of coarse material to go to tube mills. 7. Tube-milling of coarse material and secondary amalgamation treatment of finely ground products. 8. Separation of sand and slime. 9. Separate treatment of sand by percolation methods with cyanide solution. 10. Separate treatment of slime in cyanide solution by decantation method or filter pressing. 11. Extraction process for recovering the gold from cyanide solution.

The all-sliming process which has proved successful at Springs Mines and which seems to merit adoption generally, eliminates: 4. Stamp milling. 5. Amalgamation process. 7. Secondary amalgamation process. 9. Separate treatment of sand. 10. Separate treatment of slime. In place of these are substituted the following: 4. Finer crushing and increased fine-grinding capacity. 5, 7, 9, and 10. (a) Circulation of cyanide solution through the whole operation of fine-grinding classification. (b) Reduction of all the ore to 150 to 200 mesh. (c) Agitation of the pulp in suitable tanks. (d) Separation of the gold-containing cyanide solution from the treated fine material by filter pressing. The objects of the modifications are: 1. Substantial reduction in capital outlay on plant. 2. Substantial reduction in labor and supplies in operating costs. 3. Appreciable increase in recovery. 4. Improved control and checks throughout the operations. 5. Safety from theft.

In the Oct. 15 issue the series is continued with a two-page article on the subject of crushing.

Concrete—The University of Illinois had issued two bulletins on the subject of concrete. No. 34, (price 20c. from the Engineering Experiment Station, Urbana, Ill.) is a thirty-nine-page booklet entitled "The Thermal Conductivity and Diffusivity of Concrete." The absolute thermal conductivity of a number of standard concrete mixtures was determined, from which was calculated the diffusivity, or thermometric conductivity. Bulletin No. 35, sixty-three pages, price 30c., is entitled "Studies on Cooling of Fresh Concrete in Freezing Weather" and throws some light on the behavior of fresh concrete at low temperatures, and the necessity of protection or other precautions.

Mineral Resources—Recent separates of "Mineral Resources of the United States" to appear include "Iron Ore, Pig Iron and Steel in 1919," thirty-one pages; "Stone in 1919," thirty-six pages; "Zinc in 1919," eleven pages; "Antimony in 1920," eleven pages; and "Lead in 1920," ten pages. Copies may be obtained on request to the U. S. Geological Survey, Washington, D. C.

Zirconium—The most complete book on zirconium which we have seen has recently been published by the U. S. Bureau of Mines as Bulletin 186, Mineral Technology 25. A general historical discussion of the preparation and commercial uses of zirconium and its compounds is given in Part I. Part II is devoted to the results of the experimental work which was performed. The topics covered include Ore Fusions, the Preparation of Pure Zirconium Compounds, Methods of Analysis, Amorphous Zirconium, Coherent Zirconium, Zirconium Alloys, and the Use of Zirconium Dioxide as a Refractory. Part III describes the furnaces used, and Part IV is a very complete bibliography of twenty-five pages on the metal and its compounds.

Sintered or coherent zirconium is very resistive to acids, and can be used for electrodes. Zirconium steels have been suggested for armor plate and automobile parts, and nickel-zirconium alloys for high-speed cutting tools and cutlery. Zirconium oxide has been recommended as a refractory, an abrasive, a pigment in paints, and as an opaquing agent in enamel ware. The salts have been used in the textile industry as a mordant, and also for weighting silk.

The 152-page book may be obtained free of charge on request to the U. S. Bureau of Mines, Washington, D. C.

Utah Minerals—A pamphlet entitled "Utah's Mineral Wealth," compiled by Thomas Varley, C. S. Stevenson, and W. Spencer Reed, of the Salt Lake staff of the Bureau of Mines, has been printed under the auspices of the Salt Lake City Commercial Club. The book, which contains thirty-one pages of text, is furnished with attractive photographs, maps, graphical representations, and curves, showing the development of the mineral industry of the state. Utah, from 1865 to 1920, produced $1,290,391,261 from mining. It is at present the producer of one-fifth of the silver, one-sixth of the lead, one-eighth of the copper, one-eighth of the potash, and one-tenth of the vanadium supply of the world. The purpose of the book is to make known Utah's place as a mineral producer, and also the possibilities offered for profitable investment.

South African Mining—The Annual Reports of the Secretary for Mines and Industries, and of the Government Mining Engineer, Union of South Africa, for the year 1920 have been published bound together in a book of about 300 pages with a large number of plates and tables. A large amount of descriptive and statistical information is given concerning the gold and diamond mines of the country. The book may be obtained for 10s. 6d. from The Government Printing and Stationery Office, Pretoria.

Pyrite in S. Carolina—U. S. Geological Survey Bulletin [illegible] F, fourteen pages, is descriptive of pyrite at the Haile mine, Kershaw, S. C., with a note on pyritization at the Brewer mine near Jefferson. The Haile mine is an old gold mine and is roughly estimated to have 100,000 tons of pyrite ore and concentrates in sight, and to contain about 600,000 tons. Copies may be obtained on request to the Survey at Washington, D. C.

Precious Stones—*The Journal of Indian Industries and Labour* for August (price Rs. 1-8 from Superintendent of Government Printing, Calcutta) contains a twenty-two-page article on Indian Precious Stones. The principal gems produced are the diamond, ruby, sapphire, spinel and jadestone. Statistics, methods of recovery, and references to production of artificial stones are included.

Diesel Engines — *Lubrication* for September (free on request to The Texas Co., 17 Battery Place, New York City) contains a twelve-page article on the four-cycle [illegible] type of Diesel engine. [illegible] Advantages and Disadvantages, Fuel Consumption and Cost, Fuel Injection, Air Compressors, Compressor Lubrication, Fuel Pumps, Cylinder Arrangements and Construction, Methods of Starting, and Cooling of Pistons and Exhaust Valves. Several different types are described with the aid of illustrations.

Flotation—Pamphlet No. 2 of the Idaho Bureau of Mines and Geology, Moscow, Idaho, is a six-page discussion of the effect of size of mineral particle on flotation. It may be obtained on request.

Oil Shale—*Reports of Investigations*, Serial Number 2,277, obtainable from the U. S. Bureau of Mines, Washington, D. C., on request, consists of a selected bibliography on oil shale, compiled by E. H. Burroughs and M. J. Gavin.

Gold Milling—The amalgamation and cyanide mill of the Gold Bullion mine in the Willow Creek district of Alaska, is described in a four-page article in the Oct. 29 issue of the *Mining & Scientific Press*. (San Francisco, Cal.; price 15c.)

Book Reviews

First Aid and Rescue Work in Mining. By Louis G. Irvine. Cloth; 5 x 7; pp. 355; illustrated. Published by the South African Red Cross Society and distributed by the *Mining and Scientific Press*, San Francisco. Price $2.

This book is divided into two parts: Part I, a general course in first aid; and Part II, first aid and rescue work in mining. Part I covers the subject in a manner that does not differ appreciably from the general type of instruction in this work. However, the illustrations are particularly clear and show the different dressings and figures in a most understandable way. Part II, relating to first aid and rescue work in mining, contains quite a complete treatment on the work as conducted at metal and coal mines in accordance with South African practice. This does not imply that such methods can be applied only locally, for the subject matter has a wide application and will be found useful to any mining organization.

Oil-Field Practice. By Dorsey Hager. First edition; [illegible] binding; 5½ x 8; pp. 310; illustrated; 1921. McGraw-Hill Co. Price $3.

"Practical Oil Geology," an earlier book by the same author, covered the elements of oil geology in simple form. There is necessarily some overlap of the subject matter in the two volumes, but the approach of Mr. Hager's latest book is from the standpoint of development methods and deals largely with [illegible] production. The information will be found to be of practical value and the several tables are well selected for the use of the oil operator.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

The Education of the Mining Engineer

New York Section of M. and M. Society Discusses Problems of Educators

An enthusiastic meeting of the New York Section of the Mining and Metallurgical Society of America was held Friday evening, Oct. 28, at the Harvard Club, following the regular section dinner. In the absence of C. M. Weld, chairman, Sydney H. Ball, vice-chairman, presided and announced that the discussion would cover the report made by the Committee on Technical Education.

Allen H. Rogers, chairman of that committee, briefly reviewed the report and pointed out the difficulties that had been encountered in its preparation. H. A. Guess, in remarking upon the report and detailing his experiences with technical graduates, stated that his objection to some types was their lack of thoroughness. He defined the ideal young engineer as being a "self-starter with four cylinders." He should have "character, horse-sense, energy, and technical knowledge." With the addition of "two cylinders"; namely, leadership and culture, the product would be that much more desirable. L. C. Gratton, the third member of the committee, spoke briefly on their work.

Dr. F. W. McNair, president of the Michigan College of Mines, said that he wished to correct the impression, that seemed to be indicated by the report, that the course at Houghton was shorter than the four-year courses at other institutions, for although the work actually consumed three years, the time expended was equivalent to that given at other colleges in four. He emphasized the point that "reaching" the student was more important than the content of the course and classified specialization as being largely due to opportunity. Lectures, he believed, were justified under three conditions—for the announcement of new developments, for purposes of demonstration, and when the speaker was particularly well fitted for the task of lecturing. His ideal institution, he said, would be one bounteously endowed, free from politics, and where a concentrated study of the classification of the students could be made.

Prof. R. M. Raymond, of Columbia, spoke on the adaptability of the young engineer in handling foreign labor. His success, said Professor Raymond, would depend on his experience and personality, and it was most necessary that his contact be sympathetic at all times.

Prof. E. S. Moore, of Pennsylvania State College, referred to the work of the teacher at mining schools as the "prospecting, developing, and refining of the product." Requirements of teachers should be that they are progressive and that to obtain the best results from the students they must secure their enthusiasm. There was no reason, he said, why English and culture should not be the same in mining schools as in other institutions, but maintained that much of this should be obtained in the public schools and at home.

Prof. A. W. Walker, of Columbia, reviewed briefly the discussions on mining education recently presented at the American Mining Congress meeting. The suggestion of a so-called standard course was found to be impossible, due to a diversity of opinion as well as the difference surrounding various conditions. The six-year course, recently instituted at Columbia, will be watched with interest, said Professor Walker, who also expressed the opinion that he did not regard it as essential that a mining school be located in a mining district.

Prof. C. H. Warren, of the Massachusetts Institute of Technology, stressed the need of securing men on the teaching staffs who have had actual and adequate experience in the field. Modern languages, he maintained, could be left to the preparatory schools and made optional for later work, placing more weight on entrance mathematics.

Prof. J. F. Kemp, of Columbia, defined a technical course as a "short-cut to experience." Teachers, said Professor Kemp, must keep in touch with modern practice and so hold the attention of pupils. He also called attention to the importance of geologic maps and studies in the education of the young engineer, and suggested that this subject be given more prominence than had been allowed by the committee's report.

Prof. Arthur M. Green, of Rensselaer Polytechnic Institute, urged the importance of turning out men who can think and solve problems, and stated that such work required the services of men who were masters of their own branches.

Prof. Robert Peele, of Columbia, also endorsed the six-year course and was quite emphatic in his opinion that the four-year course was no longer sufficient for the needs of the mining engineer of today. Many of the schedules supposed to be in force at different schools had not been followed, said Professor Peele.

Dean George B. Pegram, of the School of Mines at Columbia, commended the report of the committee, and made the suggestion that its circularization among prospective students would be of value. In his opinion engineering education of today, generally speaking, is being conducted along the right lines, and he made the suggestion that such courses should be varied rather than an attempt made at standardization. Professor Pegram also wished to know if there were too many or too few engineers being turned out from the mining schools.

Prof. G. V. Wendell, of Columbia, emphasized the necessity of strengthening foundations and developing personalities. The young engineer does not, he believes, have "time to think," so that the greatest good can be accomplished by a good grounding in the basic subjects.

Following these speakers, J. A. Church, Jr., made a motion to the effect that it be recommended to the Council of the society that a referendum be taken on the following points: Length of course (three, four, five, or six years); teaching of English; teaching of foreign languages; too many or too few engineers, and economics. This motion was seconded by S. H. Dolbear.

In the discussion following, L. C. Gratton stated that he regretted that only one side, that of the "producer" or educator, had been presented. He agreed that wider foundations in the general sciences were necessary but hoped that some practical way of starting specialization could be found.

At the Montana School of Mines, said Charles W. Goodale, the students are given an opportunity of working two shifts per week in the Butte mines, and this practice has been very effective.

The meeting was notable for the clearness of the opinions expressed. Although some of the points, such as the actual length of course, location of schools, and inclusion of subjects, were not agreed upon by the speakers, all were in accord that certain fundamental learning and technique are necessary for the success of the mining engineer's education.

Present Status of the Wet Stoping Drill*

The Mine Inspection Department of Utah believes that the adoption of wet stoping machines will be of advantage both to the mining companies and to the employees. It is not necessary to explain the dangers to the miners' health which arise from drilling dusty holes.

The Utah Consolidated Mining Co. and the Tintic Standard Mining Co. were the pioneers in Utah in the testing of wet stopers, and their satisfactory experience caused further tests, with the result so gratifying that it can be stated that the day of the dry stoper is passed.

Most of the drill manufacturers now have on the market, or soon will have, two types of wet stoping drills, one a hand-rotated type, weighing 60 to 70 lbs., and the other an automatic or self-rotating type, weighing from 95 to 115 lbs.

Each mine has problems of its own, and each superintendent knows best how to meet the conditions and select the machine adapted to his use, so that no one type of wet stoping drill is recommended.

Before any tests were made by the State Inspection Department it was found that one mine had the following experience in testing wet stopers against the old dry stopers:

First—In raising a three-compartment shaft in exceedingly hard siliceous limestone, it took sometimes six shifts to get in a round of holes with a dry machine, and many bits were stuck, whereas with the self-rotating wet stoper only two shifts were required.

Second—In a two-compartment raise, requiring about 120 ft. of holes, it took two shifts with a dry machine, and only one shift with a self-rotating wet machine.

---

*Abstract of an address delivered recently by H. G. Snyder at a meeting of the Utah Metal Mine Operators' Institute, Salt Lake City.

Third—The drilling speed of the self-rotating wet machine was approximately double that of the hand-rotated dry machine, in hard ground.

These results appeared so favorable to the wet machines that further tests were conducted, using the Denver Rock Drill 75, wet, self-rotating; the Sullivan DT-44, wet, hand rotated, and the Denver Rock Drill 16-V, dry, hand rotated. It was found that in medium hard limestone the self-rotating wet machine averaged 1.306 ft. per minute actual drilling time; the hand-rotated wet machine averaged .956 ft. per minute, and the hand-rotated dry machine averaged .645. In sulphide ore, the wet, self-rotating machine averaged 2.218 ft. per minute, the wet, hand-rotating machine averaged 2.52 ft. per minute, and the dry, hand-rotated machine averaged .723 ft. per minute. In other words, the wet machines drilled from 50 per cent more to almost four times as much ground as the dry machine.

It should be noted in these tests that the wet machines were both using ⅞-in. hexagonal steel, whereas the dry machine was using 1⅛-in. cruciform steel, but other tests indicated that the wet machines will drill just as satisfactorily when the larger steel is used. The wet machines were also newer, but the dry machine nevertheless was in excellent repair.

The next tests were made using the Sullivan DT-44 wet, hand-rotated machine, and an Ingersoll-Rand CC-11, dry, hand-rotated machine. It was found that in fairly soft limestone the wet machine drilled an average of 1.888 ft. per minute and the dry machine drilled an average of .625 ft. per minute. In very hard siliceous porphyry the wet machine drilled an average of .31 ft. per minute as against the dry machine's .079 ft. per minute. In soft sulphide ore the wet machine drilled an average of 5.08 ft. per minute and the dry machine an average of .524 ft. per minute. It will be noted from these results that the wet machine had an average drilling speed of from three times to ten times that, of the dry machine. In this case the wet machine was using ⅞-in. hexagonal steel, with a starter gage of 1⅞-in., while the dry machine was using 1-in. cruciform steel, with a starter gage of 2 in.

It is probably that the wet machines will cost more to keep in repair than the dry machines.

The Anaconda Copper Mining Co., after a thorough test, has completely eliminated dry stopers and is now making comparative tests of the different makes of wet machines. Also, at the Hecla mine at Burke, Idaho, the Ingersoll-Rand CC-11 dry stopers have been converted into what are known as CCW-11 wet stopers, and are giving excellent satisfaction.

One of the nice features of the wet machines, especially the heavier, self-rotating types, seems to be the brake which is provided for the feed. By means of this brake, the forward feed of the machine can be stopped while the bit continues to rotate, which to a large measure prevents the bits from sticking, and the miners soon learn to take full advantage of it.

From talking with the superintendents and foremen in Utah and also with a number of miners who have used the wet machines, it has been found that after the miners become accustomed to them they much prefer them to the dry stopers. In Butte, the experience at first with the miners was reported to be unsatisfactory, and a number of men had to be discharged before the machines were given a fair trial.

In the Coeur d'Alenes, the Hecla mine reports that their best miners will not work in raises unless they are furnished wet machines, and in the stopes some prefer them and some do not. When men first start to use the wet drills they usually use too much water, and get themselves wet, but they soon learn to use only enough water to clear the hole. It will probably be necessary, for at least the new men, to wear slicker pants and change their clothes after the shift.

It should also be mentioned that the heavier, self-rotating machines are more difficult for the miner to handle properly, and it will be necessary for good staging to be used.

MEN YOU SHOULD KNOW ABOUT

Ira L. Wright has returned to Silver City from an examination trip in Mexico.

F. W. Bradley is in Alaska and is expected back in San Francisco early in November.

Arthur W. Jenks is examining mining properties in several districts of northern Ontario.

W. D. Arnett, formerly of Goldfields has moved his headquarters from San Jose, Cal., to El Paso, Tex.

Sydney J. Kidder, general manager of the Mogollon Mines Co. has returned to the mines from a visit to Kansas City.

Capt. M. D. Murray has returned to Los Angeles from a visit to his silver-lead properties at Tarazas, Chihuaha, Mexico.

John M. Sully, general manager of the Chino Copper Co., is on an inspection trip to the company coal properties at Gallup, N. M.

Kirby Thomas has completed an examination of gold properties in the Caribou Mountain District north of Soda Springs, Idaho.

Glenn L. Allen is at Guadalupe, Zacatecas, Mexico, conducting some metallurgical investigations for the Cia. Internacional Minera, S. A.

Edmund Norris Hobart, [illegible] with the American [illegible] Co. at Parral, Mexico, is at his headquarters in El Paso, Tex.

Louis Padison, an [illegible] in Montana and Mexico, has [illegible] for the Magma Copper Co., at [illegible], Ariz.

A. R. Chambers, of [illegible] [illegible] of the Empire [illegible] Corporation.

Walter C. Scott, of the [illegible] Station, U. S. Bureau of Mines, is returning to the [illegible] Copper Co. [illegible]

Warren R. Sholes, [illegible] of

Mines, University of Utah, has been appointed mineral examiner in the Utah field division of the United States Land Office.

C. O. Stillman, president of the Imperial Oil Co., has returned to Toronto from a tour of inspection of the company's operations in the Western part of Canada.

D. F. Haley, manager of the Chanute Spelter Co., local subsidiary of the American Metal Co., returned to Joplin on Oct. 26 from a brief business trip to New York.

Stanley Williamson has resigned as secretary of the New Mexico State Corporation Commission, to accept a position in the executive offices of the Central Copper Co. in New York.

E. H. B. Avery, formerly purchasing agent and traffic manager for the United Verde Extension Mining Co., has become connected, at Los Angeles, with the traffic department of one of the Pacific Coast steamship companies.

Dr. Charles H. Herty has resigned as editor of the *Journal of Industrial and Engineering Chemistry* to accept the presidency of a new organization, which will be known as the Synthetic, Organic, Chemical Manufacturers' Association of the United States.

J. R. Reigart, assistant superintendent of mines in the Gwinn district, Mich., for the Cleveland-Cliffs Iron Co., has resigned his position and left on Nov. 1 for Gold Hill, Nev., to assume the management of a gold property for the United Metals Selling Co.

Mining and Metallurgical engineers visiting New York City last week included **S. G. Blaylock**, Trail, B. C.; **R. A. Rank**, Tampico, Mexico; **J. K. Walsh**, St. Louis, Mo.; **A. S. Walker**, East Aurora, Ill.; **W. G. McBride**, Globe, Ariz.; **Dwight Garrison**, Philadelphia, Pa.; **Oscar Lachmund**, Spokane, Wash.; **E. S. Moore**, State College, Pa., and **Alexander Leggat**, Butte, Mont.

SOCIETY MEETINGS ANNOUNCED

American Iron and Steel Institute will hold its [illegible] meeting in New York at the Hotel Commodore on Nov. 18.

The annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, New York, Dec. [illegible]

OBITUARY

Dwight W. [illegible], of Los Angeles, was accidentally killed on Oct. [illegible] in the Yellow Aster mine near Randsburg, Cal.

Franklin [illegible], president and general manager of the [illegible] Co., [illegible] at the age of [illegible]

James F. [illegible], died at [illegible], Mass., on Oct. [illegible] He was connected with the [illegible] Mining Co. for a number of years.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

Attention is called to the review of the situation at the mines in October, published on p. 751.

The mining town of Britannia Beach on Vancouver Island, B. C., was partly destroyed by a cloudburst and flood on Oct. 28. Thirty-five were reported killed or injured.

The Ayan Corporation, managed by C. W. Purington, has undertaken gold mining and trading operations in Siberia on the north shore of the Okhotsk Sea.

Our London correspondent states that the interesting plan of the Roodepoort United company in South Africa to operate its mines on a co-partnership basis has been turned down by the men.

Another hydroelectric power project in the Southwest is being talked of. El Paso business men are investigating the possibilities of erecting a power plant at Elephant Butte dam to supply western New Mexico and eastern Arizona.

An amendment to the tax bill in the interest of gold producers has been made by Senator Walsh and accepted by the Senate.

Director Bain, of the U. S. Bureau of Mines, believes that the western states are generally in favor of revising the mining law, though many individuals are opposed through a misunderstanding of the provisions of the so-called Arentz bill.

Cloudburst at Britannia Beach Does Much Damage

Part of British Columbia Town Destroyed — Mining Company's Plant Reported Safe

A cloudburst and flood on the night of Oct. 28 swept away part of the town of Britannia Beach, on Vancouver Island, B. C., and late reports had it that thirty-five of the 1,500 inhabitants were either dead or missing. Fifty houses were carried away. The plant of the Britannia Mining & Smelting Co. was unharmed. Flood waters of the Coquitlam River were also reported to have inundated a section of Port Coquitlam, fourteen miles away.

Suit Over Premier Mine Settled By Paying Daly $15,000

Cash Payment Unexpectedly Ends Contest for Share in Property

Litigation over an interest in the Premier mine near Stewart, B. C., in which Patrick Daly sought to recover $1,960,000 from Reginald K. Neill and others, has been terminated by a $15,000 cash settlement in favor of Daly. The litigation was started last winter after M. W. Bacon, a mining engineer, had sued Mr. Neill to recover a quarter interest in the mine. Judge Rudkin ruled that Bacon could not recover the interest which he valued at $2,500,000.

Mr. Daly, who had formerly been superintendent of the Premier, immediately filed suit against Mr. Neill and associates. Daly in his complaint alleged that as superintendent of what was known as the Bush properties he discovered the great possibilities of the mine and decided to come to Spokane to get capital. He took Mr. Neill to the property and soon convinced him that the mine was rich. He declares that Mr. Neill then organized the Premier company and arranged for him to act as superintendent and confidential agent, with the understanding that he was to have a share in the mine. Some time ago Mr. Neill and his associates sold a fraction of the mine to the American Smelting & Refining Co.

Attempted Deal With Soviet Government Fails

Employees of Russo-Asiatic Consolidated, Ltd., Eager for Resumption of Work—Conditions Proposed by Officials Too Onerous for Acceptance by Mining Company

NEGOTIATIONS begun in Moscow on Aug. 20 last by Leslie Urquhart, chairman of the Russo-Asiatic Consolidated, Ltd., with the Soviet government, for the return to the company of its properties, have failed, according to information placed before the stockholders recently by Mr. Urquhart, as told by our London correspondent in the issue of Oct. 29. The chairman says that up to the evening of his departure from Moscow on Sept. 12 he was continuously engaged with the concessions commission, called the Technical Economic Commission, appointed by the Soviet government for the purpose. This commission was a large one, including men with business experience in important affairs in the old days. The direction and decision, however, rested with three ministers of the government, who in turn had to submit the draft contract to the final decision of the Council of People's Commissaries under the presidency of Lenin.

In the course of these negotiations a concession agreement was drafted and discussed. The intention of this was to return to the company its properties as they were at the time of nationalization, together with the stocks of materials, working capital, and other assets. Eighteen of the twenty-seven clauses of the agreement were agreed upon, and in certain other clauses there was only slight disagreement. There were, however, vital questions at issue which could not be decided.

Information obtained at Moscow from employees of the company who had come from the properties was reassuring as to their condition as well as to the attitude of the workmen there, according to Mr. Urquhart. Given fair opportunity, the time needed to rehabilitate the company's business would not be so great as might be expected. At all of the properties at Kyshtim, Ridder, Ekibastus, and Tanalyk the employees are pathetically anxious to resume work, according to Mr. Urquhart.

The nine clauses in the concession agreement which could not be agreed upon embodied the following points:

Referring to the return of the company's properties under the form of a concession, the Soviet government proposed to exclude lands that had been assigned or were to be assigned to the local population in accordance with the land settlement scheme of the government. The company could not agree to this until the lands to be demarcated, and the new regulations under which the land, mineral and timber rights were to be assigned, were clearly defined.

No agreement was reached as to return of the company's losses and working capital. It was held necessary also by Mr. Urquhart that state control with reference to new forest and timber regulations and other points be clearly defined; likewise the substitute for the old mining code.

The amount of royalty payable on sales, in place of taxation, could not have been paid, in the amount demanded, without loss. The company refused to consider an excess profits tax.

Mr. Urquhart insisted that all employees, whether Russian or foreign subjects, be regarded as engaged on work of state importance and should not be liable to forced labor; that their property be free from special local taxes, requisitions and confiscations; their homes free from regulations limiting living space, emigration and other similar measures of force; that all searches, arrests and similar acts be carried out against the company's employees by decision and in the presence of justiciary organs; also that qualified employees be free from military service and mobilization and on an equality with persons employed in the most important state enterprises. The commission refused to agree to this.

The company insisted on a ninety-nine-year concession: The commission offered only a seventy-two-year lease.

Certain conditions proposed by the Soviet government, involving, among other things, the right of purchase of properties by the government after a term of years, were unacceptable.

Clause 27, referring to arbitration, provides that all disputes as to the meaning or fulfilment of the concessions agreement were to be referred to a permanent arbitration commission of three; one member to represent each side, the third, or president, to be mutually agreed on. Failing agreement as to the third member, the commission proposed that the president, who must be a Russian, would be nominated by the Russian Academy of Science. The company insisted that, failing agreement, the president, who must be a neutral, that is, neither a Russian nor British subject, be nominated by a foreign scientific society, preferably the A. I. M. E. This latter, Mr. Urquhart said, "is the only safeguard (and at that only a moral safeguard so long as present conditions of lawlessness exist in Russia) that the terms of the contract would be interpreted in all fairness and justice for both sides by an unprejudiced umpire."

Mr. Urquhart refers to some of the clauses of a proposed supplemental agreement with the All-Russian Council of Professional Unions, which was to form part of the concessions contract, this council being a department and organ of the Soviet government. "To call this union a professional union," says Mr. Urquhart, "seems to me a misnomer, for whether he desires it or not it is obligatory for every man or woman worker in Russia, be he a brain worker, lawyer, mining, civil or mechanical engineer, a skilled craftsman or unskilled laborer, to be a member of this union.

In one of the clauses of this agreement, skilled workmen are divided into thirty-nine categories, whose rates of pay are based on wages paid in England and Germany. "But it is beyond the skill of mortal man today to fix the rate of exchange," comments Mr. Urquhart, "and further the conditions are not the same."

The concessionnaire is obliged to inform the Professional Unions of every engagement and every discharge of workmen. The transfer of persons employed in state enterprises to the enterprises of the concessionnaire is permitted only on the same conditions as the transfer from one state enterprise or department to another. The restriction on the personal liberty of the workman and the freedom of the concessionnaire in developing and operating his enterprise is evident.

Another clause insisted that the concessionnaire be obliged to buy from abroad for a period of not less than seven years, for the personal needs of the workmen and their families, all food, provisions, clothes, and other supplies, and to sell these at cost. Mr. Urquhart says that he pointed out that it was illogical that a seven-year period should be fixed in advance, and that it was unreasonable to force the concessionnaire to bring flour and provisions from America for seven years, when there is today wheat in Akmolinsk Province which cannot be moved by the Soviet government. Mr. Urquhart says he suggested that the interests of the workmen would be safeguarded better if the concessionnaire were obliged to buy in the cheapest market and sell at the cheapest price. The Professional Unions, however, insisted on their conditions.

New Power Project Would Use Elephant Butte Dam

Proposed To Supply Companies in Western New Mexico and Eastern Arizona—El Paso Business Men Studying Problems Involved

Another hydro-electric development project, that at the Elephant Butte dam, is being seriously considered in the Southwest. On account of the fact that the development of the supply of water power is already completed at Government expense there remains but the erection of a power house, and building of transmission lines, if it is decided to undertake the project. Fuel for power purposes in this section is one of the greatest expenses of mining and the introduction of cheap electric power would be welcome by many mining companies in west Texas, New Mexico and eastern Arizona.

A committee to look into the matter has been selected from the personnel of the government research and city planning departments of the El Paso Chamber of Commerce and it will work in connection with Charles G. Wilfong, who has been carrying on investigations in this connection for four years, with particular relation to the mining industry in New Mexico. The present peak load demand in this territory has been estimated at 58,900 hp. by the engineering fiirm of Henry & Conkling.

The transmission line considered would extend west to the Clifton district in Greenlee County, Ariz., a distance of about 150 miles. The largest consumers would be the Chino Copper Co. at Santa Rita and Hurley, using from 12,000 to 17,000 hp.; the Hanover-Fierro district, 3,000 hp.; Silver City, 1,000 hp.; Phelps-Dodge Corporation at Tyrone, 4,000 hp.; and the Lordsburg district, 2,000 hp., these points all being in New Mexico. The Phelps-Dodge Corporation, recently consolidated with the Arizona Copper Co. and operating at Clifton-Morenci-Metcalf, Ariz., would demand from 8,000 to 10,000 hp., while the requirements of the City of El Paso and Juarez, Mexico, would be about 10,000 hp.

To Mine Gold Along Okhotsk Sea

A company known as the Ayan Corporation, Ltd., with its home office at [illegible] Salisbury House, London, is conducting the development of an extensive gold mining area in Siberia on the north shore of the Okhotsk Sea as well as trading activities in the same region. J. A. Agnew is chairman of the board and C. W. Purington managing director.

Silver purchases by the Director of the Mint during the week ended Oct. 29 totaled [illegible] fine ounces, bringing the total purchased under the Pittman Act to 79,698,864 fine ounces.

The Attempt To Block the Deal To Operate the Star Mine

An Account of the Efforts of Day-Smith Interests To Prevent Joint Operation by Hecla and B. H. & S.

By A. J. Dunn

The injunction proceedings brought by Eugene R. Day, manager of the Hercules Mining Co. and a stockholder in the Hecla Mining Co., and Mrs. Sarah E. Smith, director of the Hecla and the largest individual stockholder in the company, to restrain the officers and directors of the Hecla Mining Co. from submitting to the stockholders of the company for ratification an agreement entered into with the Bunker Hill & Sullivan Mining & Concentrating Co. for the purchase and operation of the Star mine, was the preliminary step in a legal controversy that promises to become a veritable fued between the contending parties and which even now has widened the breach that has long existed between the adherents of the respective litigants. For the real animus that prompted the litigation, one must go back of the issue presented to the court. Mrs. Smith is the widow of the late James R. Smith, who was president of the Hecla Mining Co. at the time of his death. Upon the death of Mr. Smith, James F. McCarthy, manager of the company, was elevated to the presidency and he has since retained the dual position, and the steady dividend record of the Hecla, together with the vast ore reserves blocked out and the mine's modern equipment, are the best evidence of his successful management. For several years Mrs. Smith, who owns 94,000 shares of stock and for that reason alone has been retained on the board of directors, has manifested dissatisfaction with the management, but in view of the highly successful operations of the company, she has been unable to gain support from other directors or stockholders. However, at the annual meeting of stockholders of the company last April, an alliance was formed between Mrs. Smith and Eugene R. Day for the purpose of electing the latter to a place on the board of directors. The combination failed, and therein was born the attempt to gain control of the Hecla company, which appears to be the real motive back of the attempt to block the Hecla in the purchase of the Star.

In July a circular letter from the secretary advised Hecla stockholders that a special meeting had been called to meet at Spokane on Aug. 15 to take action, among other things, upon an agreement between the directors of the Hecla company and the Bunker Hill & Sullivan company for the purchase and operation of the Star mine, the letter giving full information regarding the terms of payment and the reasonable certainty that net earnings from the Star would meet the deferred payments. On the eve of this meeting a restraining order was issued by the superior court of Spokane upon complaint of Mr. Day and Mrs. Smith, forbidding the officers and directors of Hecla from submitting the ratification of the agreement to the stockholders and setting a date for a hearing on the question of making the temporary order permanent. After several postponements the case came up for hearing, when an answer was filed by the defendants, the case was [illegible] upon the ground that since the Bunker Hill & Sullivan was a party to the agreement in question, that company should be made a party to the suit, but as the Bunker Hill was a foreign corporation, the court had no jurisdiction.

The restraining order was continued five days in order to allow plaintiffs time to bring an action in a court having jurisdiction over both companies. Thereupon action was started in the district court at Wallace, Idaho. At the same time service was obtained on Frank M. Smith, director of the Bunker Hill smelter, who maintains an office in Spokane, and the court was asked to accept that as legal service on the Bunker Hill & Sullivan company. The hearing in Wallace occupied two days and upon its conclusion the court took the matter under advisement.

While the Wallace judge was still pondering over his decision, the superior court of Spokane heard the question of service on Frank M. Smith and decided that he was the legal representative of the Bunker Hill company in the state of Washington and that the court therefore had jurisdiction to hear the case with the Bunker Hill company as one of the defendants. The application for an injunction was therefore renewed in the Spokane court directed at both the Hecla and Bunker Hill companies for the purpose of preventing the stockholders of Hecla from ratifying the agreement entered into by the directors for the purchase of the Star. The turn of affairs in Spokane made it easy for the Wallace court, who immediately handed down a decision denying the injunction, but declining to discuss the merits of the case for the reason that the injunction had been continued and the questions involved were still pending in the Spokane court.

It was alleged in the complaints filed both in Wallace and Spokane that the agreement to purchase the Star had been accomplished through conspiracy, misrepresentation and fraud on the part of Manager McCarthy and the Bunker Hill company and that the Star mine is without ore of commercial value. While these proceedings were in progress, a lengthy letter was mailed by Mr. Day and Mrs. Smith to all Hecla stockholders attacking Mr. McCarthy and his management of the company with the promise that others of the same import will follow. Stockholders in person or by proxy representing 800,000 shares out of the total of 1,000,000 are waiting to ratify the agreement. The legal poceedings and the letter to stockholders has given rise to suspicion on the part of some that the attempt to block the Star deal is not in good faith, but rather with the view to discrediting the Hecla management with the stockholders in the hope of gaining control of the company.

Broken Hill To Pass November Dividend

By Cable from Reuters to "Engineering and Mining Journal"

London, Oct. 24—Cables received from Melbourne today report that Broken Hill Proprietary Ltd. will not declare a dividend for the November quarter.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Purpose in Revising Mining Law Misunderstood, Says Bain

But Believes Western States in Favor of Proposal—Every Man Should Read Bill for Himself

H. Foster Bain, the director of the U. S. Bureau of Mines, has returned to Washington after an extended western trip firmly convinced that the western states are overwhelmingly in favor of a revision of the mining laws. He found, however, that there is widespread misunderstanding of the exact purport of the bill now before Congress. An impression has been formed in some districts that an effort is being made to put something over on the West. Mr. Bain had frequent opportunity to reassure western miners that this is simply an effort to comply with their long years of demand that the mining laws be improved and made to conform with the existing situation.

"This bill," said Mr. Bain, "is simply a preliminary draft to form a basis of discussion. It is an attempt on the part of a committee to put in concrete form a demand which has been widespread and continuous through many years for a revision of the mining law. It probably is too much to think that any committee would succeed in getting everything right the first time. It is to be hoped that those concerned will use it as a basis for criticism and comment.

"One phase of the bill has given rise to much unfavorable comment. I refer to the provision that where land has been surveyed the new location must be in accordance with the land survey. In view of the inaccuracies of the surveys in the West, there is a general feeling that this provision would make disproportionate difficulties and expense, by making it necessary for the miner to tie in his claims. The intent of the committee was to harmonize the way of taking up land. The committee only suggested that lode claimants hereafter should meet the same conditions which have to be met by everyone else, including the placer miner, who takes up land. The whole matter is one of small importance and I doubt if anyone would care to argue for it, if there is any substantial objection to it. I suggest that the law be framed so that if a miner did locate his claims according to the public land survey, he should be relieved from the expense of the survey for patent, but if he prefers to locate in any other fashion, he be permitted to do so. In that event, he would be expected to pay for the patent survey, as now is the case.

"It is my impression that the square claim and the vertical boundary lines meet general approval and are likely to be adopted. The provision for staking ground in advance of discovery but requiring discovery prior to patent meets little opposition. There is some disposition to question the advisability of procedure to patent within a definite number of years. That has the effect of converting land to private ownership, and in that way makes it possible for any state, by means of its taxing power, to force the land into development. The state, of course, has no power to do that so long as the land is public property. The decision as to whether or not that should be done is one best made by individual states, representing the people most concerned.

"In general the draft, as submitted, is merely a codification of existing law. Some of the criticism has been leveled at existing law and not at any change proposed. The draft is before the House Committee on Mines and Mining. The committee does not propose to take up the consideration of the bill until after Jan. 1. This will give an opportunity for the committee to hear from every one interested.

"An opporunity now is afforded to the miners of the country to get some of the things that they have been asking for. It is important that every mining man read the bill for himself."

Tax Bill Amended To Help Gold Producers

Based on Principle That Excess Profits Tax Should Not Apply to Them

The Senate has accepted an amendment by Senator Walsh, of Montana, to the tax bill which makes paragraph (c) of Sec. 304 read as follows:

"(c) In the case of any corporation engaged in the mining of gold, the portion of the net income derived from the mining of gold shall be exempt from the tax imposed by this title, or any tax imposed by Title II of the revenue act of 1917 and assessed but remaining unpaid, and the tax on the remaining portion of the net income shall be the same proportion of a tax computed without the benefit of this subdivision which such remaining portion of the net income bears to the entire net income."

In explaining his amendment to the Senate, Senator Walsh said: "The principle of the clause under consideration and recognized in this bill was recognized in the act of 1918, but appears to have been overlooked in the act of 1917, namely, that gold mining corporations which could not take advantage of the general rise in prices, the price being fixed absolutely at $20 per oz., were not of that class against which the excess-profits tax was intended to apply."

NEWS BY MINING DISTRICTS

London Letter

Cam & Motor Opening Good Ore—Recent Development at Globe & Phoenix Unprofitable—Naraguta Tin Mines Developing Gold Find—Roodepoort United Plan Rejected

By W. A. Doman

London, Oct. 18—Whether the fortunes of the Cam & Motor have turned remains to be seen, it is nevertheless a fact that a good run of ore is being opened up on in the No. 11 level drive south. Previous to intersecting this shoot, a distance of no less than 435 ft. was traversed. At the point of contact the average gold content per ton was 30/— taken over the full width of the drive, which was 5 ft. At 440 ft. sampling showed 36/— per ton over the same width, the actual width of the lode not being exposed. During the second half of August the total driven from the point of intersection was 20 ft., and the arevage value was 161/— per ton over 56 in. High values were then reduced to 59/— per ton. When the level had attained a length of 85 ft. the average gold content was 86/— over 57 in., reduced to 40/—, the last 35 ft. being 160/— over 54 in., reduced to 61/—. During September a further 50 ft. were driven, averaging 34/— over 43 in., reduced to 68/—.

From the cabled reports it is not easy to determine the footage on the ore shoot, but the last 135 ft. average unreduced 210/— over 55 in., the reduced value being 50/—. In none of these operations was the lode fully exposed. At 540 ft., however, a crosscut was put in, and gave an average of 602/— over 164 in.; reduced value [illegible]/—.

For the Cam & Motor the unreduced values are phenomenally high, and the reduced values, which are regarded as conservative, are highly satisfactory. Although no specific mention is made of the fact, it may be presumed that these developments are in the Motor mine. The average is considerably above that of the ore reserves.

As in the case of almost every other South African gold mine nowadays, the gold premium saved the position. Last month 14,[illegible] tons of ore was treated, yielding [illegible] oz. of fine gold of a value at standard price of £20,233. Costs were £19,241, including £2,085 for development and redemption; and capital expenditure, including development, was £[illegible]. "Premium" brought in £5,500, and presumably met the capital outlays.

Development work at the Globe & Phoenix [illegible] of an unprofitable character at all points. The position at this mine is now becoming interesting [illegible] the ore reserves are being drawn [illegible] every month. Apparently about [illegible] per cent of the reserves is in the form of pillars, and the question is being asked how long [illegible] at the present rate can be maintained.

At the end of May last a report was issued by the Naraguta (Nigeria) Tin Mines concerning the gold deposit which had been discovered on the Birnin Gwari Areas. A few samples had been taken showing from a few pennyweights up to 10 oz. to the ton. The report left a good deal to be desired in the way of detail, though the results were sufficiently encouraging to warrant the directors in ordering machinery. Pumping and crushing plants have been acquired, and Mr. Clyde Allan, the company's engineer, will proceed to Nigeria in about a month to organize a comprehensive campaign of exploration and development.

A private cable dispatch from Johannesburg just received states that the scheme proposed by the directors of the Roodepoort United Main Reef to the owners for working the property (*Engineering and Mining Journal*, Oct. 1, 1921, p. 551) has fallen through, and that the mine will be gradually closed down.

Johannesburg Letter

South African Asbestos Properties Visited—Rand Gold Refinery To Start Soon—Dust Prevention Reported Upon

By John Watson

Johannesburg, Sept. 27—The South African Asbestos Mines, Ltd., was floated in September, 1920. On Sept. 17 last a party composed of the directors of this company, with the mayors of Johannesburg, Pretoria and Pietersburg, and Tudor Trevor, inspector of mines, visited the property, which lies 65 miles by road southeast of Pietersburg.

Traveling by motor-cars, the party went through the pass known as Chunes Poort. The chairman of the company is A. B. Sumner, the managing director Hugh J. Orr, and the consulting engineer H. Rose Martin. Mining operations are being confined to the McPie valley, where a treatment plant has been erected. The lode is mined to a width of 5 ft. and over that stoping width contains about 11 per cent of asbestos, varying in length from 2 in. downwards. The asbestos belt is said to extend in the direction of strike of [illegible] on either side of the property [illegible] 100 miles [illegible]. At present, the only means of transport is by ox-wagon to Pietersburg, a distance of 65 miles, the cost of transport being [illegible] per short ton. Asbestos of two varieties is found in the [illegible] asbestos [illegible] and the white [illegible] variety.

It is officially announced by the Chamber of Mines that it is expected that operations on a small scale will start at the new refinery of Rand Refinery, Ltd., near Germiston, during October. Early in next year it is expected that the whole of the production of the Witwatersrand gold mines will be refined here. A staff of about seventy employees will be engaged.

An interim report has been issued by the dust committee, appointed by the Government Mining Engineer and the president of the Chamber of Mines to inquire into dust prevention in [illegible] development. The report states: "We have, apart from preliminary tests by the individual members, conducted a series of tests in development drives in the Crown and Spring Mines to ascertain the effect of water-blast and of auxiliary ventilation after blasting. We have come to the conclusion (1) that observance of the water-blast regulations will not necessarily give such a satisfactory condition of development ends, (2) (a) that the useful purpose of a water-blast is to damp the face and broken rock; (b) that the present water-blast is ineffective in allaying the fine dust which has been projected by the blast; (c) that if the water used is not clear of solid particles the water-blast is likely to increase the dust contents of the development end; (d) that one water-blast at the face is sufficient to damp the face of broken rock if it is of a type to project the necessary water; (3) that the exact amount of air required to clear development ends has not been definitely determined. From tests conducted it would appear to be less than a volume of air equal to that of the development end. The exact amount may be dependent upon the rate and method of supply of the air; (4) that the most practicable way of dealing with the fine dust in development is by ventilation. The tests are being conducted to ascertain the volume of air necessary under different conditions for ventilation of development ends both during the working shift and after the blast.

H. C. Fletcher, of Messrs. Johnson & Fletcher, Bulawayo, has been visiting the Rand on his way back from East Africa and the Congo. Mr. Fletcher is quoted as being much impressed with the vastness of the great Kilo fields, and is one of the few British subjects who has visited them.

CANADA

Ontario

McKinley Not To Be Opened Before Spring—Davidson Resumes Work—Gold Discovery Near Lightning Lake

Cobalt—It is understood that there is no immediate possibility of the McKinley being reopened, and that the matter will not be further considered until next spring. The last annual report showed a loss of $10,[illegible] for the year. The bullion produced, however, was not sold and the increased price has raised its value to the extent of [illegible] that enough to wipe out last year's losses.

[illegible] is now handling a daily tonnage [illegible] 160 tons [illegible] 12 per cent, [illegible] has been employed.

Mining Corporation [illegible] a small portion is being made.

The [illegible] of the Beaver have announced that there is no prospect of the property being reopened before spring.

For the [illegible] the Coniagas and [illegible] were the only two companies to ship ore out of the camp.

A find of high-grade ore has been made on the Frontier property in South Lorraine.

Kirkland Lake—Developments on the 300 level of the Bidgood mine are said to be satisfactory. The shaft has been deepened, and if corresponding results are met with at 400 ft., the company will consider the installation of a mill.

The King Kirkland has taken a ninety-day option on the Boston-McRae property, at a price of $15,000. The latter property has some fair surface showings.

The September report of the Lake Shore shows the mill treated 1,622 tons of ore and recovered $40,928, or an average of $25.23 a ton.

Porcupine—Work has been resumed at the Davidson mine, and drifting has been started on the 600 level. The company has recently been financed by English capital.

A shareholders' meeting of the Thompson-Krist company was held in Toronto on Oct. 25, to consider the relationship of the company with Porcupine Crown Mines, and to determine what action should be taken in view of the fact that the latter company was threatening to take legal proceedings for the defaulting of the interest on the bond mortgage given by the North Crown Mines to the Porcupine Crown Mines, and to which the Thompson-Krist was a party.

A new company, with a capital of $3,000,000, has been formed to take over the old St. Anthony mine in northwestern Ontario.

An important find has been made on the property of the Lightning River gold mine, near Abitibi Lake. The vein has been stripped on the surface for 300 ft. in length, and an average width of from 5 to 6 ft. and shows some spectacular gold values.

MEXICO

Jalisco

El Favor Smelter Resumes

Guadalajara.—The smelting plant of El Favor Mining Co. has resmued operations after being inactive for some time.

Cave-in at El Oro Company's Mines

El Oro.—A cave-in occurred between the 11th and 12th levels of the north shaft of the Mexico mines of El Oro Mining Co. on Oct. 19. Four miners were entombed.

Coahuila

Alternations at Torreon Smelter Progressing

Torreon—Work of enlarging the Torreon smelter, owned by the Cia. Minera de Peñoles, is progressing rapidly and it is expected that the plant will be ready for operation by Jan. 1. The old furnaces are being torn out and others of larger capacity substituted. The number will be the same as before, namely, eight lead and one copper.

SPAIN

By Cable from Reuters to Engineering and Mining Journal

Madrid, Oct. 15—The Customs Commission on Oct. 14 considered the question of the taxes on iron and other ores and decided to recommend a slight reduction of the duties originally proposed, among others that on lead.

ALASKA

Culross Island Company To Equip Mine and Mill

Valdez—Development work at the property of the Culross Island Mining & Milling Co. on Culross Island has been so encouraging that plans are now being made to equip the property fully for extensive operations. It is planned to utilize a nearby stream for water power and install a 200-hp. plant to operate a 500-cu.ft. compressor and a 50-ton mill. The power installation will give an effective head of 300 ft. with a pipe line 1,000 ft. long. The company already owns some milling equipment. The mill flow sheet calls for a 12-foot Lane slow-speed Chilian mill, hydraulic classification, and table and flotation concentration.

Juneau—Alaska Juneau has reached its goal of 200,000 tons per month. This has resulted in the month of September in an operating profit of $24,000 as against an estimated operating profit of $17,000 made earlier. This is the highest operating profit that has been made in one month since operations began. Owing to the overtaxing of the coarse-crushing plant and the excessive repairs required under these severe conditions a return has been made to two shifts operation. Under this arrangement a greater operating profit is expected.

ARIZONA

Laborers Transferred from Mining Districts to Cotton Growing Section

By James H. McClintock

Phoenix—Magma Copper Co., at Superior, has awarded a contract to Paul Michaelson, of Globe, for concreting its main 3-compartment shaft, No. 2, from its collar to the 600 level. The company also will gunite and reinforce the timbering of some of the more important underground stations. The last report shows 827,000 tons of reserve ore.

Steam shovel work in the Sacramento Hill section of the Copper Queen at Bisbee suspended Oct. 31, after four years of activity, in which time 6,500,000 cu.yd. of material has been removed. The main sulphide orebodies have been well exposed and are ready for shoveling. W. H. Webster, assistant manager reports that operations during the last few months have given a stock pile of 175,000 tons of ore, available for the new mill, and that 375,000 tons of lower-grade ore has been placed in the leaching dump pile south of the millsite.

New Cornelia is shipping east via Galveston, about 2,000,000 lb. a month of cathode copper.

Transfer from mining to agriculture has practically been forced upon several thousand Mexican employees in Arizona mining camps such as Jerome, Ray, Miami and Douglas. From these points, almost daily, truckloads of Mexican laborers, with their families, are being dispatched to Phoenix, for service in the long-staple cotton fields. It is said that the men are not at all enthusiastic over the chance to work, but that the Salvation Army captains, in charge of local relief hard-heartedly have stopped issuance of rations after providing the opportunity for employment. Pickers get 2c. per lb. for seed cotton and make about $2 a day, but this applies also to women and children, who are even better pickers than the men, and thus the family income may be larger. The season lasts till February, when, it is hoped, the mines again may be working.

Legal notice of resumption of operation has been given the Arizona State Mining Inspector by the following companies: White Hills Mining Co., Mohave County; Yavapai Gold-Silver Mining Co., Morristown; Hickey Copper Co., Canon; Davis & Dunkirk, Senator district, Prescott; Davis tunnel, A. K. McDaniel, Prescott; Rowley Copper Mines Co., Gila Bend.

NEW MEXICO

High Freight Rates Retarding Development of Properties—Tax Rate May Increase

By James P. Porteus

Lordsburg—The fact that there is no market for copper ores at present has concentrated attention on lead-silver properties but the high freight charges and equally high smelter charges and penalties have been drawbacks. It is unfortunate that there is but one lead-silver smelter in the Southwest for, as in any territory where there is no competition, there is always the feeling that the lack of it has its effect upon the treatment rates and penalties exacted. That the I. C. C. has seen the necessity of making a 16 per cent reduction in freight rates in favor of the farmer on his hay, grain and grain products is a hopeful indication to the miner that a general reduction in freight rates may be effected on smelter products and coal. Though ocean competition via the Panama Canal on smelter product shipments to the eastern refineries has forced a reduction in rail rates and some few reductions have been made on concentrates favoring the big companies, rates that would benefit the ordinary operator on ore shipments and reduced rates on mining supplies and fuel generally have not been made.

A decision was rendered by the Supreme Court at Santa Fe, N. M., on Oct. 22 affecting the right of the land commissioner to reserve mineral rights in state lands sold under contract with long time payments. It also has a bearing upon possible oil and gas deposits found upon state lands, many of which have been sold to oil speculators in recent years. This case was the State of New Mexico *ex rel* A. J. Evans' appellee, versus Nelson A. Field, commissioner of public lands and J. S. Read, appellants, appealed from Santa Fe County. Judgement of the court below was reversed. The action originated in a proceeding in a mandamus to compel the land commissioner to execute and deliver a deed or patent to the lands that had been previously sold to Evans on the deferred payment plan, the contract containing the clause reserving to the state all mineral rights.

Upon hearing in the district court the commissioner's demurrer was overruled and a peremptory writ of mandamus awarded, commanding the commissioner to execute a deed to Evans without reservation of mineral rights. The opinion of the supreme court was unanimous and held that "mandamus will not lie against the commissioner of public lands to compel him to issue a deed covering the public lands free from the reservation of the minerals therein, which reservation was contained in the contract of sale, because it is in effect an action against the state."

It is intimated from Santa Fe that an increase in the tax rates to provide necessary state revenues may be looked for, due to the heavy falling off in tax valuations on account of the idleness of the big copper properties and the low production at the coal mines.

NEVADA

Spearhead Gold Mining Co. Announces Suspension of All Work on Company Account

Tonopah—The Belmont mine continues to produce a larger tonnage than any other mine in this district. Development work is being accomplished on all levels from the 700 to the 1,300, with satisfactory results. The main shaft is over 1,600 ft. deep and there are levels below the 1,300 on which considerable work has been done, but showings at depth are not considered sufficiently encouraging to justify work below the 1,300 at present. The Belmont mine contains many veins, some only a few inches wide which are exceptionally rich at times, and others up to 60 ft. in width. The better portion of the wide veins has, of course, been mined. At present most of the ore mined is coming from enrichments in the hanging and foot wall which were passed over in previous years, low-grade ore which was left in the hanging or foot wall at a time when the price of silver was too low to make it profitable, and from the numerous narrow veins. The Halifax crosscut on the 900, which is the highest level of the mine, is making good progress toward the orebody which was discovered by leasers about six months ago and which was traced above the 900 level. The West End continues development in Tonopah "76" ground in favorable formation. Both raising and crosscutting are in progress at the present time.

Goldfield—The management of the Spearhead Gold Mining Co. has announced a suspension of all work on company account and the intention to turn any part of the mine over to leasers. This decision was reached on account of water difficulties on the lower levels which made cost of operations prohibitive. The mine has been opened to a depth of 1,100 ft., the lower workings being from winzes, and work has been continuous for twelve years. Small high-grade orebodies have been encountered and considerable low-grade ore but results as a whole have been disappointing.

Hornsilver—The main shaft of the Orleans Hornsilver has about reached the 700-foot point and a crosscut will soon be started to intersect in the vein on this level. Much interest is manifested in this piece of work, as upon the proving of the continuity of the ore shoot developed on the 600 level to the 700 depends the starting of considerable other work in the district.

Argentite—On the [illegible] property of original discovery, the shaft has reached a depth of 100 ft., and crosscutting to pick up the vein, which was faulted near the bottom of the shaft, has been started. The [illegible] property has been taken over on lease and bond and the [illegible] are [illegible] in preparation for active work. The shaft is 50 ft. deep and the vein is [illegible] as much as 5 ft. wide in places and to average [illegible]

CALIFORNIA

1,500 Men Working in Grass Valley District

Redding—L. Gardella is operating two gold dredges on Clear Creek near Redding. The Shasta Dredging Co. is operating one dredge near Gas Point. The American Dredging Co. has shut down the Holton No. 5. The Valdor Dredging Co. is operating its dredge in Trinity County and L. Gardella is building a dredge at Lewiston.

At Winthrop the Shasta Zinc & Copper Co. is delaying its operations pending changes in its plant. Harry Thompson of the Shasta Hills Mining Co. is working the Sybial and Niagara mines near French Gulch. The Hornet of the Mountain Copper Co., is in steady operation.

Fred Searles, Jr., is examining the Gladstone mine at French Gulch. At the Milkmaid mine, the mine dump is being worked and some leasers are at work at the Summit mine at French Gulch.

Grass Valley—The North Star mine has a payroll of 460 men, according to local reports. It is estimated that 1,500 men are at work in the district.

Downieville—The Brandy City Mining Co. is preparing to operate several giants. Recently a 200-ft. gravel bank was blasted, preliminary to hydraulicking. A restraining dam has been constructed on the Yuba River.

Weaverville—The Lorenz mine is making ready for operation as soon as the water supply warrants. The Enterprise mine near Helena is also being prepared for operation.

UTAH

Newly Organized South Hecla Mines Files Articles of Incorporation

Alta—Articles of incorporation have been filed by the South Hecla Mines which is a consolidation of several properties on the south side of Little Cottonwood Canyon at Alta. The capitalization is $500,000 and there are 5,000,000 shares of which [illegible] shares remain in the treasury for financing and development. The properties involved are the South Hecla Mining Co., which receives four shares of new stock for one share of old; Albion Consolidated Mining Co., share for share; Alta Tunnel Mines Co., one of new for two and one-half of old; South Hecla Extension Mining Co., one of new for eight of old. The combined mining territory amounts to 1,300 acres. Active development is being done at three points from the Quincy tunnel level of the former South Hecla Mining Co. The new officers and directors are: George H. Watson, president and general manager; George F. Watson, vice-president; Robert E. Martin, secretary-treasurer and J. Will Knight and A. B. [illegible], directors.

The Cardiff is shipping daily up to a car of silver-lead ore of a gross value of [illegible] a ton. Repairs are being made to the large storage bin at the mouth of the [illegible], where ore is accumulated during the winter when the road down the main canyon is blocked.

Drifting is being done by the Tar Baby at [illegible] ft. in the main tunnel. A foot of gouge [illegible] and a little galena is being followed along the [illegible]. The property is north of the Cardiff in the South Fork of Big Cottonwood.

The Alta Tunnel & Transportation Co. [illegible] to move not less than 10 tons of ore daily from Silver Fork of Big Cottonwood. Three carloads have been marketed, the ore netting about $40 at ton.

Eureka—Ore has recently been opened on the 400 level of the Iron Blossom in a heretofore undeveloped part of the property. The work is under the direction of H. R. Trenholm.

American Fork—Milling ore has been developed by the Pacific Gold M. & M. Co. on a strong fissure 1,100 ft. from the portal of the main tunnel and 400 ft. from the surface during the summer months. The vein is 4 ft. wide and has been opened for 300 ft. on its strike and raises have been driven for 75 ft. in ore. [illegible] This property has produced [illegible] over $200,000 in the past and has paid dividends of about [illegible] is general manager.

Active development will be carried on through the winter by the newly organized Midwest Development Co. which has taken over control of the Old Miller and other American Fork properties. The officers of the Midwest company are: George S. Silsby, president; A. W. Larson, R. V. Smith and Albert W. Hahn.

MONTANA

Paul A. Gow Gets Injunction To Prevent Cascade Mines & Mills Co. From Carrying Out Deal

Butte—Interest was aroused during the week by reports that the Anaconda Copper Mining Company was purchasing shares of the American Brass Co., supposedly with the idea of acquiring control of the latter corporation, and thus affording the company another outlet for its zinc and copper. In this connection there was also a report to the effect that the Anaconda for sometime has enjoyed an agreement with the National Brass Company of Ohio whereby its zinc and copper requirements will be filled by the mining company. The reports are unverified. The Anaconda [illegible] several hundred men at the Washoe Reduction Works [illegible] The company has started driving on the 1,900 level for what is believed to be the Hornet vein, from the West Gagnon workings.

Official word has been had that logging operations on the Anaconda's western timber lands in this state will start [illegible] together with operations at its [illegible] lumber plants, where [illegible] afforded employment.

[illegible]

Butte & Superior's copper ore showing on the 2,200 level of the Black Rock continues to impress the management with its possibilities when it shall have been opened on the 2,600 level, where a crosscut is being driven for the copper fissure.

North Butte is continuing the drifting on the 3,600 level of the Edith May on a branch of the fissure with very encouraging results. Development work on this level is the principal labor under way at the Granite Mountain property.

Barnes-King Development Company reports gross bullion output for September at $27,867.42 as compared with $28,605.04 the preceding month, a decrease of $737.62. Only the Shannon mine is operated by the company and its tonnage and assay values for September show little change as compared with August, crude values ranging from $11.38 to $11.78 per ton. Announcement of discontinuance of further development at the Betsy Baker claim in Madison county was made together with the abandonment of work below the 500 level of the North Moccasin mine, which is under the operation of leasers and from which in September the Barnes-King received $645.15 in royalties. Apparently no development of the prospect near Waterloo, Madison County, will be undertaken until a road has been constructed to the property, which is situated in an accessible section of a rugged mountain range.

Elkhorn—Both ends of the power line over which the Elkhorn mill of the Boston & Montana will receive its power are being connected, the Montana Power Co. being only a mile or two out of Butte stringing wires and the Boston & Montana's own crew practically finishing up at the Elkhorn camp. The end of the month should see the tuning up of the mill begun. Cost of the construction of the Elkhorn mill to Sept. 30 was $1,086,265, according to official figures and since 1914 there has been actually expended on the Boston & Montana properties $4,347,732. Expenditures thus far this year have been approximately at the rate of $75,000 monthly, it is reported.

MICHIGAN

The Copper Country

Copper Shipments Heavy in October—C. & H. To Aid Former Employees This Winter—La Salle Holds Little Promise—Mohawk Making Money

By M. W. Youngs

Houghton—October will probably prove the banner month of the year for copper sales in the Lake district. Metal shipments have been unusually heavy, both by boat and rail. There has been an increase of activity at all smelters and the outlook is better than for some time. Calumet & Hecla is now working eight furnaces instead of six, two more having just gone into commission. Two are being employed on cupola blocks, turning out anodes, while six are making special shapes, presumably for Germany. The company has just shipped out 600,000 lb. by boat to Detroit and Buffalo. It also has engaged in shipping by rail 560,000 lb. ordered by Middle West consumers.

The Calumet & Hecla has announced that it is planning to aid former employees needing assistance the coming winter. The co-operation of Calumet business men in the work of relief has been asked, the aim being to have the business men look after the needs of residents who are not former employees of the company. Committees have been appointed to make adequate plans to handle the situation.

The announcement is taken to indicate that there will be no resumption of operations at the Calumet & Hecla mines until spring. The majority of the former employees still reside in the district and many of them will be in need of help this winter. Practically all of them have been enabled to get along during the summer, either having found other work or having lived on their savings. They are paying no rent for their homes and with the organized relief that will be provided it is believed there will be no particular suffering in the district during the cold months.

In addition to the Superior mine, which has been abandoned, LaSalle is another Calumet & Hecla subsidiary that holds out little promise and it is unlikely this property ever will be worked again except through the Osceola workings. Exploratory work in LaSalle, up to the time of its shutdown in November, 1920, revealed no ground that warranted either stoping or a continuation of development. Only a total of 3,430 tons of rock was treated, although Osceola mined 24,419 tons under a royalty arrangement. Where penetrated by the Osceola openings LaSalle ground is the best yet encountered. The 59,713 lb. of copper obtained from the rock milled by LaSalle in 1920 was produced at a cost of $1.12 a lb., including mining costs and mine taxes, but exclusive of other costs and depreciation, which brought the total up to $1.30.

Mohawk has temporarily ceased sinking in No. 1 shaft to give the timbermen a chance to catch up on their work. Sinking continues in Nos. 4 and 6 shafts. With coal and other costs down, Mohawk is now better than breaking even on the present price of copper. Wolverine is still on the losing side but with a reduction in freight rates would turn its loss into a profit. Wolverine is producing at the rate of 350,000 lb. of refined metal monthly, or 4,200,000 lb. a year. This compares with 3,640,000 lb. produced last year.

Menominee Range

Penn Iron Mining Co. Closes Two Out of Three Mines—New Hydro-electric Plant To Be Running Jan. 15

Norway—The Penn Iron Mining Co. has closed its East Vulcan and Central Vulcan mines, leaving the West Vulcan the only mine working at Vulcan. The pumps have been pulled and the mines will be permitted to fill to the sixth level. Most of the old hands employed at the two mines closed have been given places at the West Vulcan.

Iron Mountain—It is expected that the Peninsula Power Co.'s new hydro-electric plant on Pine River will be generating current by Jan. 15, 1922. The construction work is fully up to schedule. The dam, 32 ft. high, is expected to impound a 28-ft. head of water, leaving 4 ft. of freeboard. It is 500 ft. long. A 10-ft. canal, 1,500 ft. long, runs to the power house. Two 9-ft. penstocks carry the water down to the turbines. The water drops 93 ft. from the canal to the turbines, of which there are two. These are S. Morgan Smith machines and are directly connected to two 2,000-kw. generators, giving the plant about 5,300 electrical hp. The current will be generated to a pressure of 2,300 v., which is stepped up through transformers to 66,000 v. for transmission to the Commonwealth station, where it will be turned into the main lines. The Peninsula Power Co. now has two plants in operation and furnishes power to most of the mines on the Menominee range.

JOPLIN-MIAMI DISTRICT

Search for Lead Ore Stimulated—Taxation of Ore in Bins Troubles Operators—Rumors of Merger Circulating

By P. R. Coldren

Joplin—Production of the Tri-State field is proceeding with only slight increase being reported. Most of the mining companies are concentrating their efforts on lead production, trusting that metal to pay their operating expenses the while they hold their zinc ore for future profits. This special search for lead is naturally being rewarded. Recently the Kanok Company at its Premier mine in Picher, Okla., opened up an unusually rich face of lead ore, being a vein approximately 4 ft. in thickness made up of almost solid lead ore. It is one of the finest lead showings reported in the field for many months.

The Federal Mining & Smelting Co. recently started up its Brewster mine, near Hockerville, Okla., and is producing dirt that shows a recovery of about 6 per cent lead ore and 3 per cent zinc. The Underwriters' Land Co., which started its No. 4 mine several weeks ago after a prolonged shutdown, is also making expectional lead recoveries and up to last week had held all the zinc ore it has been making, amounting to about 25 tons weekly.

The matter of taxation of ore in the bin for school purposes in the Oklahoma section of the field is bothering mining companies greatly. The law has been so doubtful in this regard that some of the attorneys of some of the largest companies had advised that the assessment for last year be held back. Recently, however, the county authorities have threatened seizure and tax sale and in most cases the taxes will be paid forthwith. The tax rate on ore in bin has been raised once more this year in some of the school districts, and amounts to so much that producers already are making plans to sell at least some of their ore before Jan. 1. Others may go to the trouble and expense of having the concentrates hauled over into Kansas where there is no tax on stored but unsold ore.

Within the past week there has been a recurrence of the rumors concerning reported options taken on local mining companies, and it is reliably reported that options have been taken by a St. Louis concern of magnitude on two of the largest producing companies in the Picher field. An investigation of the properties is understood to be under way, looking toward the ultimate closing of these options.

It is commonly believed here that before the slump that has recently been experienced has completely disappeared there will be a definite tendency in this field to place more mines under the ownership or control of one large company.

The Situation at the Mines in October

CONDITIONS in the metal-mining districts of the country showed improvement in October. Copper camps remained generally shut down or running on the same basis as in recent months. Zinc-lead mining improved, however, notably in the Joplin-Miami districts and in Wisconsin. The Pittman Act continued to stimulate the production of silver and the search for new deposits of silver ore, while gold producers also continued to regain very gradually their long lost ground. As for iron, the Birmingham district is apparently recovering more quickly than the Lake Superior ranges and gave unmistakable signs of improvement during the month. Conditions of unemployment were nowhere noticeably bad except in the Butte district, though the situation in this respect may be expected to worsen.

In the Birmingham district at the end of the month the schedules for resumption of iron and steel making operations announced for October were found to have been more than realized. Five furnaces were blown in during the month, bringing the number in blast to eleven with the probability strong of others coming in at short notice. The October output of pig is estimated at over 100,000 tons. The production of coal, iron ore and limestone reflected a more favorable general condition.

Shipments of iron ore from the Lake Superior district were practically completed for the season by Oct. 31, very little ore then remaining to be transported to lower lake ports. The October movement was less than one-third of normal. The open-pit mines were closed with few exceptions and only a small part of the underground mines were in operation and few working on a full-time basis. Two Michigan mines resumed production in October. There were many unemployed but various relief measures were tried.

In the Lake Superior copper country, the number of furnaces worked during October was 16 per cent of normal and the number of men employed 25 per cent. Eight furnaces were in blast at the Calumet & Hecla smelter, compared with six in September, two at the Michigan smelter and one at the Quincy. Copper production in October was estimated at 6,225,000 lb., including the Calumet & Hecla refinery output, against a normal monthly production of 22,800,000 lb. The total number employed during October in Houghton and Keweenaw counties was 4,793. The district was remarkably free of cases of absolute destitution. Relief measures were being organized and sawmills and camps to furnish employment were being started.

There was no curtailment in the Wisconsin zinc-lead district in October. Production is estimated at 2,500 tons crude blende concentrates; 1,500 tons roasted blende; and 200 tons lead ore. Five producing mines were active, one roaster, one acid plant, and one oxide plant. One new mine was opened. About fifty individual miners were reported to be prospecting independently. October witnessed the first sale and shipment of high grade blende [illegible] May. There was a large tonnage of ore in storage.

Fifty-five mines were operated in the Joplin-Miami zinc-lead district in October compared with 130 two years ago and less than thirty a few months ago at the depth of the slump. Some of the companies worked but a few days per week. The October output is estimated at 5,600 to 5,800 tons of zinc concentrates. The amount of unemployment was small. Until recently there was a slight labor shortage.

In the southeast Missouri lead belt conditions were generally satisfactory. The St. Joseph Lead Co. operated at about 60 per cent of normal with its force of men in the same proportion. This is believed to correspond to other operations in the district. Unemployment was not apparent.

In the Ducktown district in Tennessee, the Tennessee Copper & Chemical Corp. ran its smelter and acid plant at about [illegible] per cent of normal capacity. The Ducktown Sulphur Copper & Iron Co. ran at [illegible] per cent [illegible] normal.

Passing to the Western States, but two companies, the Homestake and the Trojan, were producing gold in the Black Hills during October, both of which ran at capacity. The Homestake continued its work of equipping its new stamp mill that is to increase its output.

Gold mining in California showed steady improvement in October. Increasing interest was taken in operations on the Mother Lode. With the resumption of the North Star, the Grass Valley district reached practically the pre-war scale of operations. Except in Plumas County, where the Engels company ran as usual, the copper camps were dead. The serious strike in the oil fields continued throughout the month and there was some talk that it might spread.

The situation at Nevada mines was generally good. The labor supply was ample, there being more jobs than men, though wages were above the pre-war basis. There was marked activity in development work on the Comstock. Pioche was very quiet as was the Ely district. Unemployment in most camps was not serious.

In Utah, things were rather quiet as in September, though with some improvement. Labor was plentiful. The Tintic district employed more miners than any other camp, most properties having relatively full forces and the production of lead and dry silver ores being good. Bingham was quiet with the United States mines the only property working. Park City was active, its output of silver-lead ores being not far below normal. Alta and the Cottonwoods shipped a moderate tonnage of silver-lead ores. The valley smelters were still short of ores: Midvale worked three furnaces, two on lead and one on matte; Murray worked three lead furnaces; Garfield ran three reverberatories treating an increased tonnage of siliceous silver ores.

October showed general improvement in mining conditions throughout Colorado. Much exploration and development work was under way and production continued to increase, especially in Cripple Creek and in districts where gold and silver predominate. Conditions at Leadville were not so good as a year ago but better than in the earlier months of 1921. Production at Telluride increased, due principally to the completion of the Smuggler Union mill. In Park County several new enterprises got under way; the Yuba Dredging Co. started its new dredge near Fairplay. The Aspen output was restricted on account of the smelter limiting tonnage of lime-silver ores. Operations were slowing up in the carnotite fields.

Greater optimism based on the prices of lead and silver prevailed in the Coeur d'Alene district but conditions were little changed in October from September. The Hecla, Morning, and Bunker Hill & Sullivan maintained their normal output. The Bunker Hill smelter continued to operate one furnace. Custom ore accumulated at this plant owing to the expansion of the smelter's field through more favorable freight rates. The company had about 1,600 tons of pig lead on hand. It announced that it planned to erect a lead products plant in or near Spokane. The three companies employed about 2,000 men [illegible]

The Tacoma and Trail smelters maintained curtailed production in October. The Northport smelter remained closed, with little indication of early resumption. Labor was plentiful.

In Montana, operators made an effort to relieve the unemployment situation by increasing positions where possible. Anaconda kept more men on the payroll than market conditions warranted, having [illegible] on repairs at the Washoe works and over [illegible] on split shifts in the [illegible] on repair and development work. [illegible] produced to a limited extent. [illegible] but little destitution was reported. [illegible] on development at its [illegible] properties. Gold and silver [illegible] mining improved a little.

Throughout the Southwest the [illegible] copper mines were closed except New Cornelia, which produced to a limited extent, and Miami Copper, which [illegible] at the rate of [illegible] lb. per month. Silver mining was active, particularly at Tombstone, Ariz., which shipped to El Paso. Gold mining also showed continued recovery, especially in Mohave County, Ariz. There was little distress from unemployment. One method of relieving it adopted was the transfer of Mexican laborers from mining camps to the cotton fields of the Salt River Valley.

THE MARKET REPORT

Daily Prices of Metals

Oct.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
27	12.625@12.75	27.75	28.125	4.65@4.70	4.40	4.55
28	12.625@12.75	27.625	28.00	4.65@4.70	4.40	4.55
29	12.625@12.75	27.625	28.00	4.65@4.70	4.40	4.55
31	12.625@12.75	27.75	28.25	4.65@4.70	4.375	4.55
Nov. 1	12.75	27.375	27.875	4.65@4.70	4.375	4.55@4.60
2	12.75	27.375	27.875	4.65@4.70	4.375	4.60

*These prices correspond to the following quotations for copper delivered: Oct. 27 to 31 inc., 12.875@13c.; Nov. 1 and 2, 13c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Oct.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
27	65½	66⅜	72	156½	158⅞	24	23⅝	25⅞	26⅜
28	65¾	66¾	72	156	158¼	24	23¾	25⅞	26½
29									
31	66½	67	72½	156½	158¾	24	23½	26	26½
Nov. 1	66⅛	67⅛	73	155½	157¾	23⅞	23⅜	26⅛	26⅝
2	67	67⅜	73½	155	157¼	23⅝	23⅜	26	26⅝

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver			Oct.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York. Foreign Origin	London
27	392½	99¼	69¾	40	31	392¾	99¼	70¾	40¾
28	390¼	99¼	70¼	40¾	Nv. 1	392	99¼	69⅝	40⅛
29	392	99¼	71	41¼	2	391	99¼	70¼	40½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Monthly Average Prices for October

Copper:	
New York Elecrolytic	12.673
London Standard	67.327
London Electrolytic	73.476
Lead:	
New York	4.690
St. Louis	4.439
London	23.679
Silver:	
New York, foreign	70.970
New York, domestic	99.250
London	41.442
Sterling Exchange	386.315
Zinc:	
St. Louis	4.605
London	26.315
Tin:	
99 per cent	27.278
Straits	27.655
London	156.380
Antimony	5.085
Quicksilver	39.840
Platinum	81.800

Metal Markets

New York, Nov. 2, 1921

The metal markets have been generally quiet, with practically unchanged prices, during the last week. The October average prices, published in another column on this page, show uniform advances over the figures for September, with the exception of quicksilver, which is the lowest for seven or eight years. Unlike some of the other metals, however, quicksilver has not so far dropped much below pre-war levels. Lead, zinc, tin, and antimony averages for October were the highest since May or June. The average quotation for platinum is the highest since last November, and silver exhibits a new high monthly price for the year.

Copper

Copper was somewhat firmer yesterday and today, although sales have not been large, either domestic or foreign. The slightly increased firmness among the producers is no doubt due to the unexpectedly high figure for October sales—approximately 140,000,000 lb. This is the best month's business of the year, exceeding by about 30,000,000 lb. the very satisfactory figure for May. A large proportion of this business was for domestic account. The brass, wire, and sheet-metal businesses all seem gradually improving. The improved demand for copper is particularly noticeable from brass manufacturers, who are running out of the supplies of scrap, of which they had such large quantities.

We understand that the world's stock of scrap is now largely made up of the 150,000 tons which was recently taken over by a British metal company. This will be in large part divided among American, German, and British refineries, and deliveries are to extend over the greater part of the coming year. The balance will no doubt go to brass manufacturers, who will be able from time to time to take reasonable quantities of the higher grades. In view of the manner in which the American copper surplus is being handled, and of the character of the people now holding this foreign scrap, it is reasonable to assume that it will be marketed carefully and that it will not interfere with a gradually rising copper market. The scrap bogey is now a thing of the past, and by May the surplus American copper stocks are likely to have faded away also.

Small lots of spot copper are still available at 12.875c. cash, delivered to near-by points, but producers generally are quoting 13c. for November, and 13@13.125c. delivered for December.

Lead

The official contract price of the American Smelting & Refining Co. continues at 4.70c. The market has been quiet but firm, especially in New York. In St. Louis there has been more of a disposition to shade prices, and since Monday lead has been freely offered for prompt delivery in lots of several hundred tons at 4.375c. The Chicago business has been done at 4.50c., as a rule, though some sales at 4.475c. are reported. Corroders expect to work at capacity all winter, and the lead-cable, pipe, and cartridge businesses continue satisfactory.

Zinc

The zinc market has been fairly quiet. Trading early in the week was almost entirely on a 4.55c. basis, the steady advance in the metal being held up partly by the psychology of the threatened railroad strike and partly by the disposal of some speculative lots of metal. The market is firmer since Monday, and it would be difficult to obtain zinc below 4.60c. today. Inquiries are reported in fair volume. High-grade zinc still commands 6c., with freight allowed.

Tin

Tin has been irregular. There has been a little buying every day, but nothing like the business of early October. Consumers are expecting somewhat lower prices. The American deliveries for October—2,280 tons—were somewhat lower than expected. Tin for forward delivery was quoted as follows: Oct. 27th, 28.375c.; 28th, 28.375c.; 29th, 28.375c.; 31st, 28.625c.; Nov. 1st, 28.375c.; 2d, 28.375c.

Arrivals of tin, in long tons: Oct. 25th, Australia, 15; 28th, London, 25; 31st, Rotterdam, 25; Straits, 600. Total for October, 2,565.

Gold

Gold in London: Oct. 27th, 104s. 5d.; 28th, 104s. 10d.; 31st, 104s. 9d.; Nov. 1st, 104s. 9d.; 2d, 104s. 10d.

Foreign Exchange

Exchange markets have generally been narrow, with minor fluctuations. Italian lire have moved above 4c. Sterling cables continue to be quoted at one-half cent premium over the price of demand as given in the table on page 752. On Tuesday, Nov. 1, francs were 7.335c.; lire, 4.02c.; and marks, 0.52c. New York funds in Montreal, 8 11/16 per cent premium.

Silver

Although the immediate tendency is uncertain, owing to the influence which the speculative transactions in Shanghai are having on the London market, the impression is that the undertone is firm, as our information from various sources is that the requirements of China for the actual metal will continue for some time. The monsoon now completed, we understand, has been considered good, so that the prospects for the Indian crop are more favorable, and there is no reason to suppose that India will not also continue to want at least moderate quantities of silver.

Mexican Dollars—Oct. 27th, 53⅞; 28th, 54⅛; 29th, 54⅛; 31st, 54⅛; Nov. 1st, [illegible]; 2d, [illegible]

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices of 24.5@25c are nominal. Outside market, 17@18c., with practically no sales.

Antimony—Chinese and Japanese brands, 4.90@5.25c.; market firm. W.C.C. brand, 5¼@5½c. per lb. Cookson's "C" grade, spot, [illegible]. Chinese needle antimony, lump, nominal at [illegible] per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, [illegible].

Bismuth—$1.50@$1.55 per lb.

Cadmium—Range $1@$1.10 per lb. in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $3@$3.25 per lb.; black oxide, [illegible] per lb. in [illegible].

Iridium—Nominal, $150@$170 per oz.

[1]**Molybdenum Metal**—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominal, $60 per oz.

Platinum—$85 per oz. Market firm.

Quicksilver—Market weaker at $38@$40 per 75-lb. flask. Heavy imports reported. San Francisco wires $42.25.

[1]**Rhodium**—$150 per troy oz.

[1]**Selenium**—Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]**Thallium Metal**—Ingot, 99 per cent pure, $20 per lb.

[1]**Tungsten Metal**—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $24@$26; ground, $28; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—22@23c. per unit, seaport; chemical ore (MnO_2) $50@$55 per gross ton, lump; $70@$75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 45@50c. per lb. of contained sulphide, New York. Quotation purely nominal.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

Titanium Ores—Ilmenite, 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolfram, 60 per cent WO_3 and over, per unit of WO_3, $3, f.o.b. Atlantic ports. [illegible]

Uranium Ore (Carnotite)—Ore containing [illegible] per cent U_3O_8 and [illegible] per cent V_2O_5 [illegible] per lb. of U_3O_8 and 75c. per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and [illegible] per cent V_2O_5 [illegible] higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 [illegible] New York. [illegible]

[1] [illegible]

Zircon—Zirconium silicate, f.o.b. Pablo, Fla., 4½@13c. per lb.

[1]**Zirkite**—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Oct. 29—Zinc blende, per ton, high, $26.40; basis 60 per cent zinc, premium, $24; Prime Western $23; fines and slimes, $23@$22; average settling price, all grades of blende, $23.38.

Lead, high, $64.65; basis 80 per cent lead, $60@$55; average settling price, all grades of lead, $62.95 per ton.

Shipments for the week: Blende, 7,007; lead, 2,001 tons. Value, all ores the week, $289,840. Shipments for ten months: Blende, 231,470; calamine, 102; lead, 51,370 tons. Value, all ores ten months, $8,111,830.

Offerings of $22.50 basis this week brought no ore on the market, and offerings were advanced to $23 and at the very close $24 basis, with light purchases, as many buyers remained on $22.50 basis and secured no ore. Lead prices were lowered on purchases for next week's delivery to $55 basis.

Compared with last year the shipments for ten months are lower by 259,803 tons of blende, 8,734 tons of calamine, and 25,488 tons of lead.

Platteville, Wis., Oct. 29—Blende, basis 60 per cent zinc, $30. Lead ore, basis 80 per cent lead, $60 per ton. Shipments for the week: Blende, 602; lead ore, 40 tons. Shipments for the year: Blende, 9,310; lead ore, 1,605 tons. Shipped during the week to separating plants, 676 tons blende.

Non-Metallic Minerals

Asbestos—Crude, No. 1, [illegible]; No. 2, [illegible]; spinning fibers, $250@$850; magnesia and compressed sheet fibers, [illegible]; shingle stock, [illegible]; paper stock, [illegible] $70; cement stock, [illegible]; floats, $8.50@$15, all per short ton, f.o.b. Thetford, Broughton, and Black Lake mines, Quebec, Canada.

Barytes—Crude, [illegible] per cent barium sulphate, [illegible] per net ton; ground (white) $23@$24 in bags, carload lots; [illegible] in bags, carload lots; all f.o.b. South Carolina points. [illegible] material, [illegible] per net ton, f.o.b. Atlantic seaports. [illegible] f.o.b. Cartersville, Ga.

Bauxite—[illegible]

Borax—[illegible]

Chalk—[illegible] Do- [illegible] per lb. [illegible] New York.

China Clay (Kaolin)—Crude, $6.50@$8.50; washed, $9@$10; powdered, $12@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $25@$40, f.o.b., quoted at New York.

Emery—Turkish emery, 6c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b., from New England points.

Feldspar—No. 1 soap grade, $7@$7.50 per ton, f.o.b. North Carolina points; No. 1 pottery, $6@$6.50; No. 2, $5@$5.50. Market dull. For No. 1, Canadian, ground, $23, f.o.b. Ohio points.

Transactions are reported on a $5 basis for crude No. 1; prices are still nominal.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; gravel, $15; lump, $12.50, f.o.b. Lordsburg, N. M. Ground, acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, ¾@2½c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York. Raw crushed rock, $3.50@$4.50; calcined stucco, $9; f.o.b. works, Illinois.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $45@$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica — India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

[1]**Monazite** — Minimum of 6 per cent thorium oxide, $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $11; 75 per cent, $9.50; 75@74 per cent, $9; 70 per cent, $6.25; 68 per cent, $5.75; 68@66 per cent, $5.50.

Pumice Stone — Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 13c.; Spanish lump, 13@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic, f.o.b. Texas and Louisiana mines; $18@$20 for export, f.a.s. New York.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $7.50@$11 per ton; less than carload, $25, f.o.b. cars. Imported, $30@$40; Canadian, $18@$40 per ton.

Mineral Products

Arsenic—5¾@6c. per lb.

Copper Sulphate — Large crystals, 5.35c.; small crystals, 5.25c. per lb. f.o.b. New York.

Sodium Nitrate — $2.35@$2.45 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $12.50 per ton, f.o.b. in bulk, Western mines, spot and six months' contract; $20@$22 per ton, New York.

Potassium Sulphate—Powder, domestic, $1.15@$1.20 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 11c. per lb. of chromium contained; 4 to 6 per cent carbon, 11@12c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $58@$60, f.o.b. furnace; resale, $90, delivered; English and German, $60@$63, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $25@$27 per gross ton, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.25 per lb. of contained metal, f.o.b. works. Imported material, $1.70@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $38@$40; 50 per cent, $57@$59; 75 per cent, $120@$125

Ferrotungsten—Domestic, 70 to 80 per cent W, 40@45c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$4.25@$4.50 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 20.50c. per lb.; wire, 14.50c.

Lead Sheets—Full lead sheets, 7⅜c.; cut lead sheets, 8c. in quantity, mill lots.

Nickel Silver—29.50c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets, 17.25c.; sheathing, 16.25c.; rods, ⅝ to 3 in., 14.25c.

Zinc Sheets—$10 per 100 lb., less 8 per cent on carload lots, f.o.b. smelter.

Refractories

Bauxite Brick—56 per cent alumina, $50 per ton; 76 per cent, $90@$95 f.o.b. works.

Chrome Cement — 40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—$52@$55 per net ton.

Fire Brick—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $65@$70 per net ton; 9-in. arches, wedges and keys, $77; soaps and splits, $98, f.o.b. works.

Silica Brick—9-in., per 1,000; $35@$45 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Nov. 1, 1921.

Buying of finished-steel products in general has clearly been receding in the last fortnight.

The Steel Corporation's reported earnings for the September quarter, $18,918,058, are of interest in the steel market, in that they fell a trifle short of covering the preferred dividend, but were about $15 per ton shipped, a better rate than in many pre-war years. The Steel Corporation wrote off many items in 1920 that the independents that now show losses probably deferred considering.

Not only has the attempted $5 a ton advance in sheet failed, but the old prices are now being shaded, the market being quotable at 2.25c. to 2.50c. for blue annealed, 2.90c. to 3c. for black, and 3.90c. to 4c. for galvanized. Plates are still easier, with shapes and bars unchanged.

Pig Iron—There is no important buying of pig iron, the market remaining very dull. Basic is easier. Bessemer, $20; basic, $19 to $19.50; foundry, $21, f.o.b. Valley furnaces.

Coke

Connellsville—Furnace, $3.25@$3.50; foundry, $4.25@$4.50.

---

[1] Foote Mineral Co., Philadelphia, Pa.

Review of Several Industries Indicates Upward Trend

Iron and Steel, Railroad, Construction, Electrical, Automobile, Marine, Textile, Agricultural, and Leather Industries Report Various Stages of Revival—Steady Prices, Stabilization of Wages, and Increased Production Among Influencing Factors

AT THE NATIONAL CONFERENCE of the Business Papers Editors at Chicago on Oct. 24, summaries were presented by the editors of leading industrial publications dealing with existing conditions, and forecasting the future. These summaries and forecasts are of interest to mining men, since their own industries will follow the general business trend.

The Iron and Steel Industry

A. I. Findley of *Iron Age* in speaking of conditions in iron and steel stated that production reached its lowest point in July and is now on the upward trend, although an uninterrupted advance need not necessarily be looked for immediately.

The country's capacity is between 52,000,000 and 53,000,000 tons of steel ingots annually, and during July operation was about 20 per cent of capacity. Today steel works are operating at about 42 per cent. Ordinarily the "wear and tear" of the country requires about a 60-per cent operation and rarely has this fallen below 50 per cent.

Compared with other commodities, finished steel prices are the lowest in the list given by the Department of Labor, in relation to the level of 1913. Steel works wages today are 40 per cent below the war peak, whereas few other industries show reductions exceeding 25 per cent. Generally speaking, price liquidation in steel is well advanced.

The railroads and building trades will determine largely to what extent the steel industry is to see revival in 1922.

A prediction of a gradual advance to a 60 per cent operation in 1922 would represent a fair allowance for favorable developments that are not yet in sight.

Railroads Handicapped with High Wages

Samuel O. Dunn, editor of *Railway Age*, stated that in the railroad business the rates are fixed by Government bodies, chiefly the Interstate Commerce Commission, and wages, rules, and working conditions are set by the Railroad Labor Board. In July, 1920, an increase in railway employees' wages was made, in addition to those increases already made under Government control. In August, 1920, an advance in rates was granted, but subsequent operating expenses were so excessive that the returns expected were not realized. Then the decline in traffic in the latter part of 1920 and early in 1921 made matters worse than ever. Retrenchments were then made both in supplies and labor and in July, 1921, a reduction in wages was allowed. The railways are doing better financially at present than they have been at any time during the year; they will ask for further reductions in wages; if these are not obtained they will resist further substantial reductions of rates; if they do get reductions in wages there will be voluntary reductions.

Construction Industry Waits for Steady Price

Improvement in the construction industry, stated W. W. DeBerard, Western editor of *Engineering News-Record*, is looked for in 1922. Prices have fallen steadily since the peak in July, 1920, and construction costs are now about 30 per cent cheaper than a year ago, or 34 per cent under the peak. For the whole country common labor has dropped from 64c. per hour to an average of 50c. per hour, the average for the country in 1913 being about 22c. per hour. It is, therefore, probable that labor cost will continue to decline in 1922, and this will work to draw certain materials below the present levels. The volume of construction of an urgent nature is steadily swelling and a certain proportion of this must be released, irrespective of market conditions. It seems safe to predict that 1922 will be a considerably better construction year than the present.

Electrical Industry Optimistic

Frank E. Watts, of *Electrical Record*, in presenting a resumé of conditions in the electrical industry, indicated a rapid recovery in the manufacture and sales of electric appliances. Export business for the 12 months ending June 30, 1921, shows an increase of 37 per cent over 1920. Surveys of the entire industry indicate that the production of manufacturers today is between 55 and 60 per cent of capacity.

Revival in Automobile Industry Due to Price Reductions

Concerning the automotive industries [illegible], editor of the *Class Journal*, stated that all branches of the automobile industry would produce this year approximately [illegible] vehicles, as compared with [illegible] in the 1920 [illegible] year. Ford will produce from [illegible] to [illegible] per cent of this total. During the [illegible] automobile sales have been [illegible], the farmer [illegible] in a [illegible] way. After a complete cessation of the automobile industry in the fall of 1920 there was an unexpectedly heavy revival in the spring of 1921, which continued well through the summer, this being largely due to price reductions. The motor truck industry has passed through the quietest year in its history. There has been a gradual revival in the last six or eight weeks. The farm tractor industry has had the slowest year in its history. The airplane industry has been in a state of coma during the past year. Ford prices are lower than ever before. The prices of many other makes are 10 to 35 per cent higher than the 1916 level. Throughout the world it is estimated 10,000,000 automobiles have been in use.

Marine Industry Pessimistic and Optimistic

An analysis of the marine industry according to R. V. Sawhill, editor of the *Marine Review*, shows somewhat of a paradox. Many of the war-boom shipyards have permanently closed down and many others have changed over to other lines of industry. On the other hand ship construction now under way is about 25 per cent more than the banner production for an entire year prior to the war. The U. S. Shipping Board has more vessels tied up in idleness than it has in service. Export trade is slack and private ship owners have found difficulty in obtaining profitable freight for the decreased number of ships in service. The present shipping board, however, is showing an intelligent concept of its functions.

Undue Optimism Not Warranted in Textile Industry

The textile industry, as reviewed by V. E. Carroll, editor of the *Textile World*, has been passing through a period of drastic deflation and readjustment and it would appear that this has been completed as far as manufacturing and the wholesale distribution of merchandise are concerned. The textile industry may be said to have passed through its slough of despond and to be on the up trend, although conditions as indicated by economic tendencies do not appear to warrant any undue optimism on the part of producers.

The Farmer Tends to His Knitting

The farmer, according to Clifford V. Gregory, editor of the *Prairie Farmer*, is setting the business world a good example in attacking the present depression. He is hard at work and operating his "plant" at normal capacity. Agriculture is as the country's [illegible] basis of any [illegible]. Reduced production costs, readjustment of prices, more liberal credits, lower railroad rates and sane work will put the farmer at the head of the procession in 1922.

Shoe, Leather, and Hide Industry

The shoe, leather, and hide [illegible], according to [illegible], editor of the [illegible], were among the first to suffer deflation, the beginning [illegible] in August, [illegible], when [illegible] prices had reached the peak prices. At that time [illegible] prices for finished goods [illegible] high prices [illegible] created a "buying strike" [illegible] material prices [illegible]. Tanners are now operating about [illegible] per cent on the average and the annual production of leather [illegible] demand

---

*[illegible] *Mining Journal* of [illegible].

COMPANY REPORTS

Temiskaming Mining Co. Shows Deficit

Silver; Ontario

A report of operations of the Temiskaming Mining Co. for the eighteen months ended June 30, 1921, states that 243,029.2 oz. of sliver was produced during the first eleven months of this period, the mill being shut down in November, 1920. Profit and loss account follows:

Production			
Ore sales		$271,330.05	
Less ore on hand Dec. 31, 1919		92,035.38	
			$179,294.67
Costs			
Development and exploration	$31,828.80		
Mining	162,137.77		
Milling	84,166.42		
Shipping and marketing	8,380.94		
		$286,513.93	
Administrative and General			
General expense, mine office	44,442.98		
Taxes, insurance and general expense	35,582.56		
		80,025.54	
			366,539.47
			$187,244.80
Miscellaneous Earnings			
Interest, discount and exchange	49,049.76		
Miscellaneous	2,429.54		
			51,479.30
Deficit, transferred to surplus			$135,765.50

Surplus Dec. 31, 1919, was $864,018.70. Subtracting a deficit of $135,765.50 gives a surplus June 30, 1921, of $728,253.20. The company is capitalized at $2,500,000.

McIntyre Porcupine Surplus Increases

Gold; Ontario

A report of operation of the McIntyre Porcupine Mines, Ltd., for the fiscal year ending June 30, 1921, states that 171,916 tons of ore was treated, having a gross value of $11.67 per ton and containing 91,330.3 oz. of recoverable gold and 19,806.4 oz. of silver.

Profit and loss account follows:

Earnings		
Bullion recovery		$1,904,326.36
Operating costs:		
Mining, development, and exploration	$615,310.65	
Transportation of ore	39,841.14	
Milling	207,190.04	
Heating and maintenance of buildings and camps	28,929.21	
Employees' insurance and welfare	44,169.68	
		935,440.72
Administrative and general expenses:		
Management and general expense, mine office	$61,732.17	
Administrative and general expense, head office	76,712.29	
Insurance, general	14,878.65	
		153,323.11
Total operating costs, before providing for taxes and depreciation		1,088,763.83
Net operating earnings, before providing for taxes and depreciation		815,562.53
Non-operating revenue:		
Interest and exchange earned	$267,570.59	
Miscellaneous earnings	5,380.79	
		272,951.38
		$1,088,513.91
Appropriations:		
Provision for municipal, provincial and dominion taxes for current year	$64,125.54	
Reserve for plant depreciation	207,526.50	
Holdings in adjoining mining properties written down	1,331.75	
Total appropriations		272,983.79
Net profit for the year transferred to surplus		$815,530.12

Surplus on July 1, 1920, was $1,381,683.98; adding net profit of $815,530.12, a rebate of $480.40, and deducting three dividends paid of $182,014.15 each, and a tax deduction of $5,444.29, gives a surplus of $1,646,207.76 on June 30, 1921.

The company has $3,640,283 in capital stock outstanding

Kerr Lake Mines Shows Profit

Silver; Ontario

A report of operations of Kerr Lake Mines, Ltd., for the year ended Aug. 31, 1921, states that 194,351.7 oz. of silver and 17,096 lb. of cobalt were produced. Profit-and-loss account of the Kerr Lake Mining Co., Ltd., the operating company, follows:

Debit:		
Expenses in connection with operation of mine, production, development, shipment and treatment of ore, general expense and adjustment of Canadian taxes	$143,355.42	
Expenses in connection with lake draining	2,200.04	
Balance, being profit	50,264.80	
		$195,820.26
Credit:		
Proceeds of ore sales	$175,957.07	
Less		
Ore on hand at smelters and in transit, Aug. 31, 1920 (estimated)	82,174.65	
	$93,782.42	
Plus		
Ore on hand Aug. 31, 1921 (estimated)	523.08	
	$94,305.50	
Interest	76,633.79	
Exchange	17,530.97	
Dividends received	7,350.00	
		$195,820.26

The surplus of Kerr Lake Mining Co. on Aug. 3, 1920, was $1,962,966.40. Adding a profit of $50,264.80 and subtracting a loss on sale of bonds amounting to $20,590 and dividends totaling $590,000, gave a surplus on Aug. 31, 1921, of $1,402,641.20.

Kerr Lake Mines, Ltd., the holding company, paid four dividends of $75,000 each. Surplus balance on Aug. 31, 1920, was $941,142.84. Plus income and expenditure account balance of $178,979.51, and less loss on bond sales of $5,907.93, gave a balance on Aug. 31, 1921, of $1,114,214.42.

During the early part of 1921 an opportunity presented itself to acquire the Hargrave property, consisting of eighty acres (adjoining the Kerr Lake mine) at a favorable price. The ore taken from this property has already returned the purchase price.

The Tahoe silver mine, in Utah, in which this company has a majority interest, has been in continuous operaton, but many difficulties have been encountered.

Mining Dividends for October, 1921

The following dividends were paid by mining and metallurgical companies during October, 1921:

Companies in the United States	Situation	Per Share	Totals
American Smelters Sec. pfd. "A"	U. S.	$1.50 Q	$146,071
American Smelters Sec. pfd. "B"	U. S.	1.25 Q	39,855
Eagle-Picher Lead, pfd.	Mo., Okla.	1.50 Q	15,000
Homestake Mining, g.	S. D.	.25 M	62,790
Phelps Dodge Corporation, c.	U. S. and Mex.	1.00 Q	450,000
Tonopah Extension, g. s.	Nev.	.05 Q	64,836
Tonopah Mining, g. s.	Nev.	.05 SA	50,000
United Eastern, g.	Ariz.	.15 Q	204,455
U. S. Smelting, Ref. and Mng. pfd.	U. S. and Mex.	.875 Q	425,556
Companies in Canada			
Asbestos Corporation	Que.	$1.50 Q	$45,000
Asbestos Corporation pfd.	Que.	1.75 Q	70,000
Dome Mines, g.	Ont.	.25 Q	119,167
Hollinger Consol., g.	Ont.	.05 4 wks.	246,000
Kerr Lake, s.	Ont.	.125 Q	75,000
Nipissing, s.	Ont.	.15 Q	180,000

M, monthly; Q, quarterly; SA, semi-annual; c, copper; g, gold; s, silver.

Tintic Standard, which paid 5c. per share in July, passed its dividend. This was also the case a year ago, but a double dividend was paid the following quarter. It is unknown whether this is again the intention of the directors. The other companies reporting exhibit unchanged disbursements.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York 1920	New York 1921	London 1920	London 1921	Sterling Exchange 1920	Sterling Exchange 1921
January	132 827	65 950	79 846	[illegible]	367 082	372 650
February	131 [illegible]	59 233	85 005	34 745	337 466	385 932
March	125 551	56.023	74 194	32 479	370 870	389 806
April	119 779	59 337	68 848	[illegible]	392 438	391 784
May	102 585	59 810	60 010	[illegible]	383 360	396 580
June	90 957	58.510	51 096	[illegible]	393 663	377.236
July	91 971	60 260	53 736	[illegible]	385.538	362.565
August	96 168	61 597	59 875	[illegible]	360 404	364 505
September	93.675	66.160	59 476	[illegible]	350 370	371 725
October	83 480	70 970	54 197	41 442	346 460	386 315
November	77 734		50 952		342 333	......
December	64 774		41 845		[illegible]	
Year	100 900		61 590		364 840	......

New York quotations, cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic 1920	New York Electrolytic 1921	London Standard 920	London Standard 1921	London Electrolytic 1920	London Electrolytic 1921
January	18 918	12 597	118 095	70 964	123 238	79 119
February	18 569	12 556	120 188	[illegible]	126 950	75 925
March	18 331	11 976	109.533	67 565	118 348	71 190
April	18 660	12 438	103 025	[illegible]	111 500	[illegible]
May	18.484	12.742	96 750	[illegible]	109 200	74 298
June	18.065	12.697	87 864	[illegible]	101 909	75 682
July	18 576	12 170	90 148	[illegible]	106 455	75 286
August	18 346	11 634	93 935	[illegible]	111 143	72 705
September	18 144	11 948	96 381	67 977	111 905	72 295
October	15 934	12 673	93 327	[illegible]	104 905	73 476
November	14 257		84 807		94 614	
December	13 188		75 702		85 905	
Year	17 456		97 480		[illegible]	

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York 1920	New York 1921	St. Louis 1920	St. Louis 1921	London 1920	London 1921
January	8 561	4 821	8 300	4 747	[illegible]	23 387
February	8 814	4 373	8 601	4 228	50 256	20 650
March	9 145	4 084	8 894	4 000	46 054	18 911
April	8 902	4 356	8 618	[illegible]	39 225	20 589
May	8.576	4 952	8 352	[illegible]	38 488	23 399
June	8 323	4 485	8.169	[illegible]	34 330	22 563
July	8 338	4 410	8 283	[illegible]	34 960	23 399
August	8 687	4 382	8 725	[illegible]	36 304	23 489
September	8 177	4.600	8 160	[illegible]	35 452	23 148
October	7 070	4 690	7 018	[illegible]	35 238	23 679
November	6 159		6 127		32 489	......
December	4 727		4 717		[illegible]	
Year	7 957		7 830		37 832	

New York and St. Louis quotations, cents per lb. London, pounds sterling per long ton.

Tin

	New York 99% 1920	New York 99% 1921	New York Straits 1920	New York Straits 1921	London 1920	London 1921
January	61 596	36 000		[illegible]	376 512	190 464
February	58 466	28 534	59 932	32 142	[illegible]	[illegible]
March	61 037	27 296	61 926	28 806	369 489	156 024
April	61 120	28 990	62 115	[illegible]	345 450	[illegible]
May	53 230	31 431	55 100	[illegible]	[illegible]	177 411
June	46 125	28 514	48 327	[illegible]	250 614	[illegible]
July	45 798	[illegible]	49 154	[illegible]	[illegible]	164 530
August	43 856	[illegible]	47 620	[illegible]	274 048	155 318
September	41 940	26 280	44 465	[illegible]	[illegible]	156 750
October	39 310	27 278	40 [illegible]	[illegible]	258 190	[illegible]
November	35 667		36 854		241 080	
December	31 135		34 058		[illegible]	
Year	48 273		49 101	.....	295 866	

New York quotations, cents per lb. London, pounds sterling per long ton.

Zinc

	[illegible]	[illegible]	[illegible]	1921
January	[illegible]	[illegible]	[illegible]	[illegible]
February	[illegible]	[illegible]	[illegible]	[illegible]
March	[illegible]	[illegible]	[illegible]	[illegible]
April	[illegible]	[illegible]	[illegible]	[illegible]
May	[illegible]	[illegible]	[illegible]	[illegible]
June	[illegible]	[illegible]	[illegible]	[illegible]
July	[illegible]	[illegible]	[illegible]	[illegible]
August	[illegible]	[illegible]	[illegible]	[illegible]
September	[illegible]	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	[illegible]	[illegible]
November	[illegible]		[illegible]	
December	[illegible]		[illegible]	
Year	[illegible]		[illegible]	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York 1920	Antimony (a) New York 1921	Quicksilver (b) New York 1920	Quicksilver (b) New York 1921	Platinum (c) New York 1920	Platinum (c) New York 1921
January	10.577	5 258	90 192	48 440	154 23	73 400
February	11.588	5 250	84 432	49 545	151 59	70 227
March	11 056	5 282	[illegible]	[illegible]	[illegible]	72 463
April	10.500	5.137	102 192	[illegible]	127 04	73 404
May	9.655	5 250	89 560	47 000	97 50	73 740
June	8 289	5 087	90 154	[illegible]	85 19	74 942
July	7.500	4 735	90 333	[illegible]	83 94	70 440
August	7 177	4 597	83 806	[illegible]	111 44	73 222
September	7 113	4 564	75 000	42 660	[illegible]	[illegible]
October	6 723	[illegible]	67 200	39 840	[illegible]	[illegible]
November	6 109		58 417		[illegible]	
December	5 534		49 577		[illegible]	
Year	8 485		81 12[illegible]		[illegible]	

(a) Antimony quotations in cents per lb. for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce.

Pig Iron, Pittsburgh

	Bessemer 1920	Bessemer 1921	Basic 1920	Basic 1921	No. 2 Foundry 1920	No. 2 Foundry 1921
January	$40 47	33 96	$39 88	[illegible]	$39 86	33 88
February	42.95	28 96	42 61	26 96	43 40	[illegible]
March	43.40	28 16	42 90	26 46	43 40	27 85
April	43 72	26 96	44 22	24 46	43 90	[illegible]
May	44 00	26.21	44 88	23 84	45 36	25 56
June	44 89	24 96	45 41	[illegible]	46 40	[illegible]
July	47.21	22 84	47 42	[illegible]	[illegible]	22 36
August	48 90	21.96	49 88	[illegible]	49 35	[illegible]
September	50 46	21.96	50 46	[illegible]	51 96	[illegible]
October	49.21	21 96	44 38	[illegible]	48 58	22 96
November	41.26		39 20		42 61	
December	36.96		34 90		37 73	
Year	44.45		43 85		44 93	

In dollars per long ton.

Monthly Crude Copper Production

1921	June	July	August	September
Alaska shipments	3,234,693	3,019,812	[illegible]	3,709,844
Arizona Copper	(b)	[illegible]	[illegible]	[illegible]
Calumet & Arizona	(b)	(b)	[illegible]	[illegible]
Con. Ariz. Smelting	(b)	[illegible]	[illegible]	[illegible]
Inspiration	(b)	[illegible]	[illegible]	[illegible]
Magma	(b)	[illegible]	[illegible]	[illegible]
Miami	3 930 000	4 [illegible]	4 [illegible]	4 [illegible]
New Cornelia	1 300 000	1 [illegible] 927	[illegible]	[illegible]
Old Dominion	(b)	[illegible]	[illegible]	[illegible]
Phelps Dodge	(b)	[illegible]	[illegible]	[illegible]
Shattuck Arizona	(b)	[illegible]	[illegible]	[illegible]
Ray	(b)	[illegible]	[illegible]	[illegible]
United Verde	(b)	[illegible]	[illegible]	[illegible]
United Verde Extension	(b)	[illegible]	[illegible]	[illegible]
Calumet & Hecla	(b)	[illegible]	[illegible]	[illegible]
Other Lake Superior	4,500,000	4 [illegible]	4 250 000	4 [illegible]
Anaconda	[illegible]	[illegible]	[illegible]	(b)
East Butte	1,3[illegible] 000	[illegible]	1,278 000	[illegible]
Nevada Cons.	[illegible]	[illegible]	[illegible]	[illegible]
Chino	[illegible]	[illegible]	[illegible]	[illegible]
Utah Copper	(a)	(a)	(a)	(a)
Others, estimated	10,300,000	8,150,000	7,520 000	9,150,0[illegible]
Total United States	24,623,693	22,033,739	23 249 3[illegible]	23,855 317
Imports, ore and concentrates, matte, etc	5,129,065	10,924,973	[illegible]	[illegible]
Imports of blister, unrefined	12,531,637	20,749,969	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]		
[illegible]	4 [illegible]	4 [illegible]	[illegible]	[illegible]
Chile	4 [illegible]	[illegible]	4 [illegible]	4 [illegible]
[illegible]	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]			[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	

(a) [illegible]

Comparative Annual Copper Production

	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	

MINING STOCKS

Week Ended October 29, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Ahmeek	Boston	53¼	50	51½	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*40	*37	*38		
Allouez	Boston	21	20½	21	Mar. '19	1.00
Anaconda	New York	42	39¼	41¼	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2½	2	2¼		
Ariz. Com'l	Boston	9	9	9	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*37	*30	*34		
Bingham Mines	Boston	13½	13	13¼	Sept. '19, Q	.25
Calumet & Arizona	Boston	52	48½	51½	Sept. '21 Q	.50
Calumet & Hecla	Boston	245	235	240	June '20, Q	5.00
Canada Copper	N. Y. Curb	*30	*29	30		
Centennial	Boston	†8½	†8½	9	Dec. '18, SA	1.00
Cerro de Pasco	New York	30½	28¾	30¼	Mar. '21, Q	.50
Chile Copper	New York	12¼	11½	12		
Chino	New York	26½	24½	26	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*14½	*14	14		
Con. Arizona	N. Y. Curb			*1	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1½	1 1/16	1 1/8		
Copper Range	Boston	35	33	34½	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*42	*31	*40		
Davis-Daly	Boston	7¼	6¾	7¼	Mar. '20, Q	.25
East Butte	Boston	9¼	9½	9¾	Dec. '19, A	.50
First National	Boston Curb	*85	*80	*85	Feb. '19, SA	.15
Franklin	Boston	*2¼	*2	2		
Gadsden Copper	Boston Curb	*50	*46	*50		
Granby Consol	New York	19½	18¼	19½	May '19, Q	1.25
Greene-Cananea	New York	24	22½	24	Nov '20, Q	.50
Hancock	Boston	3	†2¼	2¼		
Howe Sound	N. Y. Curb	2⅝	2⅝	2⅝	Jan. '21, Q	05
Inspiration Consol	New York	36¾	34½	36	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6	5¾	6	Sept. '20, K	25
Isle Royale	Boston	21¼	20	21	Sept. '19, SA	.50
Kennecott	New York	23	21	22½	Dec. '20, Q	.50
Keweenaw	Boston	1⅛	1⅛	1⅛		
Lake Copper	Boston	2¼	2¼	2¼		
La Salle	Boston	†2	2⅜	1½		
Magma Chief	N. Y. Curb			*8		
Magma Copper	N. Y. Curb	*21½	*21	*21½	Jan. '19, Q	.50
Majestic	Boston Curb	*6	*6	*6		
Mason Valley	Boston	†2	†1¼	1½		
Mass Consolidated	Boston	2½	2	2	Nov. '17, Q	1.00
Miami Copper	New York	23¼	22¼	23⅛	Aug. '21, Q	.50
Michigan	Boston	2¼	2¼	2¾		
Mohawk	Boston	54	50	52¼	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	5¼	5⅛	5¼		
Nevada Consol	New York	12¼	11¼	12⅜	Sept. '20, Q	.25
New Baltic	Boston Curb			3		
New Cornelia	Boston	15½	14½	14⅞	Aug. '20, K	.25
North Butte	Boston	11	10	10⅝	Oct. '18, Q	.25
North Lake	Boston	*20	*20	*20		
Ohio Copper	N. Y. Curb	*8	5	*5		
Old Dominion	Boston	24	23¼	24	Dec. '18, Q	1.00
Osceola	Boston	32	27¼	30	June '20, Q	.50
Phelps Dodge	Open Mar.	†180	165	....	Oct. '21, Q	1.00
Quincy	Boston	40	39	39	Mar. '20, Q	1.00
Ray Consolidated	New York	13⅜	13	13⅜	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*26	*24	*26		
St. Mary's Min. Ld.	Boston	39	38	38	June '20, K	2.00
Seneca Copper	Boston			13½		
Shannon	Boston	*1¼	*1 1/16	1¼	Nov. '17, Q	.25
Shattuck Arizona	New York	6¼	6	6	Jan. '20, Q	.25
South Lake	Boston	*75	*75	75		
Superior & Boston	Boston	1¼	1½	1¼		
Tenn. C. & C. cfs.	New York	8½	7¾	8½	May '18, I	1.00
Tuolumne	Boston	*38	*36	*36	May '13	10
United Verde Ex.	Boston Curb	27½	25	27	May '21, Q	25
Utah Consol	Boston	3¼	3	3	Sept. '18,	25
Utah Copper	New York	56	52	56	June '21 Q	50
Utah Metal & T	Boston	1½	1⅜	1 1/16	Dec. '17,	30
Victoria	Boston	†1½	†1½	1¼		
Winona	Boston	*60	*40	*50		
Wolverine	Boston	12	11	11		
		NICKEL-COPPER				
Internat Nickel	New York	14	12¾	13⅜	Mar. '19,	50
Internat Nickel, pf.	New York	74	74	74	Aug. '21, Q	1.50
		LEAD				
National Lead	New York	76	75¼	76	Sept '21, Q	1.50
National Lead, pfd.	New York	103	103	103¼	Sept '21 Q	1.75
St Joseph Lead	New York	13	12½	13	Sept. '21, Q	25
		QUICKSILVER				
New Idria	Boston	*60	....	*50		
		ZINC				
Am Z. L. & S	New York	9¼	9¼	9¼	May '20,	1.00
Am. Z. L. & S pfd.	New York			32	Nov. '20, Q	1.50
Butte C. & Z	New York	4¼	4	4¼	June '18,	50
Butte & Superior	New York	15	13½	14½	Sept. '20,	1.25
Callahan Zn-Ld	New York	4⅛	3⅞	4⅛	Dec. '20, Q	50
New Jersey Zn	N. Y. Curb	126	126	126	Aug. '21 Q	2.00
Success	N. Y. Curb			2	July '16,	03
Yellow Pine	Los Angeles			*55	Sept '20, Q	03
		GOLD				
Alaska Gold	New York	⅜	⅜	⅜		
Alaska Juneau	New York	⅝	⅝	⅝		
Carson Hill	Boston	14	12½	12¼		
Cresson Consol. G.	N. Y. Curb	1⅞	1¾	1 13/16	June '20, Q	$0.10
Dome Extension	Toronto	*68	*68	*68		
Dome Mines	New York	18½	18	18	Oct. '21, Q	.25
Florence Goldfield	N.Y. Curb	*42	*35	*38		
Golden Cycle	Colo. Springs	*66	*66	*66	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*5	*5	*5	Dec. '19,	.05
Hollinger Consol.	Toronto	7.50	7.42	7.45	Oct., '21, 4 wks.	.05
Homestake Mining	New York	56	56	56	Oct. '21, M	.25
Kirkland Lake	Toronto	*33	*37	*30½		
Lake Shore	Toronto	1.26	1.22	1.24	Aug. '21, K	.02
McIntyre-Porcupine	Toronto	1.92	1.86	1.90	Sept. '21, K	.05
Porcupine Crown	Toronto	*13	*11	*13	July '17,	.03
Porcupine V. N. T.	Toronto	*16½	*15	*16		
Portland	Colo. Springs	*38	*38	*38	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb			*4	May '19,	.05
Schumacher	Toronto	*23½	*22	*23½		
Silver Pick	N. Y. Curb			*8		
Teck Hughes	Toronto	*17	*15	*16½		
Tom Reed	Los Angeles	*46	*32	*35	Dec. '19,	.02
United Eastern	N. Y. Curb	2⅜	2¼	2 5/16	Oct. '21, Q	.15
Vindicator Consol.	Colo. Springs	†*30	†*22	*24	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb			*7		
Yukon Gold	N. Y. Curb	1⅜	1¼	1¼	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	*20	*17	*19	Apr. '20, M	.03
Batopilas Mining	New York	....		⅜	Dec. '07, I	.12½
Beaver Consol.	Toronto	*25	*21	*24½	May '20, K	.03
Coniagas	Toronto	1.50		....	May '21, Q	.12½
Crown Reserve	Toronto	*13	*12	*12½	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3½	3¼	3¼	Oct. '21, Q	.12½
La Rose	Toronto	*36	*33	*35	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*20½	*19	*20½	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.15	1.00	1.12	Sept '20, Q	.12½
Nipissing	N. Y. Curb	5¼	5	5⅛	Oct. '21, Q	.03
Ontario Silver	New York	4	4	4	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	*12	*12	*12	Jan. '12,	.10
Temiskaming	Toronto	*26	*22	*26	Jan. '20, K	.04
Trethewey	Toronto	*13	*10½	*11	Jan. '19,	.05
		GOLD AND SILVER				
Boston & Montana	N. Y. Curb	1	*85	*96		
Cash Boy	N. Y. Curb	*5	*5	*5		
Consol. Virginia	San Francisco	....	....	*36		
Dolores Esperanza	N. Y. Curb	1⅛	1⅛	1 1/16		
El Salvador	N. Y. Curb	*18	*15	*15		
Jim Butler	N. Y. Curb	*7	*7	*7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*2	*2	*2	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	⅛		
MacNamara M.& M.	N. Y. Curb	*14	*13	*14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	....	....	4	Jan. '21, Q	.30
Tonopah-Belmont	N. Y. Curb	1 7/16	1¼	1¼	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*71	*68	*70		
Tonopah-Extension	N. Y. Curb	1⅛	1 1/16	1 1/16	Oct. '21, Q	.05
Tonopah Mining	N. Y. Curb	1⅜	1¼	1⅜	Oct. '21, SA	.05
West End Consol.	N. Y. Curb	1	*80	*97	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N. Y. Curb	*7	*6	*6	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	1.05	1.05	1.05	Dec. '20,	.15
Chief Consol.	Boston Curb	3	2¾	3½	Aug. '21, Q	.05
Consol. M. & S.	Montreal	18	16½	18	Oct. '20, Q	.62½
Daly Mining	Salt Lake	‡		....	July '20, Q	.10
Daly-West	Boston	1¼	1⅜	1⅜	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†3	†2½	2	Apr. '21, K	.05
Electric Point	Spokane	*6	*5½	*5½	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*49	*39	*41		
Federal M. & S.	New York	....	....	7½	Jan. '09,	1.50
Federal M. & S., pfd	New York	25⅜	24	25⅜	Sept. '21 Q	1.00
Florence Silver	Spokane	*5	*5	*5	Apr '19,	.01½
Grand Central	Salt Lake	‡	....	....	June '20, K	.03
Hecla Mining	N. Y. Curb	4¼	4⅛	4¼	Sept. '21, Q	.10
Iron Blossom Con.	N. Y. Curb	....	....	*17	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	‡	....	....	Sept '20, Q	.12½
Marsh Mines	N. Y. Curb		....	*3	June '21, I	.02
Prince Consol.	Salt Lake		....	*7½	Nov. '17,	.02½
Rambler-Cariboo	Spokane		....	*2	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*10	*8	*9		
South Hecla	Salt Lake	‡			Sept '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*10	*10	*10	Oct '17,	.05
Stewart Mining	N. Y. Curb	*4	*4	*4	Dec '15	.05
Tamarack-Custer	Spokane	1.90	1.80	1.90	Jan. '21 K	.04
Tintic Standard	Salt Lake	1.95	1.85	1.90	July '21, Q	05
Utah Apex	Boston	2 11/16	2½	2⅜	Nov '20, K	.25
Wilbert Mining	N. Y. Curb	*1	*1	*1	Nov. '17,	.01
		VANADIUM				
Vanadium Corp.	New York	33⅜	30½	33¼	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	55½	52	55½	Oct. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	74½	74	74	Oct. '21, Q	1.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	39¼	37	39	Mar '21, Q	1.00
Amer. Sm. & Ref. pf	New York	76½	74	76½	Sept '21, Q	1.75
Am. Sm. pf. A	New York	78	77¼	77¼	Oct. '21, Q	1.50
U. S. Sm. R. & M.	New York	33	32½	33	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	New York	39½	39¼	39½	Oct. '21, Q	.87½

*Cents per share. †Bid or asked. ‡Quotations missing. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

NEW MACHINERY AND INVENTIONS

The Krom Sintering System

The Krom sintering system is said to remove the difficulty in the sintering of those ores, flue dust and concentrates which are in a finely divided form, and which stick tenaciously to the sinter grate, the former condition requiring special mechanical construction for securing a uniform sintering draft through the charge, and the latter condition requiring means for economically removing the same from the grate. The Krom system of sintering is based on the unit-oven principle, so sucessfully developed by the modern byproduct coke ovens.

To produce either coke or sinter most satisfactorily the period of heat treatment must be under control independently of all other steps in the process, such as charging, igniting, and discharging. In both coking and sintering operations the treatment is perfectly controlled by unit charges; namely, separate ovens or pans independently charged and discharged.

The Krom sintering system consists of a battery of circular cast-iron pans. The circular form of the pan has the following features:

1. *Suction Draft.* The bottom or grate portion of the pan is adapted to a cone-shaped sheet-iron extension, from the apex of which the suction draft is drawn. This construction insures an even draft of air through all portions of the sinter charge resting on the pan grate above. On account of this construction the pans can be made of any size desired. The usual dimensions are from 12 to 25 ft. in diameter, the former size having a capacity of from 250 to 500 tons per day, and the latter from 1,000 to 2,000 tons. The greatest capacity is reached when the ore is to be simply sintered; but when high sulphur is to be eliminated a longer heat treatment is generally necessary.

2. *Charging the Pan.* The circular form of the pan allows the charge to be quickly and evenly distributed without compression or packing. This is accomplished by a rotary distributor.

A motor-driven traveling igniter equipped with burners for gas or oil which cover the entire surface of the pan is used. A two-pan battery is provided with a pivoted gas pipe which is permanently connected with the traveling igniter. In a unit of this size the charging distributor and the igniter travel over the pan by motor power on circular tracks. In the case of three or more pans the tracks are laid in a straight line over the extent of the battery, and the igniter receives its gas supply from an automatic valve at each pan location. This is accomplished by a new method, namely, the retaining walls of the pan holding the charge on the grate also form a motor-driven ram for pushing off the finished sinter. The rim, or the retaining wall of the pan, is mounted on wheels and is provided with a cast-steel plow. This plow travels clear of the grate section, ripping the sinter cleanly from the grate and at the same time breaking it into desirable sizes. The discharging operation is said to be automatic, fast, and positive in its results.

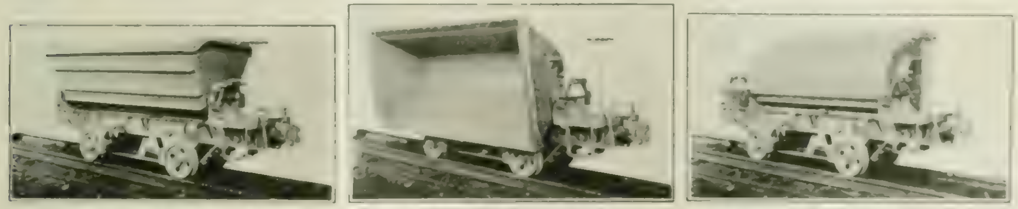
Mine Dump Cars Shipped to Mediterranean

Recently the Koppel Industrial Car & Equipment Co., Koppel, Pa., shipped to the Island of Cyprus, in the Mediterranean, a consignment of thirty specially designed, heavy duty, two-way, all steel rocker dump cars of 3 cu.yd. capacity. These cars, which are of 30-in. gage, are to be used to handle iron pyrite ore weighing 170 lb. to 175 lb. per cu.ft. that will be loaded from underground chutes. The height of the car is limited to 5 ft. 6 in., and the width over all to 5 ft.

Because of special loading conditions, the car body of the V-shape type required extremely heavy reinforcement and this type is made of heavy steel plates, the mould or side plate is provided with a wood false bottom, and in addition a steel lining plate gives further protection against the heavy shocks caused by the impact of run-of-mine boulders from 12 to 18 in.

The ends of the body are slanted so that the bodies can be telescoped or nested for export shipping purposes. The so-called cradles or rockers attached to the end plates are made of cast steel. The car body is held in an upright position by means of a patented automatic locking device. The underframe is made of extra heavy channels and well reinforced, one end being provided with a brakeman's platform. A powerful screw brake acts on all four wheels and is employed on all cars. The coupling device consists of a [illegible] MCB coupler, with a slotted knuckle and a powerful spring draft gear.

The running gear is made of 16-in. cast steel plate, which is mounted on 3½-in., high-carbon steel axles with a single spring suspended inside the bearing boxes and brass bearings.



TYPE OF 3-CU.YD. DUMP CAR TO BE USED IN MINING PYRITE ORE ON ISLAND OF CYPRUS

Time Studies on a "Shuveloder"

Results of a detailed time study upon the "Shuveloder" mucking machine used at the Kern Canyon tunnel of the San Joaquin Light & Power Corporation, of Edison, Cal., are given in the accompanying table, which is a summary of the observations made.

The cross-section of the tunnel varied, the unlined section being 14 ft. wide by 13.5 ft. high; the lined section 10.5 ft. wide and 11.25 ft. high, the roof being arched. On the 14-ft. wide sections the "shuveloder" did not quite reach the extreme sides, the track being in the center, but this did not entail much difficulty, as two muckers worked the rock over to the loader by hand. The ground consisted of blocky granite and in places there were loose slides consisting of a mixture of granite blocks and sand. The work consisted of enlarging a 6.5 ft. square heading already driven. The muck as a consequence contained comparatively large masses of rock, some pieces being as heavy as 2,000 lb. These were handled by the dipper by having the crew assist the dipper by lifting. During May six machines were on the job, five at work and one always as a spare. Working from several headings about 2,700 ft. of tunnel were enlarged.

The machines were worked twenty-four hours per day. When one heading was mucked out, a machine would be moved to another. It was estimated 27 ft. of tunnel was mucked in twenty-four hours. [illegible] The muck equal 1.26 cu.yd. per ft. The maximum tramming distance was 1,000 ft., but the average distance was approximately [illegible] ft. The crews worked three shifts per day. A shift consisted of one shifter, four muckers, four drill [illegible], one dipper, [illegible] two muckers in the cut, two muckers to wall back material to the car, and two muckers behind the car cleaning up the bailing in the lower section of the tunnel [illegible] a brakeman, and a [illegible] completed the shift crew.

[illegible] was [illegible] was [illegible] Forgings were substituted for castings, and as these were made in the shop the cost was high. Solid rollers were substituted for the roller bearings, forged clamps for the cast iron; the gear segments were reinforced and extra metal was welded into the frames.

semi-steel with moulded teeth. The motor pinion is of forged steel, and the gear which engages with it is of semi-steel. Both have machine-cut teeth.

The drum is 8 in. in diameter, 13½ in. long between flanges, and the ratio of gearing and sizes of shafts are well proportioned for the duty imposed. Over-all dimensions are width, 2 ft. 9 in.; length, 3 ft. 6 in., and height, 2 ft. 1 in. Approximate total weight is 900 lb., complete. The base may be bolted to wooden skids for convenience in moving.

TIME STUDIES OF A SHUVELODER

	Hours
Time operated (actual)	4.92
Time idle due to changing cars and miscellaneous delays	4.00
Total	8.92
Changing cars required	2.33
Miscellaneous delays are accounted for by:	
Waiting for motor	0.64
Moving up mucking machine	0.06
Unloading steel and powder	0.14
Changing shift — oiling machine	0.16
Engineers marking face	0.17
Lunch	0.50
Miscellaneous delays — total	1.67

Performance	Cars	Cu.Yd.	Tons
Total much loaded	52.0	104.0	156.0
Per hour actual loading time	10.6	21.2	31.8
Per hour total loading time	5.8	11.7	17.5
Per man-hour actual loading time	1.8	3.5	5.3
Per man-hour total time	0.97	1.94	2.91
	Per Car Minutes	Per Cu.Yd. Minutes	Per Ton Minutes
Average loading time	5.7	2.85	1.88
Average total time	10.3	5.15	3.43
Average time switching	2.7	....	....

Size car—L.72, W.52, D.30, in.; 43 cu.ft.; loaded 6 to 12 in. above top or 2 cu.yd. per car.

Material—Blocky granite; each car contained in addition to other material at least five pieces weighing over 5,000 lb. and in the muck from every round there were at least ten pieces weighing from 1,000 to 2,000 lb.; weight per cubic yard estimated at 1.5 tons.

Air pressure was 100 lb. at the compressors, but the machine pressure was about 80 lb. Though the machine will operate under 60-lb. pressure, it lacks "punch" at this pressure. Track gage was 36 in., and a 25-lb. rail used. At first a section of track was taken up before blasting and short lengths were used, but considerable trouble was caused by the machine tipping up, and in some cases completely tipping over, when an attempt was made to handle large blocks. Finally the rock was blasted down on the rails, and this did away with the tipping trouble, although hard on the rails. Storage battery six-ton locomotives were used. The speed of the mucking machine was dependent upon the operator. All of the operators were broken in. Scale of wages paid was as follows: Shifter, $6.50; mucking machine operator, $6.50; miners, $5.50; muckers, $4.50.

Small-Type Hoist for Underground Use

An electrically driven stope hoist or small car-haulage winch for use in and around mines has been developed by the S. Flory Manufacturing Co., Bangor, Pa. The hoist is single drum, with the drum cast integral with the main gear. The drum and gear are keyed to the drum shaft. The intermediate shaft is equipped with a sliding pinion, which is thrown in and out of gear with the main gear and the drum shaft as desired, thus actuating free stopping the rotative movement of the drums. This sliding pinion is operated by a lever in a quadrant. The motor may be alternating or direct current and of a size to meet operating conditions, generally 3 or 5 hp. The bed plate is a single casting and heavily ribbed with the bearing housings cast integral. The main drum gear and pinion are of

INDUSTRIAL NOTES

C. H. Hobbs has recently been appointed assistant general manager of sales for the Detroit Seamless Steel Tube Co., Detroit, Mich.

J. E. Kennedy has joined the Celtic Products Co. as sales engineer for the northern California district, making his headquarters at the Monadnock Building, San Francisco.

Chain Belt Co., Milwaukee, Wis., has opened offices at 735 Ellicott Square, Buffalo, N. Y., and has announced the appointment of T. E. Cocker as district manager of that territory.

Byron B. Oberst is president of the newly formed Powdered Coal Development Corporation, with headquarters at Omaha, Neb. This company controls the Pruden patents for the burning of pulverized coal in the western half of the United States, and is actively engaged in financing and erecting central pulverizing plants and installation of equipment used in the burning of pulverized coal.

J. C. Townley, formerly district manager of the Pittsburgh office of the Cement-Gun Co., Inc., sailed for Holland Oct. 15, where he will take up his duties as general manager of the International Cement-Gun Co. which has been recently organized to handle the foreign business for the Cement-Gun Co., Inc., with the exception of Canada, Mexico and Cuba. The address of the company will be at 50 Maria Plaats, Utrecht, Holland.

TRADE CATALOGS

Material Handling Machinery — The Jeffrey Manufacturing Co., Columbus, Ohio, have announced catalog No. 350, on Jeffrey Material Handling Machinery. This book contains price lists and dimensions of Jeffrey chains, sprockets, conveyor and elevator details, transmission and gears; illustrations and descriptions of elevating and conveying machinery for every industry; complete coal handling equipments for boiler house and tipples; mining machinery, ventilating fans; crushers; pulverizers; shredders; portable loaders, and related devices.

Wood Pipe — Pacific Tank & Pipe Co., San Francisco, Cal., has issued its catalog, "Pacific Woodstave Pipe." In addition to descriptions and illustrations of its various products, a number of views of different installations are shown and tables are given.

Nordberg—Mine equipment and Nordberg are generally agreed to be synonymous, and it is difficult to find a mining district in the world where this famous line of machinery is unknown. "Nordberg and the Mining Industry" is the title of a new booklet issued by the Nordberg Manufacturing Co., Milwaukee, Wis. The booklet illustrates the plants of fifteen mining companies, gives data concerning their production of copper, gold and silver, mentions the capitalization, assets and dividends of each plant and briefly describes the important equipment, including the Nordberg apparatus in use.

Flotation Oils—American Turpentine & Tar Co., New Orleans, La., in a small booklet, "Destructively Distilled Flotation Oils," announce its active participation in the marketing of flotation oils. General descriptions and specifications of seven different oils produced by this company are given.

Transits and Levels—Warren-Knight Co., 136 N. 12th St., Philadelphia, Pa., have included illustrations and specifications of several types of surveying instruments and appurtenances in their recently issued booklet, "Sterling Transits and Levels."

Dry Vacuum Pumps—Chicago Pneumatic Tool Co., New York, has issued Bulletin 710, "Chicago Pneumatic Dry Vacuum Pumps—Steam, Belt and Motor Driven," which outlines several new features of design.

Excavating Machinery — The Marion Steam Shovel Co., Marion, Ohio, has recently issued Catalog 190, "Marion Excavating Machinery," which contains descriptions, specifications, and working ranges of the various types of steam and electric shovels and dragline, orangepeel, and clamshell excavators. The bulletin is well illustrated and gives an excellent idea of the diversity of uses that may be made of Marion machines.

Gas Masks—Bulletin 72 of the Mine Safety Appliances Co., Pittsburgh, Pa., details the design and operation of Burrell gas masks for mine fire fighting and other purposes where dangerous gases are encountered. This company also carries a complete line of safety materials and devices that are utilized in safety practice.

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
[illegible] H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
A. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

[illegible] New York, November 12, 1921 Number 20

Politics and Mines in Asiatic Turkey

THE RAPID OBSOLESCENCE of the theory and practice of mandates was marked when on Oct. 30 the French government ratified a separate treaty with the Turkish Nationalist government, which has its capital at Angora, in Asia Minor, and has no affiliations with the Turkish government at Constantinople. Under the League of Nations, France was given a mandate over Syria. Now by separate treaty with a new Turkish power, sprung up since that time, France fixes the boundaries of Syria, frankly ignoring the League of Nations and as frankly acting upon the assumption that Syria is French in every sense of the word.

This, of course, is not a new development. The British, for example, have never comprehended the word mandate, except as an equivalent for new British territory; and the typically American conception of a trust to be accounted for from time to time to the family of nations has fallen into desuetude on account of its being too advanced. It is further interesting from the League of Nations viewpoint to note that while France has recognized one government in Turkey, Great Britain has recognized an opposing government—that which accepted the first treaty—the now clearly weaker government at Constantinople.

Especially interesting to us is that along with this new treaty France gets a mining concession—one for ninety-nine years—to the iron, chrome, and silver mines in the valley of Harchite, in the northern part of Anatolia or Asia Minor, near the Black Sea, not within or near the French occupied territory of Syria. All this is part of the picture of the shattered Turkish Asiatic empire, which picture comprises the question of oil in Mesopotamia, considered by Great Britain conceded exclusively to British interests by the League of Nations mandate, a conception which the State Department at Washington has been endeavoring, with some little show of success, to shake; but not without some astonishment and resentment in London.

All this goes to show that the Disarmament Conference in Washington has not had its work already done by the League. It also points out the necessity of considering mineral questions and mining concessions as one of the basic features of the policy which is to be debated in Washington. Washington must not lose sight of the far-reaching significance of political and commercial geology in these vital questions of statecraft, and should have a properly qualified group watching this element and furnishing prompt and fair advice concerning it.

Stabilization of Foreign Exchange

EXCHANGE STABILIZATION is receiving attention from Washington. Hearings have been held before the House Committee on Banking and Currency on the subject, but despite the fact that it is one of the most absorbing and important economic topics before the world today, little enthusiasm has been aroused among Washington officials, who are reported to feel that the difficulties in the situation are well known and that any remedies or recommendations would lack the force requisite to their introduction and execution.

The countries that appear most concerned in exchange stabilization are not those whose currency has depreciated enormously, but seemingly those whose currency is at a great premium compared with that of other nations. Thus the depreciation of the German mark—it has no end—is perturbing many commercial and financial interests in the United States. Germany, however, does not seem to be worrying, and is reported thoroughly satisfied with her present fiscal policies and their practical results. A recent visitor to that country told us that he inquired of many influential bankers where they thought a continuation of the present state of affairs would lead. The reply was generally a shrug of the shoulders, accompanied by a remark of indifference as to the probable outcome.

Much space has been devoted by the press to the advantages and disadvantages of distorted exchange relationships. As a rule they resolve themselves into giving a temporary larger external purchasing advantage to the country with currency at a premium and a greater selling advantage to the country with currency at a discount. Germany is evidently satisfied with the ability she now possesses of being in a position to underbid rivals in the markets of the world. Possibly one of the underlying motives in her attitude is the attempt to recapture markets lost during the war, regardless of the cost and the destruction of her finances.

It is difficult for many to comprehend how Germany, in a greatly weakened financial state, and embarrassed by exchange, has been able to buy large quantities of copper and to maintain the position of the most important European copper-consuming nation. The answer is simple. Germany is paying cash. Exchange difficulties are subordinate, as the copper transactions are closed in a short space of time. The copper bought from American producers is fashioned into wire, copper utensils, or perhaps a motor, or some other electrical instrument, and promptly exported. Although exchange relations may have been adverse to Germany in the purchase of raw materials, they are favorable to her in the disposal of the finished product—a balance is almost struck. The net result of the steps is the manufacture and sale of an article in which cheap German labor has been used and in which exchange is a minor consideration. It must be admitted, however, that widely fluctuating exchange rates are a serious impediment to commercial intercourse between nations.

One of the thoughts in the mind of a Washington participant in the exchange hearings is a probability of the accumulation of a still greater quantity of the world's gold in the United States and the possible repudiation of the gold standard by other countries, with disastrous consequences to American trade. Such a contingency is unlikely, as the gold which is coming to the United States is largely newly mined metal. The gold holdings of the Bank of England and the Bank of France are larger than they were before the war. Even Germany has a reserve that compares favorably with the pre-war supply. We may rest assured that these nations will cling tenaciously to their relatively slim metallic reserves, and rely on the simple expedient of a gold embargo to prevent a decrease. Some seem to have the impression that we cannot count upon our recent accretions of gold to become a basis of our credit and currency structure. This is strange reasoning, as practically all the gold that has swelled our stocks, heavy importations, has entered the vaults of the Federal Reserve Banks to become part and parcel of our credit and currency system. True, the recent accumulations may not be permanent, but we do not expect to see them disappear in such a short space of time that we cannot use them for credit and currency.

We are great believers in the natural working of economic law. Without the help of national and international agreements the situation in exchange will correct itself. Recommendations and carefully considered legislation can aid somewhat, but a stimulus to investment in foreign enterprises and a change of our trade balance are the natural remedial agencies. The best remedy is to let nature take its course; and above all, to beware of tariff obstructions.

Arbitration in Guanajuato

THAT ARBITRATION is the best way of straightening out all difficulties between capital and labor the world over is a principle that seems axiomatic, yet today there are many on both sides that are apparently more inclined to fight things out to a finish. Still it is far more generally accepted than it was, say twenty years ago, when it was a popular subject for debating societies, which was evidence of its lack of application then. Thus society is making progress toward a time when industrial harmony shall be the normal condition.

Last spring, in Mexico, the State of Guanajuato passed a law "of conciliation and arbitration," in accordance with which there must be established boards in each municipality, whenever occasion requires, for the purpose of settling the controversies that arise between capital and labor in the state. Three delegates compose a board, one elected by the employers, one by the workmen, and the third by the municipal government of the locality, the chairman being selected from the members by a majority of votes. The law also provides that there shall be a central board in the capital, composed of five members elected by the Chambers of Commerce, Industry, and Agriculture existing in the state; another five appointed by the Chambers of Labor and the General Labor Unions; and one representing the state executive. The chairman is elected by the members of the board. For selecting the government's delegate, the government is required to propose three candidates, one of whom the representatives of labor may elect.

The municipal board is empowered to decide a controversy by sentence or arbitration, if conciliation is not otherwise effected. The central board is empowered to review the decisions of the municipal boards, if requested, and to make decisions in doubtful cases.

There is some criticism of the law as it stands. Inasmuch as only those having full civil rights can become council members, a foreigner may not sit as such, so that a Mexican representative (of the companies) must be appointed, at, of course, a certain salary.

The chief point raised, though, is that the law gives powers of public authorities and judges to the council members. Our correspondent at Guanajuato says that lawyers there hold that under the Constitution no one but a qualified lawyer may be made a judge, and that the findings of the councils can be appealed to an ordinary civil court of law and there probably be annulled. The lawyers also say that the councils themselves are unconstitutional, as the Magna Carta of Mexico provides that all courts cover all civil and criminal proceedings and expressly forbids any special courts for the benefit of any particular class, except courts martial.

Some other points are interesting: The refusal of an employer to abide by the umpire's decision obligates him to pay to all the workmen involved the total of their wages for three months, the labor contract being annulled. However, if the workmen refuse, their contract is annulled, and the authorities will take the necessary measures to guarantee the employer's liberty to make new contracts and to prevent the workmen from hindering the new laborers in their work. Thus it is seen that it is a much more serious matter for the employer to refuse than it is for the employee.

The law is based upon certain sections of Article 123 of the Constitution of 1917, according to our correspondent, who says that many of the other states in Mexico are expected soon to pass similar laws.

In Kansas, we have the Industrial Court Law, functioning differently, and with the basic idea of settling disputes between capital and labor in the interest of the public welfare, rather than of simply protecting the workingman's rights, as the Guanajuato law seems to seek. The Kansas Industrial Court is not a court at all but an administrative body exercising part of the police power of the state. "A court cannot move until its process is invoked by an appropriate formula," said Senator F. Dumont Smith, of Kansas, at Denver last year. "This administrative body moves of its own initiative. It requires no complaint. It can move upon suspicion; it has broad inquisitorial powers. . . . The Kansas law starts by declaring that food, fuel, and clothing are the necessities of human life." It begins to function whenever any industrial disturbance threatens to impair the production or distribution of these necessities.

Our Biographical Sketches

"I HAVE READ with great interest the biographical sketches and have been glad to see the faces of so many old colleagues and friends in the pages of the *Journal.*"

So writes a man we all know in response to our request for his portrait and biography. He likes to see his friends and read about how they have "arrived," and he is willing to give this pleasure to others by getting away from the shyness which is apt to characterize mining engineers and sending on his own biography and photograph. It is a friendly act, to us and to you. We like to read about people—real people —and thousands of our readers in many lands are grateful for the intimate glimpses of personality and the helpful and encouraging story of the lives of our friends and those whom we would be glad to know.

WHAT OTHERS THINK

Retailing Copper and Brass At Reasonable Prices

In an article published in *Engineering and Mining Journal* of Oct. 15 you state "We are going to give a lot of free advertising to the first copper or brass company to start a retail store with common-sense prices."

We do not want you to consider this letter as a bid for this free advertising, but if there is any free advertising to be had, we would be very glad to receive it.

In view of the continual controversy that seems to have been going on for some time as to the exorbitant prices charged by the metal jobbers, we would like to have you consider this letter as an invitation to anyone of your staff to visit our establishment, go over the situation with us, and let the writer of this communication show him exactly how the jobber is treating the consumer of brass and copper material.

In your article you lay considerable stress on the fact that it would be very desirable if a store were established where you could buy a sheet of copper for 25c. or 30c. per lb. If you will visit our store, we will show you we are daily selling large quantities of sheet copper, both in small and large lots, at a price very much under 25c. per lb. As a matter of fact, even if we were inclined to charge 25c. or 30c. per lb. it would be impossible to get a consumer to pay it, as most consumers today know about what the market prices are, and competition in our line is so keen as to make it impossible to secure these exorbitant prices even if we wished to do so.

We would like to inquire whether the writer of your article knows that in the autumn months of this year enormous quantities of copper conductor have been sold for building purposes, and that the prices at which this metal has been sold to the jobbing trade and in turn to the building trade are so close to the actual mill cost of raw material that any practical man would look at the figures in amazement and wonder how it could be done. It would also be a matter of interest to know whether the writer of your article knows that the manufacturers of copper and bronze mosquito netting have reduced their prices during the last summer to a point where this material was sold on a low level of price which has not obtained since long before the war.

We are wondering whether your writer knows that the large consumption of this material during the last season has been one of the outstanding features of the wire-netting trade. Does your writer know that it is a fact that this copper and bronze mosquito netting was handled by the jobbers at a profit of about ½c. per sq.ft. or approximately 5 per cent over the cost from the manufacturer?

Does your writer know that brass pipe is being sold to the plumbers today on a level that has not been reached since the lowest of the low pre-war prices were made? Does he know that the mills which are making brass pipe are unanimous in their claim that they are losing money on every pound of it that they are selling today, and does he know that the jobbers handling brass pipe are turning it over at 7 per cent profit?

These items are selected for comparison by your writer himself and it is therefore upon these that we have made our comment. We would like to repeat here our invitation to any of your staff interested in this matter to call on the writer of this letter for a frank discussion. We will be pleased to show you our orders, prices charged and any of the details which might be of value or interest in clearing up this matter. We would be pleased to give him a fairly complete list of these people and let him educate himself as to the real conditions by calling upon as many of them for interviews as he may find convenient to do.

We trust that you will not fail to give this matter some attention, as it is exceedingly unfair that statements such as are made in your article should go unanswered and undisputed.

J. J. WHITEHEAD,
Vice-president, Trumpbour-Whitehead Brass & Copper Co., Inc.
New York.

[We of course were glad to take advantage of Mr. Whitehead's offer. His warehouse, office, and store is at the corner of Canal, Mercer, and Howard Sts., in a section of the city not usually visited by the general public. It is similar to the store of the Rome Brass & Copper Co. in Chicago, mentioned in our editorial columns in the Nov. 5 issue. Several other manufacturers maintain similar outlets for their products, among these being, we understand, the Taunton-New Bedford Copper Co., C. G. Hussey & Co., the Scovill Manufacturing Co., the Detroit Copper & Brass Rolling Mills, and the Baltimore Copper Smelting & Refining Co. These warehouse stores are situated in New York, Chicago, or St. Louis, and possibly in other cities of the country.

Mr. Whitehead seemed interested in some of the examples which we cited of the extortionate prices charged small consumers by hardware and plumbing supply stores. These were, in his opinion, outrageous. Where the ordinary hardware store sells copper window screening for from 12 to 15c. per sq.ft., Mr. Whitehead is willing to sell anyone in any quantity at 6.75c. per sq.ft. The price of Monel metal screening is 12c. per sq.ft. We might also mention ⅜-in. copper tubing, so-called "hooch tubing," for which the store nearest this office now charges 18c. per ft. This can be obtained in even as small quantities as one length of 12 ft., for 33c. per lb., which is equivalent to about 3½c. per foot. Plainly, the manufacturers and their agents are not at fault in the prices which they charge, although it would seem advisable for them to make those prices known to the general public. The more highly manufactured forms of copper are still obtainable in small quantities only through the customary retail channels. We believe that either the retail dealers are profiteering or else there are unwarranted costs in merchandising. A few days ago the U. S. Department of Commerce made public a report which indicated that there are far too many stores in proportion to buyers. Possibly there are twice as many hardware stores in the country as is desirable; there are four in the small town in which we live, and we think from observation that all of the business could be as well done by one and with no increase in the sales force. We are pleased to know that so many copper products can be obtained at reasonable prices if one knows where to go, but the fact remains that the ordinary retail buyer pays more than he should and is firmly imbued with the idea that copper is a luxury.—EDITOR.]

Chloridizing Volatilization—Some Experiments and Their Practical Application

Tests Indicate That the Ore Should Be Heated Rapidly and That Care Must Be Taken To Add the Chloridizer at the Proper Time—Fifteen-Ton Furnace Eliminated Troubles From Accretions and Gave High Recoveries

By Harai R. Layng*

Written for *Engineering and Mining Journal*

IN MOST CHLORIDIZING volatilization work, a mixture of ore and chloridizer is fed to a revolving furnace fired at the discharge end. The chloridizer is usually salt, but occasionally calcium chloride is substituted, in part. Small experimental furnaces can produce good volatilization results on some ores, under certain conditions, by such methods. Large furnaces of the type mentioned could also produce good volatilization results on some ores by such methods, provided the ore could pass through the furnace. Even then, however, they would have to be fed so slowly that the process would be unprofitable.

When mixtures are fed to large practical-sized furnaces of the type mentioned, at practical rates, the mixture is slowly heated. The chloridizers usually melt at a temperature below their volatilization point, and unless there is an element or compound present which will decompose them at a temperature about or below their melting points, they will often stick to the ore and form a cemented mass. This will frequently stick to the walls of a revolving furnace and gradually build up a ring or series of rings in the furnace. My experience has been that these rings, if they form within a few hours, usually make the process impractical.

These methods, even when applied on a small scale, require excessive amounts of chloridizer, sometimes ten times the theoretical requirements. This leads to high fuel consumption, and, with many ores, to the formation of sintered material. Sintering hinders extraction and also causes rings to build up in a furnace. These sintered rings usually build up at a point further along in the furnace than those rings caused by cementation, and consequently are more difficult to remove. It is usually necessary to shut the furnace down and allow it to cool before they can be dug out.

With such a chloridizer as calcium chloride there are two distinct classes of cementation. Calcium chloride attracts water, in which it dissolves. The ore absorbs the solution, and on heating the mixture to a relatively low heat, the water of solution is driven off and the mixture is cemented. Further heating causes the $CaCl_2.6H_2O$ to be decomposed to $CaCl_2.2H_2O$, which latter, when heated to a higher degree, causes the mass to become still harder. These cementing tendencies of mixtures containing calcium chloride make it impractical to feed such mixtures to a revolving furnace by the ordinary means.

Slow heating of the mixture often causes other difficulties, such as coating the mineral with an impervious layer and the formation of non-volatile oxychlorides or oxides. With many ores, slow heating causes the chloridizer to be expelled from the mixture before some of the metals have been chloridized, or perhaps before the metal chlorides have been volatilized. I have discussed this subject in a previous article.[1]

Some ores, when heated with chloridizers like sodium or calcium chlorides, cause the chloridizer to be expelled from the charge so rapidly that by the time the ore is heated sufficiently to enable reactions or volatilization to occur to the desired extent, no chloridizer is present or, at least, not sufficient to accomplish the result. Such ores are usually those having a highly siliceous gangue and particularly those siliceous ores containing compounds of silica and alumina, which compounds, for lack of a better definition, I shall refer to as "silicate of alumina." Among the ores mentioned in Table I, ore No. 2 particularly, ore No. 1, and to a lesser extent ore No. 5 were of this type. Such ores also have a tendency to cement, especially when calcium chloride is used with them. Ore No. 1 showed the greatest tendency to cement, and ore No. 5 showed the least.

TABLE I ANALYSES OF ORES

Ore Number		1	2	3	4	5
Loss on ignition..	total		5.50	......	..	1.50
	H_2O	3.27		24.99	13.57	......
	CO_2	1.73		......	3.52	......
"Insoluble"......	total		82.34(a)	......	10.40	44.80
	SiO_2	62.88	..	14.00(b)	...	..
	Al_2O_3	15.00	..	......		....
	$BaSO_4$			...	..	21.50
SO_3		0.68	0.91	0.95	Present	1.35
CaO		0.83	3.65	19.93	1.10	3.25
MgO		Trace	1.43			None
$Fe_2O_3+Al_2O_3$		9.00	3.75	15.00	54.90	12.50
PbO		6.37	1.35	11.63	5.71	Trace
CuO			0.58	1.38	0.25	Trace
Ag_2O		0.013	0.018	0.048	Present	0.014
MnO_2		Trace	0.15	Trace	Present	2.50
ZnO		Trace	Trace	12.07	4.70	6.83
As_2O_3					Present	None
Sb_2O_3			Trace	None	Present	None
Hg			Trace	None		.
Ni and Co		None	None	None	None	.
NaCl (water-soluble chlorides)			0.24		.	Present
Total determined		99.77	99.92	100.00	94.15	94.24
Gold, oz. per ton		0.06	0.06		0.41	Trace
Silver, oz. per ton		3.54	5.07	10.86	1.05	4.00
Copper, per cent			0.46			Trace
Lead, per cent		5.9	1.25	10.00	5.3	Trace

(a) Mostly silica and alumina
(b) Combined with CaO in ore

In some ores of this type, especially ore No. 1, the silver seems to be locked up in the silica and is in part combined either chemically or mechanically with the "silicate of alumina." The following screen analysis on ore No. 1 proves that the silver is associated with the harder particles of the ore:

SCREEN ANALYSIS, ORE NO. 1

Mesh, Product	Weight, per Cent	Assay Silver, Oz.	Assay Lead, per Cent
-10 + 20	39.1	4.52	6.51
-20 + 30	9.5	4.10	
-30 + 60	17.0	3.30	
-60 + 100	8.9	2.74	
-100 + 200	5.6	2.52	
-200	20.0	2.34	6.0
Loss	0.9		
Calculated total assay	3.594 oz. silver		

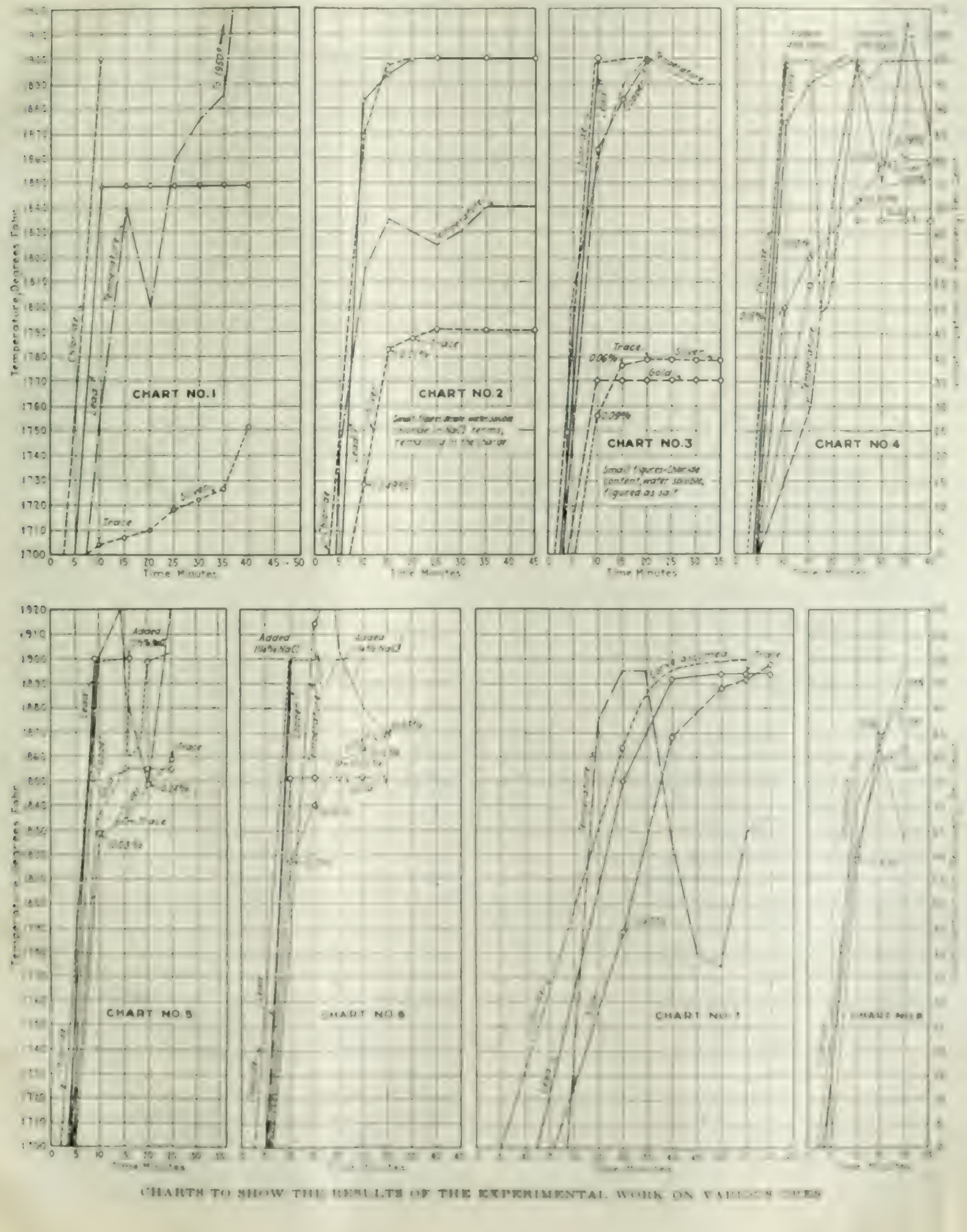
---

*The disclosures made herein are subject to patents allowed, pending and to be applied for by the author.

[1] "Chloridizing Processes," *Min. & Sci. Press*, Jan. 17, 1920.

Examination of the harder particles showed them to be mostly "silicate of alumina." Further proof is available from a concentration test which resulted in a recovery of only 7 per cent of the silver, whereas 66 per cent of the lead and 59 per cent of the gold were recovered. Additional proof is obtained by the fact that no appreciable amount of silver could be extracted by either salt or cyanide leaching, or by chloridizing roasting followed by amalgamation.

Small volatilization tests run in parallel on 200- and on 20-mesh ore gave 6.7 per cent more silver recovery from the 200-mesh ore than from the 20-mesh ore. That



CHARTS TO SHOW THE RESULTS OF THE EXPERIMENTAL WORK ON VARIOUS ORES the silver may possibly be chemically combined with the "silicate of alumina" is indicated by the fact that 10 per cent more silver was volatilized from a test on a mixture of ore, water, chloridizer, and 1.10 per cent charcoal, heated in a crucible, than was obtained from the same mixture of ore, water, and chloridizer without the charcoal heated at the same time in a roasting dish. (Aluminum chloride forms under reducing conditions, and it is easily volatilized.) The residue from the charcoal test was considerably less than from the other test. The ore was of a sandy structure, with voids between the cemented grains, and cemented easily. Briquets made of the ore, calcium chloride, and water could be charged wet into a heated muffle without breaking or cracking. There was a tendency to sinter at about 1,850 deg. F. when calcium chloride was used and at a much lower temperature when salt was used. Calcium chloride always gave better results than salt in comparative tests.

SILVER HELD IN A RESISTANT MINERAL

To prove that the silver was not locked up in a simple quartz casing I ran two small tests. In test *A* the 20-mesh ore was heated in a muffle for thirty minutes at 1,600 deg. F., then cooled and mixed with the chloridizer. In test *B* the same amount of chloridizer was used and the other conditions were the same except for the preheating. The recovery in test *A* was 41.1 per cent of the silver and 92.2 per cent of the lead. The recovery in test *B* was 48.8 per cent of the silver and 100 per cent of the lead. These tests indicate that nothing could be gained by preheating the ore before adding the chloridizer. They also indicate that lead silicate formed and that the silver was held in a more resistant compound than quartz, which would have cracked at the high temperature and exposed the incased silver.

The rapidity of the expulsion of the chloridizer and the resulting effect upon the silver recovery are shown by Chart No. 1, which is the plotted result of test No. 1 on ore No. 1. This test consisted in mixing the 10-mesh ore thoroughly with 10 per cent of $CaCl_2.2H_2O$ and 10 per cent of water, screening through a ½-in. square mesh screen, and charging the mixture into a muffle, previously heated to 1,800 deg. F. In all the muffle tests the charges were rabbled occasionally to insure even and quicker heating and even sampling. Samples were taken at intervals designated by the small circles on the charts. In this test, lead silicates or like compounds were formed. The rate of their formation is shown by reference to Table II. Column *A* shows the assays of the samples of the residues when 2 c.c. of hydrofluoric acid was used with the hydrochloric acid for decomposing the sample. Column *B* gives the results on the same sample when run by the usual methods without hydrofluoric acid.

TABLE II. FORMATION OF LEAD SILICATE IN NO. 1 ORE

Time of Treatment in Muffle in Minutes	"*A*" Lead, per Cent	"*B*" Lead, per Cent
12	1.65	1.3
17	1.65	0.7
22	1.65	0.1
25	1.65	0.05
32		Trace
37	1.65	Trace
42	1.65	Trace

The importance of adding hydrofluoric acid to the lead assay on volatilization residues is often not recognized.

Chart No. 2 shows the results of the second test on the same ore. Test No. 2 consisted in mixing the 10-mesh ore with 16.6 per cent $CaCl_2.2H_2O$ and water, molding the mixture into briquets having the shape of a 1½-in. cupel, and charging them into a heated muffle. Briquets were removed at intervals for assay. The results also show the rapidity of the expulsion of the chloridizer. The use of a large amount of chloridizer insures the presence of some at least, at a time when the ore has been sufficiently heated to permit the silver to be attacked. This test, as well as others which I have conducted, disproved the common idea that it is necessary, from a chemical point of view, to expose each particle of ore to the oxidizing atmosphere of the furnace gases. It also indicated that it requires a longer time to expel a large quantity of chloridizer than to expel a smaller quantity. Compared with Test No. 1 it clearly shows the benefit to be derived by having the chloridizer present at the proper time.

RAPID HEATING GIVES BETTER COMPARATIVE RESULTS

Laboratory tests on this ore ground to 20 mesh, mixed with 5 per cent of salt, and heated slowly, as it would be heated in an ordinary revolving furnace, for forty-five minutes at an average temperature of 1,771 deg. F., resulted in a recovery of 67.4 per cent of the lead and 15.9 per cent of the silver. On the other hand, in a large-furnace test with my methods on ore crushed to pass a 4-mesh screen, using about 4 per cent salt, and heating the ore to about 1,650 deg. F. in a few seconds, thence to about 1,770 deg. for about nine minutes, the recovery amounted to over 62 per cent of the silver and about 90 per cent of the lead. The temperatures were, of course, too low to produce a good silver recovery, but the comparison is decidedly favorable for the rapid-heating method.

The temperature in the large-furnace test never exceeded the stated degrees, whereas in the laboratory test it reached 1,850 deg. F. and averaged 1,830 deg. F. for fifteen minutes. Owing to limited time and facilities in conducting the large-furnace test, the furnace was not heated to the desired extent, nor was the desired kind or amount of chloridizer used. I feel certain that otherwise a complete recovery of the lead and a considerably higher recovery of the silver would have been realized. I may add that the large furnace was a green one. The bricks were not thoroughly dry, and the plant had not been adjusted.

Ore No. 2 was a sample of pan-amalgamation tailing which would all pass a 40-mesh screen. The "insoluble" was mostly "silicate of alumina." The silver was partly combined with manganese, and some was apparently locked up in the silicates; the rest was with the lead. Approximately 60 per cent of the silver was soluble in cyanide solution. About 61 per cent of the lead, but no copper, was recovered in twenty-five minutes by means of calcium chloride solution heated to 69 deg. C. The ore sintered at about 1,850 deg. F. when heated with sodium chloride, but showed no signs of sintering when heated with calcium chloride to as high as 1,950 deg. F. This ore cemented so badly that it would be difficult to feed it to a revolving furnace in the usual manner.

Parallel dish tests on No. 2 ore were heated slowly and progressively from a muffle temperature of 1,640 deg. F., five minutes after starting the test, to 1,850 deg. F. at the end of fifty minutes, and are called tests No. 3 and No. 4. In test No. 3, 12 per cent of salt was mixed with the ore, without water. In test No. 4, 12 per cent of $CaCl_2.2H_2O$ was mixed with the ore. Test No. 4 absorbed moisture from the atmosphere prior to placing it in the furnace. The results of these tests are given in Table III.

TABLE III. TESTS NO. 3 AND NO. 4 ON ORE NO. 2

	Weight, per Cent	Gold, Oz.	Silver, Oz.	Copper, per Cent	Lead, per Cent	Chloride, per Cent Water Soluble, in Terms of NaCl
Feed	100	0.059	5.07	0.46	[illegible]	
Residue No. 3	96½	0.027	2.81	0.07	None	3.05
Residue No. 4	95½	Lost	1.70	Tr.	None	0.36

The foregoing tests required about fifteen minutes thoroughly to heat the ore to about 1,745 deg. F. This rate of heating is perhaps a little faster than the rate at which it could be heated in a commercial-sized revolving furnace fired at the discharge end. The tests are typical of those showing the advantage of calcium chloride. When compared with the following tests on the same ore, No. 3 and No. 4 show the disadvantage of slow heating and also show that, even with excessively large quantities of chloridizer and longer treatment time, the results with slow heating are not so good as those with quick heating, even when smaller quantities of chloridizer are used in the quick-heating tests.

Chart No. 3 indicates the result of test No. 5 on ore No. 2. In test No. 5 the ore was mixed with 5 per cent of calcium chloride and 5 per cent of water and molded into briquets. These were charged into a muffle having a temperature of 1,800 deg. F. The temperatures on the chart were, in this case, muffle temperatures; obviously the briquets were not heated so quickly as the chart indicates. Briquets were removed periodically for assays. This test clearly demonstrates that no volatilization takes place after the chloridizer has been expelled.

Chart No. 4 indicates the result of test No. 6 on ore No. 2. In this test, the ore was mixed with 1 per cent of salt, 5 per cent of calcium chloride, and 5 per cent of water. The mixture was charged to a heated muffle and sampled periodically. Periodical additions of salt were made to the charge as the test progressed. This test shows the benefit of having a chloridizer present at a certain time and shows the better results over test No. 5, due to more rapid heating.

Chart No. 5 shows the results of test No. 7, made on ore No. 2. Test No. 7 was made on the same mixture as No. 6 but heated a little more rapidly, with smaller additions of salt. This shows the advantage of more rapid heating and also the lack of volatilization when no chloridizer is present.

Chart No. 6 applied to test No. 8 made on ore No. 2. Here the work consisted of mixing the ore with 1 per cent of salt; 6½ per cent of calcium chloride, and 5 per cent of water, and charging the mixture into a heated muffle with periodical additions of salt. This test clearly demonstrates the advantage of quick heating when a fair amount of chloridizer is present the while.

Ore No. 5 acted somewhat similarly to ores No. 1 and No. 2, but the chloridizer was not expelled from its mixtures so rapidly. This ore contained a manganese silver compound, with apparently some silver locked up in the "silicate." It was also a pan amalgamation tailing. Over 52 per cent of the silver was recovered by treating with hot solutions of magnesium chloride. Tests using concentration, sulphidizing flotation, cyanidation, and combinations of these methods did not produce over 50 per cent recoveries, whereas the first and only chloridizing volatilization tests resulted in nearly 80 per cent recoveries on both tests.

The residues from the cyanide plants in which Tonopah ores were treated acted similarly to ore No. 2 when tested by chloridizing volatilization methods. This ore could probably be treated profitably by chloridizing volatilization, provided silver would remain at $1 per oz.

All of the aforementioned ores (Nos. 1, 2 and 5) are of the "rapid" type; that is, they have the property of rapidly expelling the chloridizer. This property I attribute to the "silicate of alumina," which apparently acts as a catalytic agent. All of them are subject to the troubles already outlined when treated by the usual methods of chloridizing volatilization in revolving kilns fired at the discharge end. The "rapid" type of ores are the most difficult of the oxidized ores to treat. Sulphide ores also cause the rapid expulsion of the chloridizer, owing to the sulphate formed by oxidization.

Ores of a more amenable type are illustrated by No. 3. Such ores have sufficient bases, such as lime or iron, to prevent the extremely rapid expulsion of the chloridizer. Although the chloridizer is quickly expelled from these ores when heated in the manner required to produce commercial results, the chloridizer is not so rapidly expelled as in the treatment of ores of the "rapid" type. However, these ores must be heated quicker than they could be heated by the usual methods to be efficiently treated on a commercial scale. I discussed this type of ore in my article to which previous reference was made.

CALCIUM CHLORIDE PREFERABLE TO SALT

Ore No. 3 is a carbonate ore with most, if not all, of the silica combined with lime. About 14 per cent of the lead was in the form of a sulphate, with traces of sulphide. Cold saturated salt solution dissolved 14 per cent of the lead, whereas hot salt solutions removed 35 per cent. Hot calcium-chloride solutions dissolved 50 per cent of the lead, and hot magnesium-chloride solutions, practically 100 per cent. Only a trace of the silver was soluble in ammonium hydroxide; therefore only a little was in the form of chloride. This ore sintered easily at below 1,850 deg. F. when salt was used. It cemented to some extent with calcium chloride, but not nearly so much as ores Nos. 1, 2, or 5. Numerous parallel tests on this ore resulted in much better recoveries being obtained by the use of calcium chloride than by salt.

Chart No. 7 indicates the results of test No. 8 made on ore No. 3. In this test the 10-mesh ore was mixed with 11 per cent of 4-mesh calcium chloride ($CaCl_2.2H_2O$) and charged into a muffle having a temperature of 1,700 deg. F. Twenty minutes was required to heat the charge to 1,785 deg. F. This test clearly showed the retarding power of calcium carbonate on the rate of expulsion of the chloridizer.

Chart No. 8 shows the result of test No. 9 on the same ore. The 10-mesh ore was mixed with 9 per cent of 4-in. calcium chloride and charged into a muffle having a temperature of 1,845 deg. F. The ore was thoroughly heated to 1,785 deg. F. in five minutes. This test, although run at a disadvantage when compared to test No. 8 because of the amount of chloridizer used and its mixture with the ore, clearly demonstrated the advantage of rapid heating and that the rate of volatilization diminished as the amount of chloridizer present diminished. This test showed also that the volatilization takes place as quickly as the ore can be heated. No zinc was volatilized.

The old residues resulting from the chlorination treatment of Mother Lode concentrates act similar to ore No. 3. Excellent results can be obtained on this material by my methods.

Ore No. 4, an earthy ore consisting mostly of iron oxides, may be called a "slow" type. Most of the iron is in the form of hydrated oxide. This ore does not sinter when heated to as high as 1,950 deg. F. with calcium chloride; neither does it cake or cement when mixed with this reagent. Complete volatilization of the gold and lead was obtained when quickly heated to a high heat, but only 71 per cent of the silver was volatilized. The recovery of the silver was retarded more than that of the gold and lead when slower heating was attempted. I did not run any slow-heating experiments comparable with the rate in a revolving furnace. The indications of my test were that the best recoveries would be obtained by rapid, or at least quick, heating. This ore is well suited to chloridizing volatilization methods, and I understand that the U. S. Bureau of Mines conducted a number of tests on it, not, however, securing as high recoveries as I was able to obtain.

Gold chloride, as is well known, is decomposed first to oxide, and then to metallic gold by heat. In the tests mentioned (see charts Nos. 3, 4, 5, and 6) the lack of a chloridizing atmosphere would certainly result in the decomposition of gold chloride. Tests Nos. 3, 4, 5, and 6 clearly prove that no gold was volatilized after the chloridizer was expelled, and they indicate that gold requires a stronger chloridizing atmosphere than does silver. It is possible, however, that the lack of water vapor may have had some bearing on the result.

Direct tests on copper chloride showed that copper oxide forms to an appreciable extent when volatilization is attempted in a dry atmosphere free from chlorine. In the early stages of my chloridizing volatilization work I made some direct tests on chlorides of copper, gold, silver, and lead, as well as on other chlorides. A test made with silver chloride, placed in a porcelain crucible and heated in a muffle, indicated that it could be decomposed by heat, a probability which I have not confirmed. At 1,530 deg. F. some fumes were visible. The volume of the fumes increased as the temperature was raised. At 1,717 deg. F. the test was fuming fairly strongly and some beads of metallic silver were forming. The rate of evaporation was slow, however, when compared with lead or copper chlorides.

Two grams of pure lead chloride was placed in a porcelain crucible just large enough to hold it and the test heated in a muffle to about 1,700 deg. F. After less than five minutes' volatilization, no lead chloride remained, but a small amount of non-volatile residue was left. A test with copper chloride was run at the same time in the same manner. All of the copper chloride, with the exception of a little copper oxide remaining, was volatilized in less than five minutes. The foregoing experiments indicate that a chloridizing atmosphere should be present while silver and copper chlorides are being volatilized. Further studies have shown that lead chloride can be decomposed, by heating in air, to chlorine and lead oxychloride.

These and other tests prove that the quicker the ore can be heated in the presence of a chloridizer, the quicker and the better the volatilization; that when once the ore is heated and the chloridizer expelled, further additions of the chloridizer have no effect upon remaining metals such as gold; and they indicate that the rate and extent of volatilization are not so rapid or complete when additions of chloridizers are made after the mixture has been heated to a high heat as when the chloridizer is present during the heating of the ore.

I have purposely omitted a discussion of the effect of water vapor, to avoid confusion. This subject was freely discussed in one of my previous publications, already mentioned.

PRIMARY CONSIDERATIONS IN DESIGNING A COMMERICAL PLANT

When engaged to design a plant for experimenting with ore No. 1 on a large scale, I had to consider the following points:

1. The plant should be of sufficient size to insure that all of the methods to be used therein could be duplicated in a larger plant.
2. The ore should be heated quickly.
3. A chloridizer must be present when and where needed.
4. Calcium chloride will produce better results than sodium chloride.
5. The chloridizer must be cheaply recovered.
6. The fuel requirement must be reduced to a minimum.
7. A furnace in which cementing would interfere must not be used.
8. Water vapor should be present.
9. The furnace should be continuously fed and as nearly automatic as practicable.
10. The furnace should be of a design to allow the possible treatment of high-grade ore after experimental work on the low-grade ores had been completed.
11. I was ordered so to design the plant that its initial cost would be a minimum, even though the plant would have to be torn down and rebuilt after first trials.
12. The furnace and plant operations would have to be simple, because only inexperienced men would be available.
13. Costs must be as low as consistent with low-grade ore and expensive labor and materials.

The accompanying sketch of a fifteen-ton experimental chloridizing volatilization furnace shows the furnace which I designed to fulfill these conditions. This furnace was erected last winter under my supervision. The test referred to before as a large-furnace test was made in this furnace.

The feed screw is driven by cone pulleys. The screw also acts as a drive, through gears, not shown, to the distributor—a revolving perforated plate. (Where ore is ground in solution the distributor would consist of a screw and perforated plate closely resembling a meat chopper. This would feed the thickened pulp or cake into the furnace in the form of a number of thin streams). A spray device is installed in the tube below the distributor. Heating is done by means of a large burner as shown. The sloping base acts as a chute for conveying the charge into the short revolving furnace to which the vertical shaft is connected. The revolving furnace is kept hot by means of a small burner at the discharge end. The gases were removed from the top of the vertical shaft, the residual ore being removed from the discharge end of the revolving furnace.

The distributor fed the ore in a number of small streams throughout the area of the tube. The spray device wetted the ore with chloridizer solution as the ore passed through the spray. A little below the spray device the tube was hot enough to vaporize some of the water of the chloride solution, this vapor then ascending the tube and condensing on the cold ore. These vapors, as well as the spray, agglomerated the dust of the ore into little balls, thus eliminating all dust in the flue gases. This is a valuable method of preventing dusting.

About the time the ore, chloridizer, and water reach the end of the tube, most of the water is vaporized and passes to the flue on the outside of the tube. At a few feet below the tube the chloridizing atmosphere surrounds the ore, and volatilization begins, the gases ascending the furnace toward the flue while the ore descends. The reactions and volatilization become much more rapid as the ore descends, finally falling out of the flame to the bottom of the shaft furnace. Before the ore reaches the bottom, most of the chloridizer has been vaporized or decomposed and ascends through and surrounds the downcoming ore. Most of the lead and silver, if not all, are volatilized by the time the charge reaches the bottom. The ore has then lost all tendency to cement, and it slides or rolls down the chute-like bottom into the short revolving furnace. This latter acts as a good discharging device, and would prove serviceable for prolonging the heat treatment of the ore if necessary. Any volatilization not completed in the shaft furnace is completed in the revolving furnace, provision being made for varying the time consumed in passing through the latter. In the test, nine minutes was consumed. The ore is then discharged through a small hopper, a counter-balanced gate being provided which discharges the residual ore when sufficient has accumulated to open it. Chloridizers can be added at any point along the path traveled by the ore.

In the test the little balls of dust retained their shape throughout the process. Seeing them in the revolving furnace caused me to suspect sintering, but examination of them proved otherwise.

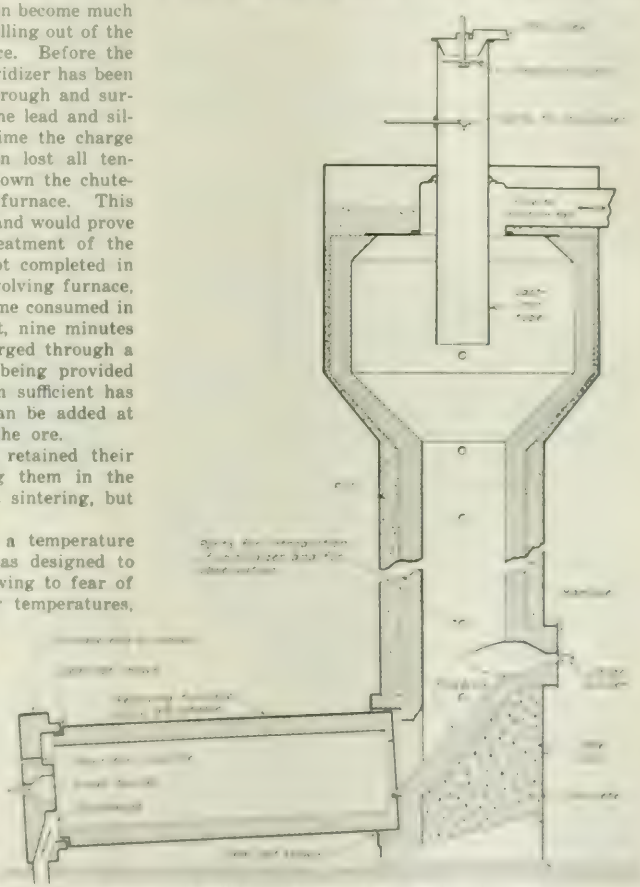
The furnace gases were emitted at a temperature of about 300 deg. F. The furnace was designed to let them go off at about 500 deg. F., owing to fear of condensation of lead chloride at lower temperatures, but, owing to lack of time, I could not heat the furnace properly before adding the ore. The indications were that the height of the furnace could be increased and the temperature of the discharged gases reduced thereby to about 300 deg. F. without danger of loss due to the precipitation of chlorides in the furnace. A low temperature of the gases assures low fuel consumption.

The gases passed through the flue to a fan which delivered them to the bases of towers filled with broken limestone. A spray of weak chloride solution was provided at the top of the towers. The ascending gases, on meeting the descending solutions and on contact with the limestone, were cleansed of their suspended metal chlorides and freed of their hydrochloric acid and chlorine vapors, which combined with the calcium of the limestone to form calcium chlorides. The valuable chloride solutions were drawn off from the bases of the towers while the gases, free of valuable constituents and chlorine compounds, escaped to the air at the top of the towers. During the test there was no measurable escape of either fume or chlorine from the towers, and consequently the recovery of both was complete. The solution, after removal of the metals which it is desired to recover, is sent to the spray device at the top of the furnace to treat other ore.

CONCLUSIONS FROM LARGE-SCALE TEST

No troubles occurred during the test which could not easily have been overcome by simple adjustments; such are naturally expected in any new plant, especially a new plant using a recently invented process.

The only plant trouble of importance was due to the back pressure of the limestone towers, which, owing to the limestone containing more fines when crushed than I had looked for, was twice the amount I had expected. This could have been overcome at the expense of forty-eight man-hours' time expended in rescreening the limestone.



[illegible] CHLORIDIZING VOLATILIZATION PROCESS

The fuel consumed during the trial was 10 per cent more than my calculations, but as I was using more fuel than would be necessary after the furnace had been dried and thoroughly heated, I believe that the normal fuel consumption will be considerably less than I had assumed.

This type of furnace will permit the treatment of ores containing considerable moisture as the chloridizer need not be added until after much of the sulphur has been oxidized. It will also permit of the treatment of ores rich in lead, because most of the lead will be volatilized before the heated ore can come in contact with the walls of the furnace; therefore there would be little danger due to sintering.

The heat balance of this furnace is almost ideal. The novel method of dust prevention helps to make the furnace practical, although with my method of recovering the fume the dust would not be a serious item. Baghouses or electrostatic collectors could be used to recover the fume if desired, but they are expensive compared with scrubbing towers.

The revolving furnace could no doubt be dispensed with in treating some ores, or other types of discharge device substituted.

By feeding the chloridizer in the form of a solution, the percentage of water vapor necessary to accomplish the desired results can be regulated.

OPERATING LOSS AND PLANT COSTS

In estimating, I usually assume a loss of about 10 per cent of the amount of chloridizer fed. This loss could be made up with salt fed with the ore or otherwise. Small tests show a complete recovery of the chloridizer. In starting a plant, salt would be used, but it would gradually be replaced by the calcium chloride recovered. When electrolytic precipitation of the lead or other heavy metals is practiced with insoluble anodes, the chlorine produced can be fed to the furnace, preferably near the base or toward the discharge end, to replace in part the other chlorides.

I estimate that a plant to treat 100 tons of the No. 2 ore per day would cost $24,000 without the building, and the cost of treatment would amount to $1.20 per ton, including freight and selling costs of the bullion but excluding depreciation. Inasmuch as the capacity of the furnace increases as the square of its diameter, it is obvious that a 100-ton plant would cost considerably less per ton than a 50-ton plant.

Swift Growth of Manganese Ore

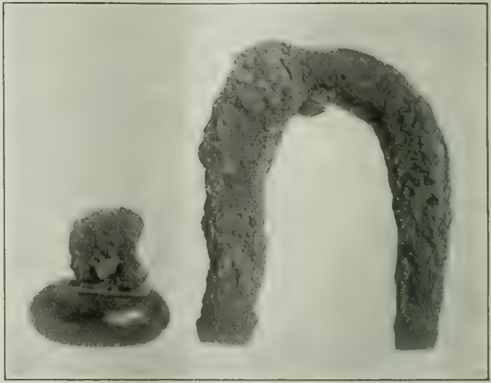
By A. K. KNICKERBOCKER

Written for *Engineering and Mining Journal*

Engineers who have spent much time in the Batesville, Arkansas, manganese district have no doubt been struck by the number of old-time miners who have tales to tell of the marked enrichment or impoverishment of ore streaks and channels during what are, relatively, brief periods of time. Some of these men have been mining, off and on, for thirty-five years. As their success is entirely dependent on their own ability to search for ore and successfully follow it, they have developed an intimate knowledge of the various properties and workings.

An example is the story of the two men who, at the time of the closing down of a property twenty to twenty-five years ago, left a breast of good ore, marked their timbers so they would be able to identify the place, and caved the drift and shaft to prevent others at any time from having access to it. During the war these men thought of this place, sunk a new shaft, and, drifting in, discovered their old marked timbers and tools just as they had left them. The old breast, however, was now so poor in grade it did not pay to work it. Such stories are heard frequently, and tales of enrichment of barren clays to clays of merchantable value in the space that is covered by a man's normal working lifetime are just as common.

The deposits are, as is well known, derived from the decomposition of limestones and shales, and lie in pockets and channels in or disseminated through the residual clays derived from these rocks. That migration, concentration, and reconcentration are going on at the present time is beyond doubt, but it is somewhat startling to be confronted with evidence that these changes take place in what is, geologically, so short a time. I have been inclined to take such stories with some allowance, believing these Ozark hill-dwellers may be something as Mark Twain once described himself to his biographer, Paine: "I used to remember everything, whether it happened or not; now I am growing old, and soon I shall remember only the latter."



DEPOSITIONS OF MANGANESE ON IRON

That movement of ore does take place and concentration ensue under favorable circumstances in a short time is evidenced by the horseshoe and doorknob shown in the accompanying photograph. These articles were picked up some time ago, on a property near Cushman, after having been buried under a few inches of soil in the place where they were thrown probably not over fifteen or twenty years ago. Though the metallic iron no doubt exercised a potent influence in the ore deposition, this factor is more than balanced by the unfavorable, nearly barren clay in which the articles lay, and by the extremely thin covering of soil. The analysis of the ore accretions is shown in the accompanying table:

	Per Cent
Iron	20.86
Manganese	29.75
Combined metals	50.61
Silica	6.64
Alumina	3.73

The ore accretions would have run higher in manganese and lower in iron had it been possible to remove the accretions without vitiating the sample with more or less iron rust. Even so, they represent a good grade of manganiferous iron ore.

The photograph shows plainly the accretions, ore particles, and crystals, and is interesting as evidence that possibly some of the processes that have been associated with long periods of time may take place in a comparatively brief period.

The Eubœan Magnesite Field

A Description of Deposits and Operations on the Island of Eubœa, Greece—Economic Geology—Labor Supply And Climate—Information for Prospective Travelers

By Harry C. Boydell
[illegible] Engineering and Mining Journal

IN ADDITION to its unequaled emery, Greece provides from the island of Eubœa the world's purest magnesite. Eubœa lies west of the mainland and is separated from it at Chalkis, the largest town (population 8,000), by the Canal de l'Euripe only, which here, where it joins the Canal d'Atalanti, is not more than 150 ft. wide and is crossed by a bridge.

The magnesite area is north of the middle of the island and is reached by taking a train from Athens to Chalkis, a distance of 60 km., and then either the steamer to Limni or the road to Mantoudi, the latter being 60 km. from Chalkis. There is also a road between Limni and Mantoudi. Compared to some of those on the mainland, the roads in Eubœa are good, though this must be accepted in its relative sense by the prospective visitor.

The rail journey from Athens is uninteresting, but the trip from Chalkis to Limni by the small steamer, which takes two or three hours, is pleasant, and the road from Chalkis to Mantoudi passes through country that is rugged and picturesque. Eubœa is not rich in antiquities, but on the Ægean coast, in the magnesite area, there is the site of the ancient city of Kerinthos, at Mantoudi the vestiges of a Byzantine church, and at Chalkis, besides some classical ruins, the comparatively recent Turkish fort of Kara Baba.

Magnesite Occurs in Serpentine Belt

The magnesite field is included in a belt of serpentine, about 18 km. long, stretching from Limni, on the Canal d'Atalanti to the west, to Kymassi, on the Ægean coast to the east. The width of the belt is about 5 km. on the west side and 7 km. on the east, but is less in the middle.

With regard to the geology, it will suffice to say that the magnesite occurs in serpentine which is intrusive into limestones of Cretaceous age, and is overlain in parts by a Tertiary covering of conglomerates, marls, and marly limestones. This serpentine area is the most fertile and best watered in the island, and forms a pleasing contrast in this respect with the typical "Karst" appearance of much of the surrounding country. The serpentine has been derived from the alteration of original peridotite, which consisted chiefly of olivine and bronzite (enstatite), two minerals rich in magnesia.

The highest ground in the vicinity is Mount Kandili (2,700 ft.) to the southwest, and Mount Mavrovouni ([illegible] ft.) to the southeast, with Mount Delphi ([illegible] ft.), the highest peak in the island, still further south. Generally speaking, the serpentine hills and ridges are well dissected by deep gullies, and the country is suitable for mining by adits.

Magnesite in Eubœa First Mined Near Mantoudi

The best known magnesite deposits are those of Mantoudi, Daphnopotamous, Limni, Pyli, Afrati, and Hagia Anna. Work at Mantoudi is carried on by the Société Financière de Grèce, a Greek company with head offices in Athens. Operations are also carried on at Koofala (connected by aërial ropeway with the main works), and at Geroremma, in the same neighborhood, and also near Limni. The total area of the concession is 30,000 *stremmata* (1 *stremmata* = 100 sq.m.). The company's plant and offices are 1½ km. from Mantoudi and 2½ km. from Kymassi, the shipping point. It was on this property that magnesite was first mined in Eubœa, about forty-five years ago.

The main deposit is 1,800 ft. long and has a width in one part of 130 ft., though this dimension varies greatly, thus giving to the orebody the form of a series of connected lenses. It constitutes the largest known body of magnesite in Eubœa, the only other that can be compared with it being the Kakabos deposit. The strike is 10 deg. west of north with a dip of 35 deg. to the northeast.

MAP OF THE ISLAND OF EUBŒA, GREECE

Mining by Pillar and Fill Method

The mine has been opened up by adits down to No. 7 level, below which a shaft has been sunk to No. 8, which is between 800 and [illegible] ft. vertical beneath the outcrop. The method of working adopted is by pillars and filling, the pillars being afterward recovered. At the time of my visit, the filling in the old workings was being worked, and much magnesite recovered from it that had been [illegible] buried in former years. In all, [illegible] tons of mineral has been mined, and at No. 7 level (No. 8 has been under water since the war), the deposit shows little indication of decrease in size.

No branch veins, similar to those at Daphnopotamous, have been found, and no faults are recorded, though it is likely, in my opinion, that some of the so-called irregularities of the deposit are due to faults that have not been recognized as such.

HAND PICKING AND CHIPPING NECESSARY TO REMOVE SERPENTINE

The foot wall is generally well defined, but the hanging wall is very irregular. The deposit is by no means all pure magnesite, but contains numerous inclusions of serpentine of all sizes and in all stages of replacement. As only the purest mineral is of value, the serpentine is separated underground and used as filling. Hand drilling—that is, single jacking—is used. The only ore dressing practiced is hand picking and chipping to remove attached pieces of serpentine, this work being done by women of all ages.

A well-built narrow-gage line connects the mine with the works and the latter with Kymassi. Locomotives of the Decauville type haul side-dumping cars of one-ton capacity.

The company has three calcining furnaces of the vertical kiln type, holding a charge of sixty tons, crude mineral, fired with lignite and yielding seven to ten tons of calcined material per twenty-four hours. There is also one rotary gas-fired furnace of complicated construction for the calcination of fine material. At one time a good quality of refractory briquets was made at the plant, but this has been discontinued since the war.

MAGNESITE OUTCROP ON COMMUNITY CONCESSION, AT LIMNI

Wages average 12 *drachmas* per day for miners. The contract price for drifts is from 100 to 140 *drachmas* per meter (in August, 1921, $1 was worth 18 *drachmas*) and that for shaft sinking (size 2 m. square) from 200 to 250 *drachmas* per meter, two men in such a shaft making a progress of from 15 to 25 cm. per shift of nine hours. Winzes cost about the same. Crosscuts and drifts in mineral require close timbering in most places, the cost averaging at present 1 *drachma* per meter. The timber used (local pine) decays rapidly, and impregnation might be tried with advantage.

The total number of hands employed in April was 180, with twenty more at Koofala and thirty at Geroremma. In addition to its magnesite mine, the Société Financière de Grèce also owns a lignite deposit at Kumi, 50 km. to the south, from which it gets fuel for calcination purposes.

STOCKPILE AND WORKERS AT DAPHNOPOTAMOUS

PUREST MAGNESITE AT DAPHNOPOTAMOUS

Daphnopotamous, which is really the name of a small stream, is also the name given to the magnesite workings near its mouth. The concession has an area of 1,500 *stremmata* and lies to the east of the Société Financière, about 5 km. from Mantoudi and 3 km. from Kymassi, south along the coast. It is controlled by A. Decilas and D. Papastratis.

The deposit outcrops along the east side of a ridge, and has been worked by open cuts and workings of a primitive kind for 1,500 ft. along the strike, which is 15 deg. east of north, with a steep dip to the east. There is an average width of 4 to 5 ft. of magnesite, which contains the usual inclusions of serpentine. The foot wall is well marked, but the hanging wall is very irregular.

Situated more or less perpendicular to and on the foot-wall side of the main deposit, but some distance from it, on the western side of the ridge, are a large number of veins of magnesite. These have a width of a few feet, a strike more or less at right angles to the main deposit, and dip either north or south. So far as they have been exploited, the magnesite in them is of irregular occurrence, and the workings have not been carried to their junctions with the main deposit, if such actually exist.

Daphnapotamous magnesite is of a high degree of purity and has the reputation locally of being the purest produced. It shows no sign of exhaustion at 60 ft. below the outcrop, the lowest point yet attained. The main workings are situated 450 ft. above sea level, and the magnesite is conveyed down hill by two aërial ropeways of home-made but effective construction. The stockpile is at the beach, shipment being effected by means of small, wooden lighters. Methods, working

ROADSTEAD OF KYMASSI WITH JETTY AND LIGHTERS (IN DISTANCE) OF SOCIETE FINANCIERE DE GRECE

conditions, and wages are much the same as at Mantoudi. About fifty men, women, boys, and girls are employed, and the output at present is 5,000 tons per year.

ENGLISH COMPANY OPERATING AT LIMNI

The most important operations at Limni are carried on by the Anglo-Greek Magnesite Co., an English corporation with head offices in London. The concession, which has an area of about 5,000 acres, is called Galataki, after the convent situated near by which acts for the Greek government as custodian of the lands in the vicinity, a function common to many convents in the country. The company was incorporated in 1902, and has operated with profitable results. Its calcining plant, engineering shops, electric generating plant, and offices are situated on the Canal d'Atalanti, about 4 km. south of Limni. The mine workings are on the opposite side of a ridge that runs parallel to the coast, and are connected with the calcining plant and stockpile by an aërial ropeway about 5 km. long, as well as a narrow-gage railway with Decauville equipment.

The magnesite outcrops are scattered over a considerable area, but at the present time operation is confined mainly to deposits at Archangelos and Kakabos. The former is of irregular form, showing no semblance of walls, the magnesite merging imperceptibly into the serpentine along no general direction. The mineral is of the usual massive kind, with inclusions of serpentine of all sizes. It has undergone post-mineral fracturing, apparently without dislocation, with the result that surface waters have introduced lime-bearing minerals. In consequence of this, the lime content of the magnesite is higher than usual, and at the beginning of June work was about to be temporarily abandoned here on that account.

KAKABOS DEPOSIT SECOND LARGEST IN EUBOEA

The Kakabos deposit is, next to that of the Societe Financiere de Grece at Mantoudi, the largest in Euboea. In the past, mineral was obtained from an open cut whose dimensions (1,500 ft. long, 100 ft. wide and 50 ft. deep) bear evidence to the amount extracted. As the workings have gone deeper, real mining methods have had to be adopted, and at present all the magnesite is got from underground workings served by an incline shaft. The width in some places is as much as 90 ft., though this is not necessarily all magnesite, there being numerous and often large inclusions of serpentine.

The mineral is not continuous along the strike, but, as usual, forms a series of lenses more or less connected. The interval between one of these and the next showed, along the prospecting drift, a well-marked wall bearing signs of movement and carrying a light creamy-colored gouge of the consistency of very soft clay.

The foot wall is generally well defined, but in most places there is no definite hanging wall. Mining has been carried on to a depth of about 120 ft. below the outcrop without the size of the deposit becoming sensibly less. The method of working is by pillars and filling, the pillars being reclaimed afterward. The company makes use of a few rock drills in its open workings, jackhammers, of the Hardy Patent Pick Co.'s make, being used. They are driven by steam generated in disused locomotives.

The calcining furnaces are of several types, some of the old kiln form, some with mechanical arrangement for moving the charge, and include two gas-fired furnaces, one of which has a Morgan's producer. British coal is used, and in the most efficient type fuel consumption has been cut down to 18 per cent of the magnesite calcined. The kilns deliver on to picking belts, from which incompletely calcined material is separated and returned to the furnaces.

WORKERS PAID PARTLY IN BREAD

Conditions of work, contract prices, and wages are much the same as at Mantoudi, but the company pays partly in the form of bread, providing a better article at a lower price than can be obtained at the local bakers.

Close to the village of Trupi, and south of the Anglo-Greek boundary, near to the foot of Mount Kandili, is a large outcrop of magnesite that has a north-and-south strike and can be traced on the surface for some distance.

Adjoining the Anglo-Greek concession on the north is one which, previously held by Mr. Limbriadarious, has been recently acquired by a Dutch proprietorship. In June two calcining furnaces were being erected, but no other work was going on. An aërial ropeway conveys the magnesite from the top of the ridge to the shore.

[illegible]
[illegible]

Still further to the north lies a concession which, having had several holders in the past, now has its mining rights vested in the Community of Limni. This area contains numerous outcrops, the most promising of which, having a general strike of north 60 deg. east, a southeasterly dip, and showing a width of 50 ft., where surface workings have exposed it in one place, is visible for a considerable distance.

PYLI, AFRATI, AND HAGIA ANNA

Pyli is situated at the southeastern corner of the main serpentine area. Mining work is carried on by the Anglo-Greek company and Messrs. Raphael and Dapien, the former employing about seventy workers. I was informed by the manager of the former company that the magnesite occurred very irregularly.

At Afrati, in a small isolated serpentine outcrop in limestone, situated near Chalkis, the Anglo-Greek company, employing about 100 hands, is working a magnesite deposit which it is said resembles the deposits of other parts of the island. Near by, at Yerakeri, the Dutch proprietorship operating at Limni is working on a small scale.

Hagia Anna, which, as was the case with Pyli and Afrati, I did not visit, lies north of Mantoudi, the magnesite occurring in an outlying serpentine outcrop. Development work has been done by which it is claimed that a large quantity of mineral has been made available. The average width of the deposit is said to be 6 ft. The shipping point is Xeropotamous.

Quite outside of Eubœa, and situated near the town of Atalanti, in Lokris, on the mainland opposite Limni, and occurring in one of a number of serpentine outcrops in that region, is the magnesite deposit of Skender Agha. Mineral has been shipped from here in the past, but no work is being done at present.

MAGNESITE DEPOSITED BY REPLACEMENT

The magnesite does not occur generally throughout the serpentine, but has been deposited by replacement along fault or shear lines in that rock, which are generally parallel to lines of major faulting represented by the Ægean coast line on the east and the Canal d'Atalanti on the west. There is also a well-recognized direction of faulting roughly perpendicular to the preceding. The deposits can be divided into the following three classes:

1. Those with a general strike about 10 deg. east or west of north and a dip that is usually easterly. These are the most important as a rule.
2. Those with a strike approximately at right angles to that of (1), with a dip that may be north or south.
3. Those in which the magnesite has been deposited in veinlets through a large mass of serpentine so that a stockwork of the mineral has been formed. These deposits are not workable.

The deposits generally are characterized by the following:

(*a*) An irregularity of the hanging wall, and consequently of width, which gives, to one and the same deposit, the appearance of a series of connected lenses.

(*b*) The presence of inclusions of serpentine in the magnesite, which are always rounded, never sharp or angular.

(*c*) The magnesite is always dense, not spongy or vesicular, and cavities of all kinds are absent.

All of these are indications of replacement. A peculiar feature is that the smooth, greasy, and often grooved or slickensided appearance of the irregular joints in the serpentine (which are the "greasy backs" of the miner) have been faithfully reproduced in the magnesite by replacement.

The commonly accepted theory of the formation of magnesite from serpentine is that it is due to the action of percolating meteoric waters in the surfaces or shallow zone. This gives to the magnesite a possible extension in depth of only a few hundred feet at most. The lowest point attained, on the Eubœan field, up to the present, is in the mine of the Société Financière de Grèce at Mantoudi, where, at No. 7 level, 225 ft. below the outcrop, but little apparent decrease in the size of the deposit is noticeable. The amount of water met with in underground work is not large and most of it comes down from open workings along the outcrop. At Mantoudi, where the No. 8 level is flooded at present, the volume of water is small.

A TYPICAL GREEK HOUSE AT MANTOUDI, EUBŒA

Usually, Eubœan magnesite is described as being amorphous, but micro- or crypto-crystalline would be the better term to use. It is generally pure white, but is sometimes slightly green or red or yellow, due to admixture of serpentine or ferruginous material derived from it. The hardness ranges from 3.5 to 4.5, but where more than the usual amount of lime is present the mineral becomes softer. Greater hardness, on the other hand, shows a higher silica content. The magnesite as shipped is generally guaranteed to have a minimum of 94 per cent of magnesium carbonate and quite commonly contains 96 to 97.5 per cent of it.

ENTIRE PRODUCT OF MINES EXPORTED

All the mineral mined is exported, none being used in Greece. It is shipped either crude or calcined. Of the latter, there are two grades: (*a*) Caustic burned or plastic magnesite which has been heated to a temperature of about 800 deg. C. and absorbs CO_2 from the air; and (*b*) dead burned, sintered or ferromagnesite, which has been heated to 1,500 deg. C. and does not absorb CO_2. Both grades of calcined have to be bagged, but the crude is shipped in bulk.

Shipment is affected by lighters. On the Ægean coast of Eubœa there is no good harbor, and the open roadsteads available are too exposed to permit of wharves being erected. With the present arrangements at Daphnopotamous, where the ship lies about 400 ft. from the beach, 220 tons can be loaded in nine hours. At Kymassi, with 800 ft. between ship and shore, 300 tons can be loaded in the same time. At Galateki (Anglo-Greek) it is said that as much as 1,000 tons has been loaded in a day, but 500 tons is nearer the average.

At present, owing to the fact that so many men are serving in the army, the labor supply is short, this applying particularly to experienced miners. Much of the surface work is done by women, but not, it must be said, with efficiency, there being a marked tendency on their part to substitute small baskets (carried on the shoulder) for wheelbarrows and hands for shovels.

A feature of working in Greece generally is the large number of holidays (saints' days), which are so numerous that there remain not more than 250 working days in the year. Incidentally, it may be mentioned that there are no birthdays, individuals celebrating their "name day" on the day of the saint whose name they bear. Thus, all the Georges celebrate their name day on St. George's day. Whether a man with a double-barreled name like George James would celebrate two name days, I do not know, and, in any case, double-barreled names are not common in Greece.

BOUNDARIES OF CONCESSIONS OFTEN VAGUE

Mining concessions are granted by the Greek government, but, owing to the backward state of the survey (the major triangulation not being completed), the boundaries are not marked by monuments but by reference to some local feature, such as a hill. As the names of these are by no means certain, boundaries are likely to be a little elastic, and visits of inquiry and confirmation by government officials are made. During one of these, recently held at Limni, witnesses ninety years old were produced to testify to certain landmarks. It would seem that Greece had, in this direction at least, set an example to other countries in providing legitimate occupations for its oldest local inhabitants. Whether they are more reliable than the oldest inhabitants elsewhere in reference to old mines, I do not know, but I hope so.

Eubœa being situated between parallels 38 deg. and 39 deg. of latitude, and the air being very clear, the summer is hot, days when the temperature is 90 deg. or over being common. Usually, however, movement of the air provides relief in the shade. At Mantoudi there is a little malarial fever in August, but not much. In winter, although there is no snow in the lower lying country and but little frost, the northeast wind that prevails from October to March is penetratingly cold. Warm bed clothing is necessary for most of the year, as the nights are cold even in spring and autumn.

TRAVELER SHOULD PROVIDE HIS OWN COMFORTS

Greece and its conditions not being well known, a few words as a result of my recent experience there may be useful to future visiting engineers and geologists. Outside the larger towns (and there are few of these), acceptable hotel accommodations are not to be had. Rooms of sorts may be got, but the beds are always suspect, Grecian vermin being both ubiquitous and extremely aggressive. So much is this the case that I am inclined to regard them as the most energetic inhabitants of the country. For this reason it is advisable to take sleeping bags when going into the country districts.

The cafés, which are to be found even in the smallest villages, provide nothing more than Turkish coffee served as demi-tasse and often very thick. Meals can be obtained in some places, but for a stay of more than a few days, to avoid the feeling of never having what he likes to eat, the visitor is advised to take food with him and to be prepared to do his own cooking in order to have it to his taste.

PLANT OF SOCIETE FINANCIERE DE GRECE AT MANTOUDI, EUBŒA

Meat, bread (black), chickens and *giaourti* are nearly always obtainable. The latter, a Turkish dish made from goat's milk, resembles junket with the fermentation carried further, and is very palatable to most people. Much the same article, but made from cow's milk, is the so-called "Bulgarian sour milk." The meat is usually immature kid or lamb, and like the Chicago hog, practically every part of the beast is used except the bleat. Fish is fairly plentiful on the coast and is often very good, though local favorite varieties, such as octopus, are not likely to suit the visitor.

Wine is always obtainable, but is the native *retsina*, which is made by adding resin (got from local pine trees) to new wine for preservation purposes, and it has a taste something between turpentine and preserved ginger. A little time is required to get used to it. Water is scarce in Greece, but is always obtainable near villages, and, being commonly from springs or mountain streams, is good.

ANIMAL TRANSPORTATION MAIN RELIANCE

But few of the roads are suitable for automobiles, and the usual means of getting about in the country districts is by mules. For much riding, it is advisable to take a proper riding saddle, as anyone who has had the painful experience of a long day's riding on a pack saddle will readily understand. The general charge for a mule and guide at present is [illegible] drachmas per day. If required for any length of time it would be better and cheaper to buy animals and sell them again when finished with them.

The difficulty of language may give some trouble at first, but the few words needed to satisfy human requirements are soon picked up, and these, combined with suitable signs, a firm attitude, and fair dealing, will suffice in most cases. French is not spoken by the peasants, though it is the *lingua franca* in Athens and the larger towns.

Telegrams can be sent in English from most country post offices, and in nearly all villages will be found returned natives who, having lived in America or some part of the British Empire, can speak English. All foreigners are looked on by the peasants as being very rich, and are regarded in consequence as fair game for extortion; on this account, therefore, most prices or demands can be reduced by bargaining. An air of indifference, too, tends to curb the same tendency.

In conclusion, I would add that it is always advisable for the visitor to give personal attention, before starting in the morning, and also at other times, to his automobile, mule, saddle, equipment and all details generally, as local assistants or attendants are prone to be neglectful in the way of that careful preparation and foresight that makes for safety, efficiency, and freedom from annoying incidents.

Early Records of the Michigan Copper Industry

Native Copper Deposits of the Lake Superior District Were Exploited by the Indians Before the Coming of the White Man

By Charles R. Keyes

Written for *Engineering and Mining Journal*

THE CULTURAL STAGES of mankind, as is well recognized, are not contemporaneous over all parts of the world. Whereas metal first began to replace stone for tools in ancient Elam, Accad, and Egypt at so remote a period as eight to ten thousand years ago, in North America, for instance, the Stone Age persisted until long after the arrival of Columbus. There are extant some curious accounts of eyewitnesses to these conditions.

Before the rudiments of metallurgy were acquired, man could only work such fragments of native metals as he chanced to pick up. Of these, gold, copper, silver, and meteoric iron appear to have received first attention. In America, however, copper stood foremost. Long prior to the discovery of the New World, native copper of Lake Superior found its way to the farthermost ends of the continent; in the form of simple tools and ornaments it was bartered throughout the land.

In London not long ago was unearthed from under the accumulated dusts of more than two and a half centuries a manuscript account of an early visit by Europeans to the Lake Superior copper country. These bold voyageurs were Pierre Esprit Radisson and Médard Chouard, Sieur des Groseilliers, sometimes in the service of the French and sometimes with the English, as self-interest dictated.

The French had already known of the existence of copper in the Upper Lake country for more than a century; and Radisson had made several trips to the region. Setting out with Groseilliers in August, 1661, for the last time, he skirted the south shore of Lake Superior and arrived at Keweenaw Bay on the fifteenth of October. There he left Père Ménard and the other Frenchmen with the Ottawas who had come with them, while he and Groseilliers pushed on to the west. Portaging across the great Keweenaw Point, they visited the Christinos, a few miles northeast of what is now called the Montreal River. While there they learned of extensive copper deposits which had long been worked and were then being exploited by the Indians. The metal was pounded smooth with stones, and finished with much skill into a great variety of curious implements, which, with those of stone, were soon afterward discarded when the spread of the French fur-trade enabled the savages to secure European iron implements at far less expenditure of labor. In Radisson's words:

> "The wildmen . . . their ears have ordinarily five holes, where one may putt the end of his finger. They use those holes in this sort: to make themselves gallant they pass through it a skrew of coper wth much dexterity, and goe on the lake in that posture. When the winter comes they weare no capes because of their haire tourned up. They fill those skrews wth swan's downe, & wth it their ears covered; . . . Here we found a small river. I was so curious that I inquired my dearest friends the name of this stream. They named me it Pauabickkomesibs, wch signifieth a small river of copper. I asked him the reason. He told me, 'Come, and I shall shew thee ye reason why.' I was in a place wch was not 200 paces in ye wood where many peeces of copper weare uncovered. Further he told me that the mountaine I saw was of nothing else. Seeing it so faire & pure, I had a minde to take a peece of it, but they hindered me, telling my brother there was more where we weare to goe. Having passed that place we made carriage through the land for 2 leagues. The way was well beaten because of the commers and goers, who by making that passage shortens their passage by 8 dayes by tourning about the point[1] that goes very farr in that great Lake; that is to say, 5 to come to the point, and 3 for to come to the landing of that place of carriage. In the end of that point, that goeth very farre, there is an isle[2], as I was told, all of copper. This I have not seene. They say that from the isle of copper, which is a league in ye lake when they are minded to thwart it in a faire and calme wether, beginning from sun rising to sun sett, they come to a great island[3], from whence they come the next morning to firme lande att the other side; so by reason of 20 leagues a day that lake should be broad of 6 score and 10 leagues. The wildmen doe not much lesse when the weather is faire. . . . They have yallow waire that they make wth copper, made like a starr or a half moone & there hang it. [in ears.] . . . The circumjacent nations goe all naked when the season permitts it. But this have more modestie, ffor they putt a piece of copper made like a finger of a glove, which they use before their nature."

A "stone" having such wonderful properties as copper could not fail to excite the cupidity of the natives as widely as did catlinite, the peculiar hardened clay from which they made their peace-pipes. Even at the time of the discovery of America, the Pueblo Indians of Arizona and New Mexico seem to have known of the location of the Lake Superior copper. This may have been really the Gran Quivira (French *cuivre*?) the mystical place in the north which Coronado mistook for a great city of wealth or a second Mexico or Peru, and which he vainly tried to find, in the summer of 1541, by a journey from the Rio Grande to the Missouri River.

New Method of Analyzing Sponge Iron

A new method has been developed at the Northwest station of the U. S. Bureau of Mines at Seattle, Wash., for the determination of metallic iron in sponge iron, which has been found to be more accurate, simpler, and more rapidly performed than any of the existing processes.

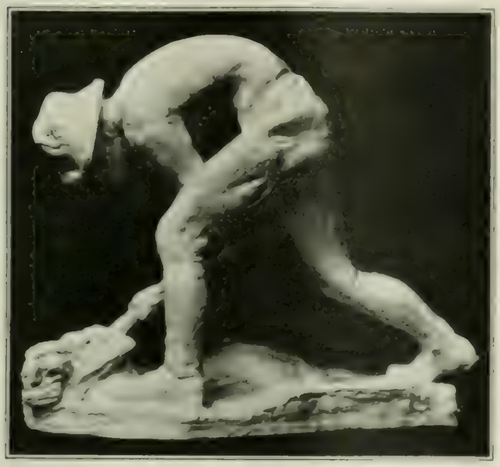
---

[1] Keweenaw Point. [2] Maniton Island [3] Isle Royale

BY THE WAY

What Is It?

What does the accompanying cut represent? A box of Chiclets is offered for the best answer received in the next ninety days. Our own guess is that it represents a mucker before he acquired common sense enough to use a long-handled shovel. That would account for his condition of curvature of the spine. However, we shall not be prejudiced in our own favor, as we have three boxes of Chiclets on hand right now. Mrs. Harry Payne Whitney calls it "The Engineer," and she ought to know, for she created it. We don't think she does know, however. The figure is part of a recent exhibit of the National Association of Women Painters and Sculptors. Another query that we are led to put is: Do not muckers wear overalls over their union suits?



"THE ENGINEER" AS SEEN BY MRS. WHITNEY

Something Dreamy

The presence of "iridium, platinum," and the "platinic metals gold, silver" at Nepera Park and Hastings, N. Y.—at New York City's back door, so to speak—has been proven. Now let us hope that there will be a real stampede of all the hoboes in Bryant Park and elsewhere. It is difficult, however, to stir up popular enthusiasm in actual mining in this part of the country, even among the unemployed. The public, for the most part, knows only the mining that is done in offices, on paper, and in the imagination.

The *Yonkers Statesman* is doing its best to help the promoters by accepting flamboyant advertising of this fake, [illegible] [illegible] from the "Irido-Platinum Gold Co., Inc.," which gives its address as Room 316, Proctor Building, Yonkers, N. Y. Undoubtedly the *Statesman* does not realize what it is doing. It should know, however, for it has an honorable reputation to protect. "Bulletin No. 2," entitled "Yonkers Gold Mines," has already appeared in its pages, with possibly more on the way. The proposition is so ridiculous that we are tempted to joke about it, but we refrain, because some simple-minded person always takes us to be in earnest.

Statements from some of the greatest authorities in the country regarding the property are to be seen in its offices, the company declaims. These men "have given a year or more of their time to make the inspection and experiments," it says. "Their word, therefore, cannot be disputed." Truly it must be a great property that takes so long to examine, and the expense in the way of experts' fees must have been enormous.

"We have written *guarantees* that each ton of rock will yield between $200 and $600," the company advertises . . . "The maximum cost to mine each ton is $10. Mills, crushers, and pulverizers sufficient to begin operations on a large scale are immediately needed. Also a smelter. The railroad runs through our property. Hence the haulage expenses will be low . . . The executive overhead will be meagre (it usually is, of course). *Our product is money itself* (gold producers and Mr. McFadden take notice). The U. S. Government will give us their check direct according to the weight of our metals. No middleman. No salesmen. *No advertising*. No showrooms. No competition." To which we add: "No platinum. No iridium. No brains, or, if brains, then no honesty."

Incidentally, it will interest many to know that this is part of the country originally prospected by Rip Van Winkle. Rip never found a gol-darned thing except a lot of hootch. We have his word for it sent by ouija.

Via Wireless

New York daily papers announced on Nov. 3 that the United Verde Extension Mining Co. had shut down. This reminds us. We take pleasure in announcing that Columbus discovered America; that Mary Pickford married Doug. Fairbanks; and that Benjamin Franklin flew his kite successfully. Our news is always up to the minute. And we take this opportunity to point out that if Ben had used a copper wire instead of a silken string he probably would have been even more successful. Make it of copper, boys; make it of copper!

Blowing Bubbles

California's latest bonanza discovery is a soap mine near Barstow, which is being worked in much the same manner as some small coal mines of the Mississippi Valley are worked, according to a St. Louis paper. "All that is required," says the *Star*, "once the soap is brought to the surface, is to put it in tins and cart it away for shipment." The story runs that the mine was discovered by a Mexican, who took some of the [illegible] resembling plaster of paris to a Los Angeles laundryman. The result was so successful that the laundryman, aided by several bankers, purchased the tract together with a strip of land five miles long believed to include the entire vein of soap. At the laundry many pounds of the soap were consumed in a month. The employees say it not only cleans well but removes stains, which gives it additional value over ordinary laundry soap.

Question No. 1: How much of this is a lie? Question No. 2: What made the Mexican think it was soap in the first place? Had he ever seen soap before? Third question à la Edison: What is the monthly clean-up at a mine of this capacity? At any rate, a [illegible] might write: "Woe unto Procter & Gamble! Surely they have met their Waterloo!" To which we add, Woe unto Pears, unto Colgate, the Palmolive [illegible] and others, including Babbitt, Kirkman and Fairbanks. For in the face of such competition their product is doomed to dissolution.

HANDY KNOWLEDGE

Railroad Rails for Ball-Mill Linings

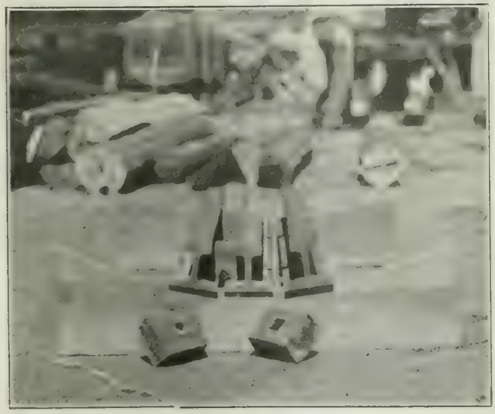
BY PERRY G. HARRISON

Written for *Engineering and Mining Journal*

Recently there has been developed at the mill of the Cia. Minera del Mirasol, S. A., situated at Cusihuiriachic, Chihuahua, Mexico, a ball-mill lining made of standard 60-lb. steel rails that has reduced the cost of shell linings to about one-tenth of the cost of standard manganese steel liners in similar service.

Although ball mills are almost universally lined with solid white castings of manganese steel forgings, it is worthy of note that many years of experiments with pebble-mill linings have resulted in the very general adoption of some form of what may be called a protective type of lining, such as the El Oro or Globe, where a large proportion of the grinding wear is taken up on pebbles wedged between ribs of the metal lining proper.

The rail lining developed at the Mirasol mill is of this so-called protective type, in that the rails are so spaced as to allow slightly worn grinding balls to wedge between them and thus become a part of the wearing surface of the lining. The success of this lining indicates that a properly adapted form of protective lining is as useful in ball-mill service as is the El Oro lining in pebble-mill work.



RAILS AND WASHERS IN POSITION SIMILAR TO THAT OCCUPIED IN LINING

The grinding equipment of the Mirasol mill consists of a No. 5 K. Gates gyratory breaking to 2 in.; a 24-in. Symons disk crusher reducing 2-in. feed to minus ⅜-in.; a Chalmers & Williams 6 x 4½-in. open-and-discharge ball mill operating in open circuit and followed by two Chalmers & Williams 5 x 10-ft. trunnion-type ball mills operating in closed circuit with a Dorr classifier. Grinding is carried to about 65 per cent minus 200 mesh.

The capacity of the Mirasol mill is limited by the tonnage that can be forced through the 6 x 4½-ft. ball mill, which is about 260 tons per day. To get this high tonnage it is necessary to run the mill on minus ¼-in. feed, using an excessive amount of water. The combination of excessive water, 4-in. grinding balls, finely crushed feed and open-end discharge results in short life of linings.

The Mirasol rail lining was designed for use in this service. The cost of a set of this lining is about $155. It will grind 16,000 tons at a grinding cost of about 1c. per ton ground. The standard 2-in. manganese steel lining which has been replaced by the rail lining costs $1,219. It has a life of 11,000 tons and costs 11c. per ton ground.

COST OF LINING OF CHALMERS & WILLIAMS 6 x 4½-FT. BALL MILL

Manganese Steel Lining		Mirasol Rail Lining	
Weight, lb.	6,075	Rail weight, lb.	4,080
Cost Chicago	$948	Washers, 96 lb.	960
Cost delivery	271		
		Total weight, lb.	5,040
Total	$1,219	Rails, cost, @ 3c. lb.	$122
		Washers and bolts	66
			$188
Tons life	11,000	Washers and bolts good for two sets lining, credit	33
Cost per ton ground	11c.		
			$155
		Tons life	16,000
		Cost per ton ground	1c.

Manganese steel linings for the 5 x 10-ft. ball mills cost $2,170. They have a life of 21,000 tons and cost 10c. per ton ground. No grinding data are as yet available for rail lining in these mills, but as this lining costs only about $250 and the wear is less severe than in the 6-ft. mill, there is certain to be a considerable reduction in grinding cost.

The railroad rail lining is made in the mine shops. Full length second-hand rails are used. They are cut to length, and bolt notches are started in the flanges with a power hacksaw. The washers which hold the rails in place are cast from scrap manganese steel which is melted down in a home-made cupola furnace. A set of ninety-six washers, weighing 960 lb., is molded and cast in three shifts. One set of washers will wear out two sets of rails.

The rails are cut so as to leave 2 in. between the rail ends and the end liners of the mill. This allows replacing end lining without removing the shell lining. The washers, which are about 4 in. long, and fill the space between the rails less 1/16 in. clearance, are of proper width to hold the rail balls, which face the center of the mill, about 2½ in. apart. There is a bolt hole and deep countersink cast in each washer, through which passes the ¾-in. machine bolt that holds the lining to the shell of the mill. Two washers are ample for a 4 or 5-ft. rail length. An Ingersoll-Rand Little David air drill is used for drilling the many new holes through the shell required for the rail lining. Lock washers similar to regular washers, but cast in halves, are used for putting in the last rail of a set of lining. The bolt going through the two halves of a lock washer holds them from slipping.

Although it is often almost impossible to remove the first section of a worn-out manganese steel lining, this difficulty is never great with the rail lining. A mill can be unloaded, lined, and reloaded in less than twenty-four hours. The rail lining can be put in full operating service as soon as the last rail has been bolted in place and the mill filled with balls. It is not necessary to hand-fill the space between the rails, as the regular operation of the mill will solidly pack the rails in a mixture of partly ground pulp and worn balls, which becomes a part of the lining and affords protection to the rails from breaking down under the blows of the grinding load.

The Mirasol rail lining is easily changeable, is made of standard, low cost, easily obtainable material, and has effected a substantial reduction in grinding cost where it has been tried. Any mill can easily be adapted to its use. Its success offers a promising field for experimentation in other mills where the cost of steel is a serious item of operating expense.

A Portable Acetylene Generator for Welding

By Robert C. Baker

Written for *Engineering and Mining Journal*

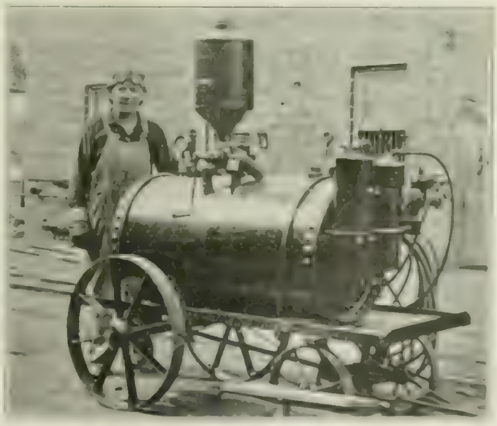
A great deal of difficulty is often experienced at outlying mining camps in obtaining tanks of acetylene gas for use in oxy-acetylene welding. This causes a great loss of time and many times seriously delays important work. To meet this difficulty at the Moctezuma Copper Co., Nacozari, Sonora, Mexico, the generator here described was devised and built. It is in service at present and giving satisfaction. Credit for the design and construction of this machine is due Joseph P. Flynn, who is looking after the welding at the plant.

The machine, as seen in the accompanying photograph, is of the carbide-to-water type. The carbide is placed in the hopper-bottomed, cylindrical container shown. The filler is a 3-in. pipe sleeve, welded into the top of the container and hermetically sealed by a 3-in. pipe plug, which prevents the escape of gas. The container is made from a piece of 10-in. pipe, about 12 in. high, and contains about 35 lb. of ¼-in. carbide. Feeding into the water chamber is effected by means of a hand crank and worm, similar to the arrangement in an ordinary kitchen meat chopper. A 2½-in. tee is connected to the bottom of the container with a close nipple, and this tee is in turn connected to a 2½-in. cross. The worm shaft enters the tee in this machine through a bearing with a packed gland improvised from a discarded valve top. Two plugs are provided for cleaning.

The water chamber, which is made from a discarded locomotive air tank, is about 24-in. in diameter by 40-in. long. A safety valve, set to pop at 20 lb., and a pressure gage is placed on top of the tank. A 2-in. sleeve and plug is welded into the top of the tank to provide for filling and washing out, and a 2-in. clean-out valve at the bottom. A ¾-in. petcock is placed about three-fourths of the distance up, in the end of the tank for determining the water level. The gas passes from the main chamber by means of a 1-in. pipe, connected into the bottom of the first auxiliary tank, which is also three-quarters filled with water, the level being determined by means of a ½-in. petcock. The upward passage of the gas in this first chamber is for the purpose of purifying and washing. This also acts as a safeguard against "flash back" and prevents ignition of the gas in the main chamber in case of backfire. This tank is made from 6-in. standard pipe 16-in. high, and is provided with a 2-in. plug at the top for filling and washing, and a ½-in. petcock at the bottom for draining.

The washed gas passes from the top of this first auxiliary tank to the bottom of a second auxiliary tank by means of ¾-in. piping. At the bottom of this second tank, a 3-in. gas chamber is maintained by means of a small stand covered with fine mesh screen. The gas passes upward through a 12-in. layer of ½-in. coke to another 3-in. gas space at the top of the tank. This is for the purpose of drying the gas. This tank is also 6-in. in diameter by 16-in. high and is covered at the top with an ordinary 6-in. pipe cap for filling and renewing the coke, and is also provided with a ¾-in. petcock at bottom for draining off the collected moisture. A fine-mesh screen is also placed in the top of this tank to prevent the egress of fine particles of coke. The gas passes from the top of this tank directly to the hose, through a ½-in. pipe provided with a valve. In this apparatus the gas pressure is regulated by the amount of carbide introduced into the water chamber by means of the crank and worm, so that no acetylene regulator is required at this point.

A cradle for holding a tank of oxygen is placed on the side of the apparatus and the regular procedure is followed from this point. The whole apparatus is mounted on a small wagon as shown, for convenience in moving about the work. The hand crank is removed when the apparatus is not in use, and the shaft covered with a pipe cap locked in place to prevent anyone from feeding carbide into it and possibly causing accident to the apparatus.



MOCTEZUMA COPPER CO.'S PORTABLE ACETYLENE GENERATOR FOR WELDING

The entire water chamber should be washed out and the carbide sludge removed each time the apparatus is charged.

The principal advantages of this device are: First, convenience, and the ability to manufacture gas in places where it is difficult to obtain tank acetylene; second, cheapness, it being possible to manufacture gas for about one-third of the price of that purchased in the tanks; and third, the extreme simplicity and practicability of the outfit.

The gas pressure, as mentioned above, is controlled entirely by the amount of carbide fed into the water chamber with the hand crank, and any pressure desired by the welder can be maintained at will. About 500 cu.ft. of gas can be made with 100 lb. of carbide. This figure, however, is quite conservative, and ordinarily about 450 cu.ft. will be found nearly correct.

THE PETROLEUM INDUSTRY

The Venezuelan Petroleum Industry in 1920*

By ARTHUR H. REDFIELD
Written for *Engineering and Mining Journal*

THE YEAR 1920 in the Venezuelan oil fields was characterized by far greater activity in the speculative than in the producing phase of the industry. Though a feverish activity was manifested in the taking out of concessions, chiefly for speculative purposes, the actual work of drilling for oil was conducted by only four companies. Commercial production remained as before, in the hands of a single enterprise. In a field somewhat removed from the consuming centers, where primitive conditions of transportation hinder the procuring of necessary equipment for drilling and for the shipment of oil when obtained, it is not surprising that more interest should be manifested in speculation in oil lands than in the prosaic and often discouraging task of drilling for oil.

NEW LAW REVIVES INTEREST IN CONCESSIONS

The enactment of the new petroleum law, which went into effect June 30, 1920, was followed by considerable activity in taking out concessions. A greater number of concessions, covering nearly three times as great an area, were awarded to individuals in the latter half of 1920 than in the entire period from 1878 (the year of the concession to the Compañia Petrolia del Táchira) to June 30, 1920.

Production of crude oil was increased by the Caribbean Petroleum Co. Drilling, however, has languished with all companies concerned. A more vigorous campaign of drilling is hardly to be expected in Venezuela until roads can be built, tractors can be obtained, tanks erected, and the facilities assured which will permit the profitable handling and marketing of the oil obtained.

The fate of the vast concession of the Colon Development Co., Ltd., which hung in the balance during the progress of the suit in equity instituted by the Venezuelan government for the annulment of the concession, was settled by a compromise out of court. This disposition of the case affects favorably several other British-controlled concessions, whose titles stood in the same doubtful relation toward the Venezuelan government.

For further and more detailed information on the operations of the oil companies, the location, extent, and terms of the concessions granted, and developments in the petroleum industry of Venezuela than is given in this paper, the reader is referred to the annual report of the Ministerio de Fomento to the Venezuelan Congress in 1921. This report includes the annual statements required to be made by the oil companies, in which geologic as well as development data occur.

No fewer than 176 concessions, covering 2,463,911 hectares (6,085,900 acres) were taken out in the latter half of 1920 under the provisions of the new Venezuelan petroleum law. The distribution of these concessions by states is shown by the following table:

CONCESSIONS TAKEN OUT IN VENEZUELA IN 1920 UNDER THE PETROLEUM LAW OF JUNE 30, 1920

State	Number of Concessions	Area Covered, Hectares	Acres
Zulia	53	746,350	1,843,500
Monagas	29	445,992	1,101,600
Trujillo	11	317,255	783,600
Táchira	20	265,562	656,000
Mérida	15	210,900	520,900
Ty. Delta-Amacuro	14	197,000	486,600
Falcón	6	80,550	199,000
Sucre	6	89,500	221,000
All other states	22	110,802	273,700
Totals	176	2,463,911	6,085,900

These concessions have been taken out by various Venezuelan citizens who are in most instances holding them either for speculative purposes or are acting in the interests of foreign oil companies.

The concessions for the exploitation of petroleum and asphalt granted prior to the petroleum law of 1920 number 74 and cover 827,861 hectares (2,044,800 acres). The principal holders of these are the Caribbean Petroleum Co., 122,251 hectares (302,000 acres), Araguao Exploration Co., 40,000 hectares (99,000 acres); Urdaneta Exploration Co., 55,263 hectares (136,500 acres); Venezuelan Oilfields, Ltd., 80,000 hectares (198,000 acres); Perijá Exploration Co., 75,000 hectares (185,000 acres); Paez Exploration Co., 73,680 hectares (182,000 acres); Miranda Exploration Co., 79,420 hectares (196,000 acres); Mara Exploration Co., 75,000 hectares (185,000 acres); Addison H. Mackay, 38,000 hectares (93,900 acres); and Hector Aranada, 87,500 hectares (216,000 acres).

It is noteworthy that, with the exception of the Caribbean Petroleum Co., the companies which have been most active in efforts to obtain commercial production have contented themselves with small acreages. For instance, the Venezuelan Oil Concessions, Ltd., holds only 490 hectares (1,200 acres); British Controlled Oilfields, Ltd., only 50 hectares (125 acres); and the Bermudez Co., only 4,500 hectares (11,100 acres). Moreover, the Caribbean Petroleum Co. has been steadily reducing its holdings, by surrendering to the Venezuelan government areas which it has found unproductive. The princely domain formerly held by the Colon Development Co., Ltd., under the Vigas concession, which covered about 2,000,000 hectares (5,000,000 acres) has now been cut to a mere 800 hectares (2,000 acres).

The Caribbean Petroleum Co. was the only commercial producer of petroleum in Venezuela during 1920. Production was confined to the Mene Grande field, in the district of Sucre, State of Zulia, on the eastern shore of Lake Maracaibo. The Caribbean Petroleum Co. is a subsidiary of the Royal Dutch-Shell group and of the General Asphalt Co., of Philadelphia, through the Burlington Investment Co., of London.

---

*Furnished by permission of the Director, U. S. Geological Survey.

The production of crude petroleum in Venezuela during 1920, by months, is shown in the following table:

[illegible]

	[illegible]	[illegible]
January	[illegible]	[illegible]
February	[illegible]	[illegible]
March	[illegible]	36,862
April	[illegible]	42,240
May	[illegible]	48,845
June	[illegible]	[illegible]
July	[illegible]	[illegible]
August ...	[illegible]	40,804
September	[illegible]	51,488
October	4,721	[illegible]
November	7,534	49,416
December	5,676	37,228
Total	[illegible]	[illegible]

Of the 69,539 metric tons (456,106 bbl.) extracted by the Caribbean Petroleum Co. from its Mene Grande wells, 2,345 tons (15,381 bbl.) was used by the company as fuel at the wells, and 67,193 tons (440,719 bbl.) refined at San Lorenzo.

The sales in Venezuela during [illegible] of refined oils produced at the San Lorenzo refinery are illustrated by the following table:

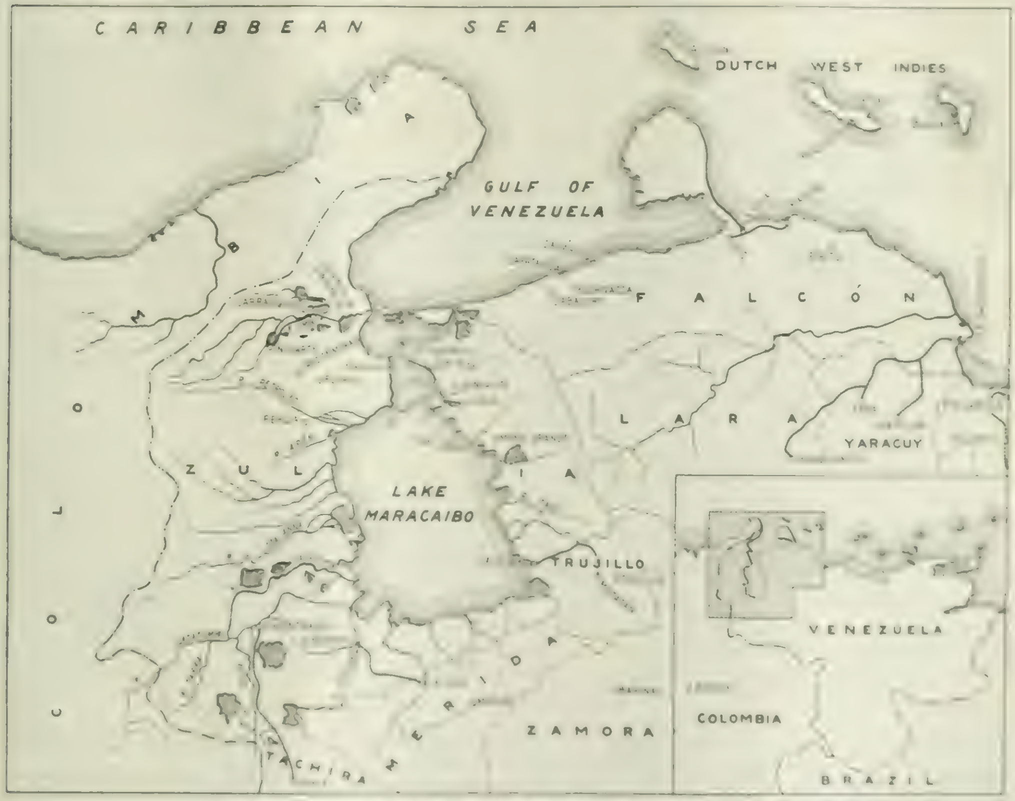
[illegible]

	1919		1920	
	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

In addition, the Caribbean Petroleum Co. sold [illegible] tons of fuel oil and 116 tons of gas oil in 1920.

For the shipment of its products, the Caribbean Petroleum Co. obtained during 1920 three tank barges, in addition to the four already in service. Steps were taken to obtain four more. With the additional transport facilities at its disposal, the company was able to begin the exportation of fuel oil which had accumulated in the storage tanks at San Lorenzo for lack of means of shipment. The exports of fuel oil during 1920 were 41,869 metric tons.

Two additional steel storage tanks, of 8,000,000 liters (50,400 bbl.) each, were built at San Lorenzo, and one of equal capacity was ordered from the United States, to be erected at Mene Grande. Storage facilities for light oils are being prepared at Caracas, and a system of distribution is being worked out. Two railroad tank-cars have been imported from the United States, to be used on the railroad between La Guayra and Caracas. Two steel tanks of [illegible] metric tons' capacity, to be erected at Puerto Cabello and at Maracaibo respectively, have been bought in the United States. At La Guayra the company has installed a large pump for supplying steamers with fuel oil.



[illegible]

[illegible]

In the Mene Grande field the Caribbean Petroleum Co. continued drilling on wells [illegible] and Zumbador No. 3.

Well Zumaque No. 2 was drilled during 1920 by the cable system from a depth of 1,079 ft. to 1,141 ft., chiefly through sandy shale. Numerous shows of oil were struck, but in small quantities and of inferior quality. Water was struck at 1,102 ft. and at 1,135 ft. At 1,099 ft. the well was plugged, and a test of production was made. The quantity of petroleum obtained was very small. The well was finally plugged with cement at 1,053 ft., the casing pulled, and the hole abandoned.

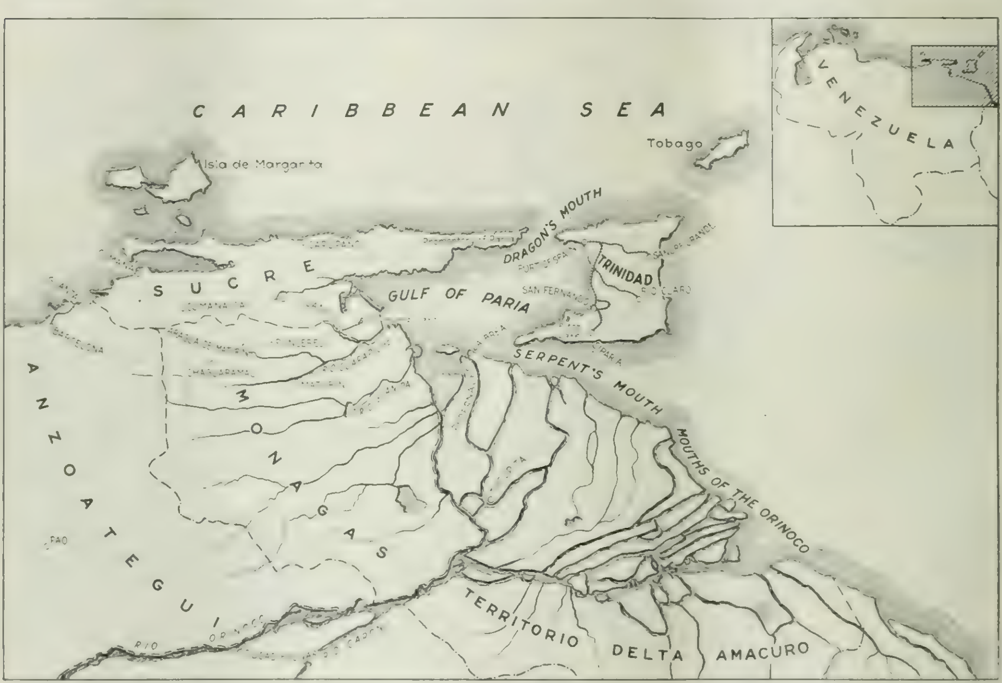
Well Zo No. 1 had been advanced from 968 ft. to 991 ft., and the 21-cm. casing carried to 987 ft. From 968 ft. to 981 ft. the strata were sandstone, and from 981 ft. downward were sandstone with shale. Oil was encountered, but a test showed the quantity to be small. The casing was accordingly pulled and the well abandoned.

Well Zo No. 2 was begun during the year and sunk to 636 ft. The formations met were chiefly sandy shale, shale and sandstone. A heavy oil was struck in small quantity at 544 ft. in a sandstone formation, 23 ft. thick. Between 626 ft. and 636 ft. oil was found in good quantities. The initial production reached 110 metric tons a day, but fell off to an insignificant quantity. Drilling has been continued.

Well Zumbel No. 2 was drilled to a depth of 784 ft. by the rotary system, and from 784 to 1,765 ft. by the cable system. The formations encountered were chiefly alternating sands and clays. Shows of heavy oil occurred between 820 ft. and 918 ft. and between 1,410 ft. and 1,722 ft., accompanied by gas. Drilling has been continued on this well.

Well Zumbador No. 2, begun July 28, 1920, was drilled to 134 ft. by the rotary system and from 134 ft. to 817 ft. by the cable system. Several asphalt sands were encountered between 125 ft. and 459 ft., and asphalt sands with gas from 459 ft. to 485 ft. and from 502 ft. to 525 ft. Oil sand with gas was struck at 813 ft. Work on this well was being suspended at the end of the year to bring up to the well a special perforated casing and penetrate the oil-bearing stratum to a greater depth.

Well Zumbador No. 3 was drilled through sands and clays to 216 ft. by the cable system, and from 216 ft. to 751 ft. by the rotary system. The formations drilled through by the rotary system alternated between asphalt sands, some of which were gas-bearing, and clays. Beginning at 121 ft. shows of a very heavy oil were numerous. An oil sand was struck at 751 ft., with little oil but with gas under considerable pressure. The casing had to be withdrawn from a depth of 728 ft. to 676 ft. Work is being continued on this well.



SKETCH MAP OF THE PARIA OIL DISTRICT, VENEZUELA

Production in the Mene Grande field during 1920, with comparative figures for 1919, is given in the following table:

CRUDE PETROLEUM PRODUCED IN THE MENE GRANDE FIELD
1919-1920

	1919		1920	
Well	Metric Tons	Barrels	Metric Tons	Barrels
Zumbador No. 1	36,862	241,775	51,448	337,448
Zumba No. 1	6,592	43,236	9,730	63,819
Zumbel No. 1	336	2,202	1,546	10,140
Zumaque No. 2	102	670	532	3,489
[illegible] No. 1	528	3,463	524	3,436
Zumaya No. 1	19,068	125,066	3,753	24,617
Zo No. 1	1,140	7,483	2,006	13,157
Totals	64,628	423,895	69,539	456,106

The specific gravities of the oils obtained from the Mene Grande wells are shown by the following table:

DENSITIES OF CRUDE OILS EXTRACTED FROM MENE GRANDE WELLS

Well	Specific Gravity	Degrees Baumé
[illegible] No. 1	[illegible]	[illegible]
[illegible] No. 1	[illegible]	[illegible]
[illegible] No. 1	[illegible]	[illegible]
[illegible] No. 1	[illegible]	16.14
[illegible] No. 1	[illegible]	[illegible]
[illegible] No. 1	[illegible]	[illegible]
[illegible] No. 2	[illegible]	[illegible]
[illegible] No. 2	[illegible]	[illegible]

PRINCIPAL PRODUCING AREAS

Miranda Field—In the district of Miranda, State of Zulia, the Caribbean Petroleum Co. finished the construction of a wagon road from La Rosa to Quiroz, built the dwelling houses necessary for a camp, and made preparations for drilling in this field.

Perijá Field—Two areas in the municipality of Rosario, district of Perijá, State of Zulia, known as Zanca and Zancada, of 500 hectares (1,250 acres) each, were renounced by the Caribbean Co. in 1920. Only one area of 500 hectares, known as Zambapalo, remains to the company.

Las Sierritas Field—West of Lake Maracaibo the Caribbean Petroleum Co. concluded in 1920 the drilling of Well Zablación No. 2 in the Las Sierritas field, district of Mara, State of Zulia. This well was drilled by the cable system from a depth of 1,168 ft. to 2,719 ft. through formations chiefly of shale and sandy shale. At 1,968 ft. shows of petroleum were obtained, but not in commercial quantity. At 2,709 ft. salt water was encountered. For this reason drilling was stopped at 2,719 ft., the casing was pulled, and preparations were made to transfer operations to another place.

BRITISH CONTROLLED OILFIELDS, LTD.

In Eastern Buchivacoa, the British Controlled Oilfields, Ltd., after geologic examination of the territory, decided to begin drilling near Bernardino and Monte Claro. The harbor of Gutiérrez, near Puerto Zazárida, was chosen as a temporary landing place for drilling material and supplies, and the town of Dabajuro as field headquarters. A Holt tractor, two Ford trucks, two automobiles, and six trailers supply the company's transportation needs. Drilling material and supplies were shipped from Maracaibo via Gutiérrez to Dabajuro, and a few buildings were erected at Dabajuro and at the oil fields.

In western Buchivacoa, the British Controlled Oilfields, Ltd., continued drilling by the cable system on the test well at El Mene, begun by its predecessor, the Venezuela-Falcón Syndicate, Ltd. Before long, a water-bearing stratum was encountered, giving 40,000 liters (250 bbl.) of water a day. Although the water would have been quite useful for the boilers, it was cased out with cement and drilling was continued. At a depth of 620 ft. petroleum was struck under sufficient gas pressure to make a flowing well. The oil was of a paraffin base and of good quality.

The first well in the El Mene field, sunk in the expectation of obtaining oil, was begun in June, 1920, and was drilling during the year to a depth of 1,380 ft., through formations consisting chiefly of dark clays and shales. Traces of gas were found. The drilling was considerably delayed through an accident to the tractor, which hindered the transport of the necessary casing pipe. Drilling was by the cable system.

Geologic exploration occupied the attention of the Venezuelan Oil Concessions, Ltd., during 1920. At the close of the year a drilling site was selected in the La Paz field, district of Maracaibo, State of Zulia. Drilling was to be begun in the early months of 1921.

Drilling in the company's proved fields in the Maracaibo and Bolivar districts of Zulia was not continued in 1920, as the problem of transporting the oil from the wells to the coast is by no means solved. Efforts are being made by the Venezuelan Oil Concessions, Ltd., to provide shipping facilities for its wells.

The Venezuelan Oil Concessions, Ltd., like the Caribbean Petroleum Co., is a subsidiary of both the Royal Dutch-Shell group and the General Asphalt Co., of Philadelphia, through the Burlington Investment Co., which holds 65 per cent of the shares of the Venezuelan Oil Concessions, Ltd.

The Colon Development Co., Ltd., a Burlington subsidiary, continued the drilling of Well Techo No. 3, formerly known as Well No. 6. From a depth of 328 ft. at the beginning of 1920 the well went through formations of chiefly sandy shale, with intercalated shale and sandstone, to a depth of 1,404 ft. at the end of the year. Considerable delay was occasioned by the jamming of the tools in the well. Only a small quantity of very heavy petroleum, of no commercial value, was encountered. Drilling was to be continued in 1921.

The company is devoting much attention to the problem of transportation. The attacks of the hostile and savage Motilones Indians continue to be a menace.

NORTH VENEZUELAN PETROLEUM CO., LTD.

The North Venezuelan Petroleum Co., Ltd., made preparations during 1920 to exploit its concession at El Pozón, in the district of Acosta, State of Falcón. A road was built from the company's harbor on Point Chichiriviche to El Pozón, a distance of thirty-five miles. Drilling equipment, shipped from the United States via Puerto Cabello, was hauled by a Holt caterpillar tractor over this road to the oil field. The heavy rains of the wet season hindered haulage over the company's road considerably. An aqueduct was built to bring water from Rio Tucurere.

Test drilling was begun at Antoncoro in the municipality of Piritu, district of Zamora, Falcón, with a small rig. Geologic examination was made of this field.

ACTIVITIES OF OTHER COMPANIES

The activities of the Paez Exploration Co. in the district of Perijá, State of Zulia, and of the Sucre Exploration Co., in the district of Miranda, State of Zulia, did not go far beyond geologic exploration of their concessions. The Miranda Exploration Co.'s drill rig and equipment arrived at Maracaibo during the year, and were shipped to Altagracia on their way to La Victoria, to the east, where a 100-ft. derrick was built. The Mara Exploration Co. had its rig up and had brought its equipment to Maracaibo, preparatory to drilling near Perijá.

ACTIVITIES IN THE [illegible] DISTRICT

The New York & Bermudez Co., operating under the name of the Bermudez Co., continued exploration in the Guanoco field and complied with the formalities necessary to keep its concessions in the district of Benitez, State of Sucre. So far petroleum has not been found in commercial quantities.

The Caribbean Petroleum Co. continued operations in its eastern fields, at Chapapotal, fourteen miles northwest of Maturín, at El Hervidero, near Chaguaramal, and on Rio Guanipa. Eight wells have been drilled to depths varying from 164 ft. to 275 ft. No indications of the presence of oil in commercial quantities were encountered to the end of the year.

COST DATA OF THE INDUSTRY

Estimates of the probable cost of drilling oil wells in the district of Democracia, State of Falcón, were given in the annual report for 1921 of the Ministerio de Fomento to the Venezuelan Congress. The source of the estimates is not stated.

The general physical conditions of the district of Democracia are typical and its distance from the coast is roughly about the average. Thus the following calculations on the cost of drilling for six months with a portable drill rig in the district of Democracia may be considered as representative:

ESTIMATED COST OF DRILLING 920-FT. WELL IN DISTRICT OF DEMOCRACIA, STATE OF FALCON

Items	Cost Bolivares	Cost U. S. Currency (a)
Portable drill rig and tools at La Vela	30,000	$5,800
365 ft. of 10-in. casing	6,800	1,300
730 ft. of 20-in. casing	11,200	2,150
915 ft. of 6-in. casing	8,000	1,550
Two drillers	32,000	6,200
Twelve laborers	15,000	2,900
Miscellaneous charges	50,000	9,650
Totals	153,000	$29,550

(a) All conversions made from bolivares at par value of bolivar in U. S. currency, $0.193.

The miscellaneous charges include the construction of houses for the workmen, maintenance of personnel, and provision of water in the dry season, on the assumption that no especial installations will be necessary. Though not specifically mentioned, the cost of transporting the equipment from the port to the oil field is probably included in the miscellaneous charges.

The cost of a 750-m. (2,460-ft.) well, drilled by the standard cable-tool system, in the same district was estimated as follows:

ESTIMATED COST OF DRILLING 2,460-FT. WELL IN DISTRICT OF DEMOCRACIA, STATE OF FALCON

Items	Cost Bolivares	Cost U. S. Currency
Wooden derrick 82 ft. to 115 ft. high	60,000	$11,600
Boiler and engine	20,000	3,850
Tools	50,000	9,650
545 ft. of 16 -in. casing	15,000	2,900
920 ft. of 12½-in. casing	21,000	4,050
1,750 ft. of 10 -in. casing	27,200	5,250
2,395 ft. of 8 -in. casing	34,000	6,550
2,755 ft. of 6 -in. casing	30,000	5,800
Tractor and trucks for transport	60,000	11,600
Transport of material	150,000	28,950
Miscellaneous charges	73,000	14,100
Two drillers for eighteen months	96,000	18,500
Twelve laborers for eighteen months	46,800	9,000
Totals	683,000	$131,800

If oil should be struck at 280 m. (920 ft.) the foregoing costs may be reduced by the following items:

DEDUCTIONS TO BE MADE FROM FOREGOING FOR 920-FT. WELL

Items	Cost Bolivares	Cost U. S. Currency
Casing 16, 12½, 10, 8 and 6 in. sizes	91,200	$17,600
Two drillers for twelve months	64,000	12,350
Twelve laborers for twelve months	31,200	6,000
Costs of constructing camp	73,600	14,200
Totals	260,000	$50,150

The cost of a 280-m. (920-ft.) well would accordingly be 423,000 bolivares ($81,650). The unused casing could be utilized in drillnig another well. Tools to the value of 120,000 bolivares, ($21,320) would also remain for further use.

Estimates of the cost of storing, pumping, and shipping the oil and of the pipe-line from the wells to Puerto Zazarida are as follows:

ESTIMATED COST OF STORING, PUMPING, AND SHIPPING OIL FROM WELLS TO COAST

Items	Cost Bolivares	Cost U. S. Currency
Steel tanks (8,000 tons' capacity)	150,000	$28,950
Pumping station		
Steel building	35,000	6,750
Two boilers, 200 hp. each	104,000	20,100
Two pumps	35,000	6,750
Pipe line, 6 in., length 45 km., at $2,300 per km.	540,000	104,200
Pumping station for loading on shipboard		
Steel building	35,000	6,750
Two boilers, 150 hp. each	90,000	17,400
One pump	40,000	7,700
Two steel tanks	300,000	57,900
Pipe line for loading on shipboard, 12 in. 5 km. at $3,860 per km.	100,000	19,300
Dwellings and plant	25,000	4,800
Totals	1,454,000	$280,600

These figures include transportation and labor.

The experience of the Caribbean Petroleum Co. in the actual cost of drilling wells is given in the following statement:

ACTUAL COST OF WELLS DRILLED BY CARIBBEAN PETROLEUM CO.

Well	District	State	Depth in Feet	Cost Bolivares	Cost U. S. Currency
Zancada No. 1	Perija	Zulia	2,240	530,000	$102,300
Zilfona No. 1	Perija	Zulia	1,915	680,000	131,250
Molestia No. 2	Piar	Monagas	3,240	680,000	131,250
Zablacion No. 2	Mara	Zulia	2,750	560,000	108,100

From the legal standpoint the two most noteworthy events of 1920 in the Venezuelan petroleum industry were the going into effect of the new petroleum law and the settlement of the Colon Development Co. suit out of court. An excellent translation of the Venezuelan petroleum law of June 30, 1920, is given in a recent bulletin of the Bureau of Mines.[1] The Colon Development Co.'s suit may be briefly reviewed. Its significance lies not so much in the legal principles involved as in the vast area of the concession the title to which was in dispute.

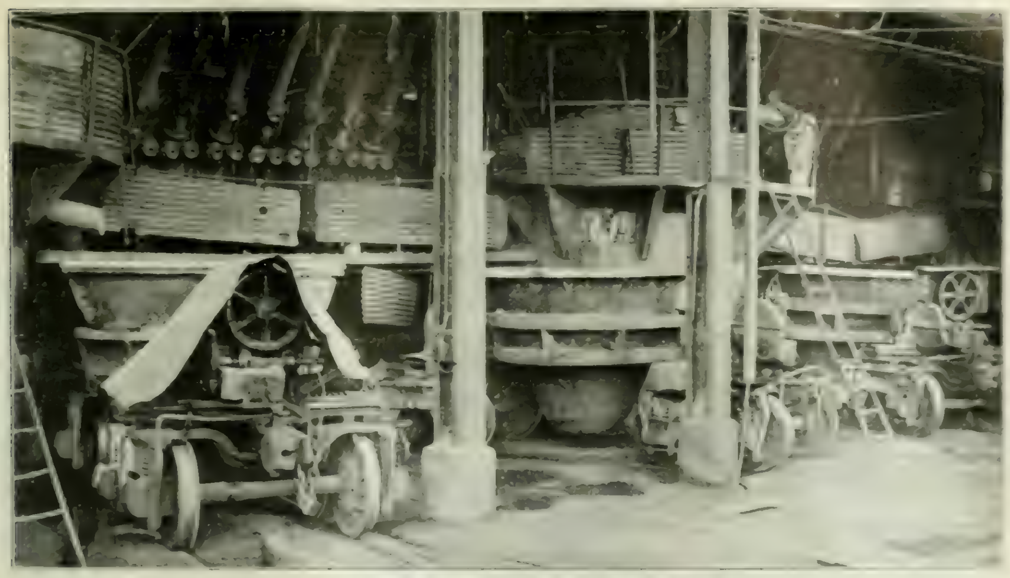
In the suit in equity which was instituted by the Ministerio de Fomento against the Colon Development Co., the Venezuelan government asked the annulment of the Andrés Jorge Vigas concession, acquired in 1913 by the company, to 5,000,000 acres, covering practically the entire Colon district, State of Zulia. The original concession, granted Jan. 31, 1907, was for fifty years, and carried with it a yearly rental of 16c. per acre. This rental, the Venezuelan government claimed, was never paid. The government alleged, moreover, that the Colon Development Co. had entered upon only 2,000 acres of the concession and that for thirteen years no active operations had been prosecuted.

By the terms of the compromise, the Colon Development Co. engages to select within five years' time certain areas of the district of Colon for exploration, surrendering the remainder of the original concession area to the Venezuelan government for its free disposal. At the end of the five years the company will pay to the government a quarterly rent of 0.20 bolivares per hectare ($0.015 per acre). At the end of a second term of five years the Colon Development Co. must make a final selection of certain areas for development, surrendering the remainder of its holdings to the government. The payment of 0.20 bolivares per hectare will not be required for those areas definitely selected for development within the first term of five years; only the ground rent named in the original concession will be exacted.

The Vigas concession is recognized as existing in full force, subject to certain modifications made by the Ministerio de Fomento on May 12, 1921. It is considered valid, however, for only the 800 hectares (2,000 acres) actually entered upon by the company.

---

[1] Thompson, J. W., "Petroleum Laws of All America." Bureau of Mines Bulletin No. 206, pp. 604-643, Washington, 1921.



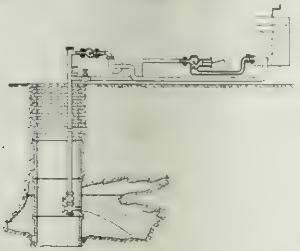
BLAST FURNACE SLAG REMOVAL AT COPPER QUEEN SMELTER, DOUGLAS, ARIZ.

Copper Smelters in the Southwest

CONVERTERS AT THE CALUMET & ARIZONA SMELTER, DOUGLAS, ARIZ.

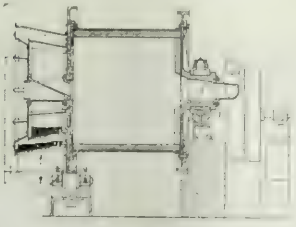
Recent Patents

Sealing Off Water—No. 1,391,678. Albert Francois, Doncaster, England. A method of consolidating and shutting off underground water, which consists in drilling small-diameter boreholes to the space to be filled, lowering pipes into these holes which are connected to low- and high-pressure pumps, forcing filling material such as cement into the space at low pressure, and subsequently forcing other filling material into the space at higher pressure.

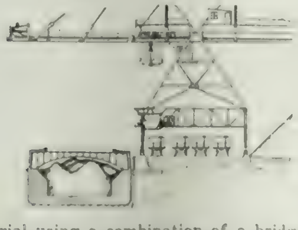


Metallurgy of Beryllium—No. 1,392,045. H. S. Booth and G. G. Marshall, Cleveland, Ohio. Process for recovering beryllium from its ores which consists in preparing a furnace charge of the material to be treated, in crushed form, adding a halogen salt of an alkaline earth metal or alkali metal, heating, and recovering the beryllium as a haloid of that metal. Patent No. 1,392,046 covers the same process, using a halogen instead of a halogen salt.

Ball-Mill Discharge—No. 1,392,887. J. R. Broadley, London, England. A method of exterior screening on a ball mill in which the oversize material is returned to the interior of the mill for further grinding, substantially as shown in the accompanying illustration.



Ore Bridge—No. 1,392,382. C. S. Williamson, Chicago, Ill. An apparatus for handling ore, coal, and other material using a combination of a bridge supported on tracks, receiving hopper, lifting bucket, weighing lorry, and means for discharging from the weighing lorry.

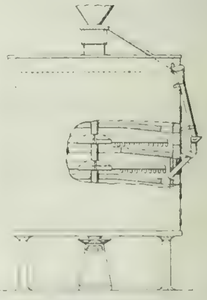


Vanadium Recovery—No. 1,392,745. L. S. Copelin, Millers, Nev. The patent covers the addition of a magnesium salt in the treatment of solutions for the recovery of vanadium.

Metallurgy of Aluminum—No. 1,392,043. H. S. Booth and G. G. Marshall, Cleveland, Ohio. Material containing aluminum and silica is mixed with a chloride and heated to form chloride of aluminum, which is then volatilized and collected. Patent No. 1,392,044 employs a haloid under the same conditions, but the aluminum haloid, instead of being volatilized, is leached

Flotation of Oxidized Ores—British Patent No. 168,098, 20.4.20. L. A. Wood and Minerals Separation, Ltd. The finely divided ore—e. g., tin ore or carbonates, or silicates of lead or zinc—is treated in a froth flotation machine with a frothing agent consisting of a fatty acid or one of its compounds, such as soap, in the presence of carbon dioxide as a gangue modifying agent. The gas is introduced into the pulp during agitation or aeration. — *Journ. Soc. Chem. Ind.*

Roaster Feed—No. 1,378,068. W. F. Weeks, Linwood, Pa., assignor to General Chemical Co., New York, N. Y. A method of introducing material on to the various hearths of a multiple-hearth roasting furnace by means of chutes, as shown in the accompanying cut.



Smelting Furnaces—No. 1,394,471. H. L. Charles, New York, N. Y. Means for varying the widths of abutment walls between adjacent furnaces of the reverberatory type, at that portion adjacent the ends of the arch roofs. Patent No. 1,394,472 refers to means for changing the relative specific gravities of matte and slag after reverberatory smelting, to insure a better separation. Patent No. 1,394,473 covers the design of a water-jacketed charge hole in the side-charging of reverberatory furnaces. Patent No. 1,394,474 covers means for absorbing some of the heat from the walls at the flue end of a reverberatory furnace. This consists essentially in embedding water pipes in the brick.

Flotation—German Patent No. 338,845, 9.11.19. K. Schlitzberger. Ore pulp is contained in a funnel-shaped container and is fed to the settling device along with a current of air flowing in the same direction and holding oil in suspension, this current being delivered to the narrower end of the funnel-shaped container by means of an injector pump. An intimate mixture of oil, ore, and gas is thus obtained. The froth is recovered in the usual manner. —*Journ. Soc. Chem. Ind.*

Technical Papers

Western Milling Plants—In 1912 an investigation was made by the U. S. Geological Survey as to the number of reduction mills in the various western states, with details of their equipment, and the results were published in the "Mineral Resources" report of that year. This list has now been revised. Strict accuracy in details is not claimed for the present list, as in the limited time at disposal it was not always possible to send for corrections or additional information. The figures of daily capacity include those of the direct milling, tailing, cyanide, flotation, and smelting plans. Although gold dredges are not considered as reduction plants in the lists given, they really perform that function, not only of digging the gravels, but of concentrating and separating the gold therefrom, and may be considered the most important of the mechanical appliances of placer-gold mining. There were forty of these dredges operating in California in 1920, four in Oregon, three in Idaho, three in Montana, and one in Nevada. For purposes of economy, the list for each state has been bound separately and given a subtitle, and the following are available:

Serial	
2287-A	California
2287-B	Oregon
2287-C	Washington
2287-D	Idaho
2287-E	Utah
2287-F	Montana
2287-G	Nevada
2287-H	Arizona

Copies of these may be obtained by writing to the Director, Bureau of Mines, Washington, D. C. Lists for other western states will also be published by the Bureau of Mines as soon as these are available. Notice will be given in this column.

Corrosion — *Factory* is running a series of articles on the subject of corrosion. (A. W. Shaw Co., Chicago, Ill.; price 25c.) The first article, which appears in the November number, presents some principles that will help one to understand why iron rusts. The hydrogen-peroxide, the carbonic-acid, and the electrolytic theory are presented, the electrolytic theory offering a satisfactory explanation for a greater number of observed facts than do either of the others, according to the author, G. A. Van Brunt.

Sintering—The new sintering equipment of the Cambria Steel Co. at Johnstown, Pa., composed of two Dwight & Lloyd machines with a combined capacity of about 1,000 tons of flue dust per day, is described in detail with several illustrations in *The Iron Age* for Nov. 3. (New York; price 50c.) Apparently the same article, only not so well edited, is also published in *The Iron Trade Review* for Nov. 3. (Cleveland, Ohio; price, 25c.)

Queensland Mining—The annual report of the Under Secretary for Mines, Queensland, for 1920 has been issued, and may be obtained for 4s. from the Government Printer, Brisbane. The report is of 166 pages and covers all mining activities for the year, with statistics in the usual form.

ECHOES FROM THE FRATERNITY

Accidents in Mining Industries Show Decrease in 1920

Accidents in 1920 at all mines, quarries, coke ovens, and metallurgical plants (except iron-blast furnaces) in the United States caused the death of 2,973 employees and the injury of 206,000 others, according to the U. S. Bureau of Mines. In these industries 1,088,000 men were employed last year, who worked a total of 279,400,000 shifts, an average of 257 working days per man. Accident rates based upon a standard of 300 working days to the year show that for every thousand men employed 3.19 were killed and 221.25 were injured. For 1919 the corresponding rates were 3.63 killed and 219.33 injured. These figures do not take into account the large number of slight injuries causing a loss of time of less than one day.

The coal-mining industry employed 4,000 more men in 1920 than in the preceding year. The copper-mining industry employed 4,000 fewer men and in the iron-mining industry there was a loss of 1,700. In the gold and silver mines 2,200 fewer men were employed in 1920 than in 1919. A loss of 1,300 employees occurred in the lead, zinc, and fluorspar mines in the Mississippi Valley states. The quarries of the country gained 11,000 employees. There was a loss of 4,200 employees at metallurgical plants and 600 at coke ovens.

In 1920 all employees averaged a larger number of working days than in 1919. The gain among workers in metal mines averaged 15 days per man.

Movies of Carnotite Mining Shown

The New York section of the Illuminating Engineering Society, at a meeting held the evening of Oct. 20, included a paper "Radio-Luminescence and Its Application," by Dr. V. F. Hess. Dr. Hess touched on the sources of phosphorescence in general and demonstrated the difference between the normal phosphorescing, as developed by ordinary light, and that produced by rays of the radioactive substances. He accompanied his paper with a motion-picture film showing the process by which radium is extracted from the ore and how luminous materials are prepared for practical applications.

MEN YOU SHOULD KNOW ABOUT

P. G. Spilsbury is visiting the Clifton-Morenci district.

Hugh F. Marriott sailed from London for South Africa last week.

C. M. Weld has returned to New York from a two weeks' trip in Kentucky.

M. C. Lake is on the Gogebic Range on geological work for M. A. Hanna & Co.

L. E. Foster has been making examinations in the Steins Pass, N. M., country.

George J. Young, Western Editor of the *Engineering and Mining Journal*, is in New York.

Guy S. Weston has joined the forces of the Great Eagle Fluorspar Co., at Lordsburg, N. M.

Edward Thornton is consulting engineer with the Bishop Creek milling Co., at Bishop, Cal.

Walter J. Eaton has been appointed mine superintendent at the Smuggler Union, Telluride, Col.

J. H. McLean and **J. Uno Sebenius** recently made an inspection trip of the Gogebic and Menominee ranges.

A. G. McGregor has been elected president of the newly reorganized chamber of commerce of Bisbee, Ariz.

Arthur L. Walker, professor of metallurgy in the Columbia School of Mines, has been elected a member of the board of Engineering Foundation. Professor Walker succeeds Dr. Joseph W. Richards, of Lehigh University, who died recently.

ARTHUR L. WALKER

K. Yoshizawa, chief mining engineer for the Mitsui Mining Co., of Japan, recently completed a tour of the Mesabi iron range.

S. L. Willis, formerly with the Federal Trade Commission at Washington, D. C., recently sailed for Europe in the interest of the Corning Glass Works.

L. D. Davenport, formerly chief engineer for the Oliver Iron Mining Co. at Hibbing, Minn., is visiting on the Mesabi Range.

Julien Raick, an engineer of Liege, Belgium, is in Butte studying mining conditions. From there he will go to Kellogg, Idaho.

Carlos Diaz de Medina, of Bolivia, arrived recently in San Francisco from Chile, where he had been examining [illegible] methods.

D. D. Muir, Jr., manager of mines in Utah for the United States Smelting, Refining & Mining Co., is making a short visit to Boston.

Reginald M. Banks sailed for South America on Oct. 26. He will visit Peru, Bolivia, and Chile, and expects to be gone about four months.

Colonel William Boyce Thompson will be among the members of the Advisory Committee at the Disarmament Conference at Washington.

Sidney Jennings has been in Salt Lake City making an inspection of the mines and smelters of the United States Smelting, Refining & Mining Co.

Jerome Drumheller, who has been connected with operations of the Tidewater Copper Co., on the northern British Columbia coast, has returned to Spokane and opened offices there.

E. F. Nieman and **J. L. Inglis**, of Salmon, Idaho, have recently completed an examination of the Bluster and Success groups at Jarbridge, Nev., for Salt Lake and Chicago interests.

Howard R. Ward, eastern representative, and **Errol Mac Boyle**, vice-president, of the International Minerals Syndicate, are at Alamo, Lower California, Mexico, in the interest of that organization.

C. H. Munger, general manager of Pickands, Mather & Co., has completed a tour of inspection of the company's properties in the Lake Superior district. He was accompanied by **W. P. Chinn**, assistant general manager, and **W. A. Rose**, chief mining engineer.

John A. Elton, formerly assistant general superintendent of the Great Falls smelter of the Anaconda Copper Co., has been appointed manager of the International Co.'s smelter at Tooele, Utah., and of that company's zinc oxide plant at East Chicago, Ind., also of the Walker mine, at Portola, Cal. **R. B. Caples**, superintendent of the Great Falls zinc plant, succeeds to the position vacated by Mr. Elton.

OBITUARY

Major Clem Webb, managing director of the *South African Mining and Engineering Journal*, died recently in Johannesburg after several operations.

Kennedy J. Hanley died Oct. 21 at Losa Gatos, Cal. Mr. Hanley operated mines in Pioche, Nev., in the early '70s, later at Coeur D'Alene, Idaho, and also in the Silver Reef district of Utah.

Charles T. Atkins died in Los Angeles on Oct. [illegible], at the age of fifty years. Mr. Atkins was a graduate of the Colorado School of Mines, and was employed first by the Guggenheim Exploration Co. Later he was recognized as an authority on [illegible].

George Dacre Kislingbury was killed by a Mexican on Sept. 28, at the Dolores mine, Chihuahua, Mexico. He was the son of George Kislingbury, who for many years was [illegible] engineer for Captain De Lamar. Mr. Kislingbury's mining career began at the age of sixteen, with the Mercur Consolidated Mining Co., at Mercur, Utah. From there he went to Gold Roads, Ariz., then to Minas del Tajo, Sinaloa, Mexico. During the war he [illegible] at Humboldt, Ariz. [illegible] years ago, he went to the Dolores mine, in Chihuahua, as superintendent of construction, where he met his death. Mr. Kislingbury is survived by a wife and two small daughters.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

The proposed revision of the mining law is exciting considerable comment. Replies of operators to a questionnaire on the subject sent out by the Colorado Metal Mining Board are given in this issue. Utah operators have also discussed the matter.

Questions of mine taxation are bothering mine owners in Canada as well as in the United States. The matter is discussed on pp. 791-92 by our correspondents in Ontario and British Columbia.

The suit over the proposed deal involving the operation of the Star mine in the Coeur d'Alene district of Idaho is to be tried on Nov. 21.

Discovery of copper ore in the Shetland Islands some time ago was widely heralded as of importance. The reverse is indicated by the results of a recent examination which are set forth in the news from London this week.

Conditions in the Joplin-Miami district continue to improve. Last week the American Metal Co. suddenly entered the local market there, buying 6,000 tons of zinc ore.

Little has been said of the results obtained thus far from the geological survey being made of its properties in northern Michigan by the Calumet & Hecla Mining Co. Some benefit is being derived, however, according to our Houghton correspondent.

Americans To Mine Asbestos in Siberia, Perhaps

Washington B. Vanderlip Not Connected With Enterprise

A wild but interesting tale, which may yet prove to be true but probably will not, was contained in an Associated Press dispatch dated Nov. 4 from Moscow, which stated that the Allied Chemical & Dye Corporation would undertake to operate asbestos mines in the Ural Mountains north of Ekaterinburg, in Asiatic Russia. It was said that Dr. Armand Hammer, now a convict in Sing Sing prison, New York, had acted as representative of the company in making the necessary arrangements with the Soviet authorities. Dr. Hammer, prior to his conviction for malpractice, had become prominently identified as a Lenine-Trotzky propagandist. According to the dispatch, the company receives no territorial rights, agrees to settle all differences in Russian courts and meet other Soviet requirements. It also agrees to deposit $50,000 in a Soviet government bank as guaranty and to produce 80,000 lb. of asbestos annually.

Britannia Beach Seriously Damaged by Cloudburst

Attendant Loss of Life, However, Worst Feature of Disaster

The New York office of the Howe Sound Co., which controls the Britannia Mining & Smelting Co., at Britannia Beach on Vancouver Island, B. C., the mining town that was recently damaged seriously by a cloudburst, reports that, according to word received from there, the damage is estimated at $35,000. Thirty-six lives were lost. Practically all the dwellings on the beach, constituting the lower town, were destroyed. The upper town at the mouth of the mine tunnel is unharmed.

Following the catastrophe all work at the mine was suspended. The only operations consisted of development work, upon which forty men were employed. The mill, which is being built to replace the one destroyed last spring, will not be ready before next summer.

Operators State Attitude on Mine Law Revision

The Colorado Metal Mining Board, in an effort to obtain the sentiment of mine owners and operators of the state regarding a proposed codification and revision of Federal mining laws, as embodied in H. R. No. 7,736, now pending in Congress, recently sent out a digest including arguments for and against the measure, and accompanied with a questionnaire in which mine owners were invited to indicate their views regarding the enactment of the bill, or any of the proposed changes.

A return of thirty-five questionnaires shows the following direct replies:

Do you think there is a necessity for material changes in the present Federal mining laws? Yes, 13. No, 21.

If you favor a revision of the present laws, do you think H. R. No. 7,736 embodies the desired changes? Yes, 6. No, 25.

If opposed to the enactment of H. R. No. 7,736 as it stands, would you favor it if so amended as to apply only to new districts, leaving existing districts subject to the operation of present laws? Yes. 6. No, 23.

Do you think H. R. No. 7,736 might be used as the basis of a desirable bill? Yes, 11. No, 20.

Do you favor the abolishment of extralateral rights? Yes, 14. No, 17.

Do you think discovery requirement, as a prerequisite to location, should be abolished? Yes, 8. No, 23.

Do you favor the proposed change in size of claims? Yes, 6. No, 27.

Do you think the boundaries should conform to legal subdivisions of the public survey? Yes, 2. No, 30.

Do you favor the option of a cash payment in lieu of annual assessment work? Yes, 6. No, 25.

East Pool & Agar To Sink Shaft

By Cable From Reuters to "Engineering and Mining Journal"

London, Oct. 31—Directors of the Eastpool & Agar Tin Mining Co. of Cornwall have approved plans for the sinking of a new shaft. Operations will start at once.

White Miners on Rand Reported To Have Threatened Strike

Object to Increasing Proportion of Native Workers at Properties

By Cable From Reuters to "Engineering and Mining Journal"

Johannesburg, Nov. 11—A crisis has arisen in the gold-mining industry. The miners threaten to strike against the government's proposal to effect economies in the working of the mines by increasing the efficiency of native labor.

The miners declare that the proposal means the abolition of the color line, which would bring about a decrease in the number of whites employed.

Press dispatches dated Nov. 5 from Johannesburg report that a general strike of the white employees at the gold mines on the Rand was threatened on Nov. 5 if the Government of the Union of South Africa should put into force its proposals providing for a slight increase in the percentage of native labor employed. The threats were made in the course of negotiations between representatives of the Government and the white miners. The miners' secretary told the premier, Jan C. Smuts, that the white miners would leave the workings within forty-eight hours after getting the proposals.

Premier Smuts, after pointing out that the present prosperity of the industry was due entirely to the existing premium on gold, declared that the mines should be more thoroughly exploited, and that he was convinced the plan would, in the end, bring about an increase in the employment of white labor.

France May Obtain Concession in Angora

By Cable From Reuters to "Engineering and Mining Journal"

Paris, Nov. 2—The Angora government is reported to favor a proposal to grant a concession for ninety-nine years to a French financial group for the exploitation of iron and chrome-silver mines in the Marckin Valley.

Supreme Court Affirms Decision on Hibbing Removal

Holds Business Men Not Entitled to Damages for Losses Suffered

The Minnesota Supreme Court on Oct. 21 affirmed the decision of the St. Louis County District Court in the case of H. P. Reed and seventy-two others against the village of Hibbing, the Oliver Iron Mining Co. and the Duluth, Missabe & Northern Ry. in holding that the plaintiffs are not entitled to damages of $500,000 sought. The defendants were charged with a conspiracy to move the village of Hibbing, thereby leaving the plaintiffs' property with a diminished business.

Peterson Lake Issues Silver Certificates

The Peterson Lake Silver Cobalt Mining Co., of Cobalt, Ont., has adopted a new scheme of financing, and is issuing silver certificates in denominations of $100 or multiple thereof, to raise $100,000 to enable it to continue operations. The company pledges its entire silver reserves as security for the payment of these certificates, which it purposes to redeem from time to time, with two years' interest, at 10 per cent, as soon as sufficient funds are available from the sales of silver.

The profits from the company's operations will not go into the treasury until the certificates have been redeemed. It is stated that the mill will be started when between $10,000 and $20,000 has been subscribed.

Bauxite Order Canceled

By Cable From Reuters to "Engineering and Mining Journal"

Paris, Oct. 15—The order relating to the prohibition of export of bauxite (aluminum ore) and establishing export duties on it has been cancelled.

Why Cornish Tin Mines Suspend

By Reuters Agency

London, Oct. 23.—In a written reply to Sir Edward Nicholl, Mr Bridgeman states that he is aware of the present deplorable condition of the Cornish mining industry, though he cannot accept Sir Edward Nicholl's version of its cause, and it is receiving careful attention in connection with the government's general proposals for the relief of unemployment.

Sir Edward Nicholl, in his question, stated that the suspension of the Cornish tin mines was due mainly to the controlled high price of coal; that these mines had to sell tin at a fixed low price because the government was buying cheap copper from, and selling cheap tin to, America; and that in meeting government requirements during the war the Cornish mines could neither devote men nor money to exploratory work. He suggested a special grant for Cornish mines and miners.

Gold Strike in New Mexico Near Monticello

A new gold strike is reported to have been made about tweny-four miles southwest from San Marcial, on the El Paso branch of the Santa Fe, in Socorro County, N. M. The gold-bearing area lies on the southeastern slope of the San Mateo Mountains and is six miles from Monticello, the nearest town. A number of quartz veins bearing free gold have been opened, and a few shallow holes, the deepest being 20 ft., have been put down. These quartz veins seem to be numerous and vary from 2 to 20 ft. in width. There are practically no accommodations on the ground at present, though plenty of wood and water is convenient. The roads from either San Marcial, Engle, or Deming are good.

Litigation Over Star Deal To Be Tried Nov. 21

Following the filing of the second amended complaint in the Superior Court at Spokane, Wash., on Oct. 4, of Eugene Day and Mrs. Sarah Smith, minority Hecla stockholders in the litigation over the Star consolidation, jurisdiction was accepted by the Spokane County court and trial is set for Monday, Nov. 21. A detailed account of the case was published on p. [illegible] of *Engineering and Mining Journal* of Nov. 5. Further particulars are given on p. 795 of this issue.

Inventor of a Flotation Process Gets $600 Damages

A suit brought by J. D. Wolf, an inventor, against William M. Baldwin, a capitalist, for $100,000 damages for breach of contract to finance a patent for treating ore by an oil flotation process, was recently heard in New York City before Supreme Court Justice Whitaker. The jury awarded Wolf $600. Justice Whitaker ruled that the evidence did not justify a determination as to the total damage sustained. It was said that another action would be brought.

Northport Smelter Defendant in Smoke Suit

Herman Pfeiffer, of Northport, Wash., has brought suit in the Superior Court against the Northport Smelting & Refining Co. to recover alleged damages of $4,557. The damages are stated to have been caused by fumes and dust from the smelter settling upon his land and destroying crops, fruit trees, and seven head of stock. The smelter is equipped with a Cottrell fume precipitating plant and until very recently there has been but little complaint about fume or dust damages.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Presence of Potash Beds Likely In Southwest, It Is Held

Core Drilling at Public Expense Warranted, in Opinion of George Otis Smith

Discovery of potash-bearing beds in the Southwest fully justifies core drilling at public expense in the further prospecting of the Permian Red Beds region, in the opinion of Dr. George Otis Smith, director of the U. S. Geological Survey. In the region where small lumps of potash-rich salts, including polyhalite, were found, very little drilling for oil is likely, and it seems improbable that private initiative will undertake this prospecting work.

It has long been contended by the Geological Survey that the Red Beds offer conditions favorable to the occurrence of potash. The discoveries at the Burns and Bryant wells in Dawson and Midland counties of Texas and in the salt crusts found in the slush pool of the River well near Barstow, Tex., have vindicated the scientific deduction. Whether or not these deposits are of workable thickness remains to be proved. Indefinite evidence, however, suggests that the beds may be of greater thickness than is indicated by the samples recovered.

Survey's Division of Geology Has Eleven Sections

The division of geology of the U. S. Geological Survey is at present employing a total of [illegible] technical men, of which eighty-five are geologists. The division is organized in sections as follows: section of eastern areal geology, Arthur Keith, geologist in charge; section of western areal geology, Sidney Paige, geologist in charge; section of coastal plain investigation, T. W. Vaughan, geologist in charge; section of glacial geology, W. C. Alden, geologist in charge; section of paleontology and stratigraphy, T. W. Stanton, geologist in charge; section of geology of metalliferous deposits, F. L. Ransome, geologist in charge; section of petrology, E. S. Larsen, Jr., geologist in charge; section of geology of iron and steel alloy metals, E. F. Burchard, geologist in charge; section of the geology of non-metalliferous deposits, H. S. Gale, geologist in charge, prior to his resignation, succeeded by G. R. Mansfield; section of the geology of coal fields, M. R. Campbell, geologist in charge; section of the geology of oil and gas fields, K. C. Heald, geologist in charge. The work is under the immediate charge of David White, chief geologist.

To Sell Sodium Nitrate

Sodium nitrate to the extent of [illegible] tons is to be sold by the War Department to the highest bidder on Nov. 30. The minimum bid to be accepted must be for 100 tons.

The movement of silver to the Bureau of the Mint during the week ended Nov. [illegible] amounted to [illegible] fine ounces, bringing the total to [illegible] fine ounces.

NEWS BY MINING DISTRICTS

London Letter

Yuill Report on Shetland Copper Discovery Exact Reverse of Optimistic One by Dr. Garbe—Development at Geduld Mine Unsatisfactory

By W. A. Doman

London, Oct. 25.—A few weeks ago I mentioned that the syndicate busying itself with a copper proposition in the Shetlands was entertaining doubts as to whether the business was of that profitable character which it had been led to expect. To confirm or remove their doubts the directors engaged Colonel Yuill, of Messrs. Bainbridge, Seymour & Co., to make an independent investigation. He has now reported, and his conclusions are not favorable. The original report was made by Dr. J. B. Garbe, and the results of the investigation by the two experts are of so diametrically opposed a character that a little further notice of the matter is justified. To put it plainly, Dr. Garbe was distinctly optimistic, and Colonel Yuill the very reverse. I have had an opportunity of perusing both reports.

Dr. Garbe says there are roughly 369,000 tons of ore in sight, fully developed and ready for immediate mining. He adds that the section of 500 ft. actually opened up represents only one-sixth of the lode existing between Sandwick and Sand Lodge, and only one-twenty-fifth of that which exists between Noness and Setter. "From the foregoing it will be clearly seen that the mine is fully proved and developed, and is ready for immediate stoping, with an immediate production of at least 1,000 tons of ore per week. A production of 500 tons per week could be proceeded with almost at once, and the tonnage produced increased 1,000 per week as soon as the equipment now being erected and prepared is completed. The mine can be worked at a very low cost." Also, "I am fully convinced that once the mine is working regularly the cost will not exceed 15s per ton." From this he estimates a gross profit of £1,200 per 1,000 tons of ore mined and treated per week.

Now for Colonel Yuill. He says: "There is no ore developed and available for stoping in the present workings, and there are no indications that further exploratory and development work would open up ore higher in average value than 1 per cent copper In a general way it can be said that it would take ore carrying 3 per cent copper to cover expenses. There is no ore carrying payable values in copper in the Sand Lodge mine, and no mineral occurrences exposed in the underground workings or on the surface which indicate that payable ore would be disclosed by exploration work should it be undertaken. We regret to have to advise you strongly that you are not justified, by the results of the systematic sampling of the lodes, in making any further expenditure on this mine." As a result of this check report the syndicate has decided to cut its loss.

With one exception recent development work at the Geduld mine has not proved over-satisfactory. The exception is in the area served by the No. 7 Shaft, which is opening up virtually a new mine in the southern portion of the property. At the annual meeting of shareholders the chairman, referring to this area, said there were good grounds for the expectation that a further large ore tonnage of high value would be disclosed. His views are being borne out. To date, about 5,770 ft. have been sampled, of which 62 per cent is payable, giving for the Rand the very high assay value of 16 dwt. over 66 in., or, as calculated in Johannesburg, 1,056 dwt. in. The exact width of the reef is not stated, as the figure of 66 in. is the stoping width. If allowance be made for 18 in. on each side, the reef itself is 30 in. thick. This is an excellent result. Taking the whole of the development footage on the reef in the September quarter, 35 per cent was payable, averaging 17.5 dwt. over 44 in., or 770 dwt. in. In the June quarter the percentage payable was 37 per cent and in the March period 35 per cent.

Broken Hill Concentrates Coming to England

By Reuters Agency

London, Oct. 25.—The Board of Trade announces that it has instructed its agents in Australia to ship a supply of Broken Hill zinc concentrates to England, and will be prepared, if desired, to maintain supplies to meet the immediate requirements of smelters in the United Kingdom. To enable smelters to restart their works and provide employment, the board will be prepared to consider offers for these concentrates delivered at works. Offers for future deliveries over a period will also receive consideration.

Johannesburg Letter

Government Engineer's Report Out—Development of Barberton Asbestos Deposits Successful

By John Watson

Johannesburg, Sept. 20—The annual report of the government mining engineer for 1920 has recently been issued. Attached to it are extracts from the various district inspectors. Tudor G. Trevor, inspector of mines, Pretoria, says: "During the last ten years, several very rich if small gold mines have been discovered, mostly by accident, and in places which were supposed to be worthless. The small attention which has been directed to the base metals and non-metallic minerals has been so successful that I have every confidence that in the future, as more attention is paid to the matter, the advance of the last ten years will not only be maintained for an indefinite period, but greatly excelled. In fact, the longer experience one has of this inspectorate the more optimistic one becomes of its future. It is a curious fact, however, that the discovery, exploitation, and proving of the value of nearly all the minerals placed on the list during the last ten years, or even twenty years, has been left to private individuals of no, or very little, financial standing, who have usually received no encouragement, but often have had very severe opposition to overcome before attaining success. It is astonishing to note what little success the big land companies and mining corporations have met with and of what little use they are in the initial stages of the development of any industry."

The development of the asbestos deposits in the Barberton district, particularly at Kaapsche Hoop, has, according to an official report, been successful. Trials show that the mineral extends over a large area and its quality is equal to any asbestos found in the Union.

A nugget of gold weighing 21 oz. was recently found at the alluvial diggings at Finesbury, near Mount Anderson. This is said to be a record for these diggings, one of 20 oz. having been discovered some time ago.

The development of the oil sites at Island View is reported to be steadily proceeding. The Vacuum Oil Co. has two tanks on the site, each having a capacity of 9,000 to 9,500 tons of oil. The Anglo-Persian Co. has one oil tank erected and another planned. The British Imperial Oil Co. has just imported a tank in sections ready for erection on the company's site. The Texas Oil Co. has secured a site, also, and will soon erect storage tanks.

The Inspector of Mines for the East Rand district, (Col. Bottomley), writes in his annual report: "The expansion of the Far East has, if anything, received a slight check during the last year, owing to the stoppage of most of the development ends on the Daggafontein mine and the poor results of the development in Springs West. The results so far achieved on these two outlying mines are distinctly discouraging, and are certain to influence opinion in connection with the long looked-for expansion of the Far East and the development of the large unworked areas between Springs and Nigel.

"It is apparent that the zones of enrichment, or lenses, are further apart and the reefs narrower going south from Springs. On the other hand, we have the splendid example of the Nigel, which was a prominent producer and dividend-earner for many years."

The Nigel mine is situated eight miles to the south of Springs, and it is more than probable that similar large patches of rich ground should be found between these two points. The difficulty lies in their location. The deep shafts on the Springs West, New State areas, Brakpan, and Geduld have now approached the Main Reef horizon, the New State having actually encountered the reef, and the coming year will witness a program of development hitherto unprecedented on these fields. Owing to the large claim areas involved, first consideration is being paid to rapid and easy transportation of ore by laying out the drives and main haulages on capacious lines. The question of ventilation is receiving every possible consideration, and the wide drives already mentioned will materially assist in this direction.

The North shaft of the New State Areas was sunk to the reef—a depth of 3,760 ft.—without a fatal accident. It has been decided that the two circular shafts of the Brakpan Mines which are now in their last stages—No. 4 having already reached the reef—are to handle the work during the development period without their permanent equipment. This means that wire-guides will continue to be used without any other steadying factor than their own weight and what is added to them for stabilizing purposes. Colonel Bottomley feels that the extra tonnage hauled will be a severe test on the conditions mentioned. The sinking of the two shafts has been a nightmare to the managers up to the present, and it is more than likely that their troubles are not yet over. It is felt that insufficient data are available in connection with the handling of a large tonnage on rope guides over a shaft depth of 4,000 ft.

AUSTRALIA

Queensland

New Discoveries of Gold and Mica Reported

By Our Special Correspondent

Brisbane, Sept. 25—In mining matters history is repeating itself in Queensland. In times of depression, when the ranks of the unemployed are swollen, and especially when miners are thrown out of work through the production of minerals becoming unremunerative, there are more men who go prospecting and "fossicking" for other minerals for which there may be a profitable demand, with the result that finds are often made that become valuable to the state. Already a promising cobalt mine and a gold mine have been started in the Cloncurry district, where previously it was thought there was no commercial mineral except copper. Now the warden at Cloncurry advises that mica of really good quality has been discovered sixty miles northwest of Argylla and in the neighborhood of Camooweal, near the northwestern boundary of the state. Samples received by the government assayer, at Cloncurry, were forwarded to Sydney for the purpose of obtaining the opinion of the manufacturers using mica as to the commercial value of the specimens sent. The samples were found to be as good in quality as mica produced in any other part of the world for certain classes of manufacture. It is understood that all arrangements have been made for the financing of operations, and a trial parcel of one ton is being sent to Sydney.

Also, what promises to be an important find of gold has been made six miles from Cooktown. One party operating on three lines of reef at a shallow depth, obtained a return, from a bulk sample of five tons of ore sent to Chillagoe for treatment, of 4.1 oz. of gold per ton; and three samples (one each from three shafts) sent to Brisbane by the warden and analyzed by the government analyst, gave results respectively of 3 oz. 14 dwt. 5 gr., 1 oz. 10 dwt. 5 gr., and 13 dwt. 9 gr. of gold per ton. The find has been visited by a government geologist, whose report on it is expected soon.

Another parcel of cobalt ore, consisting of 50 tons, has been despatched from Mount Cobalt, in the Cloncurry district, for shipment to England.

CANADA

British Columbia

Operators Consider Present Tax Levies Excessive

By Robert Dunn

Victoria—Mine operators of British Columbia are making strong representations to the government in regard to what are termed the present excessive taxation levies. A delegation of representative coast mining men waited upon the provincial executive recently in this connection, and there is to be another discussion of the matter at an early date between the government and those identified with mining in the interior of the province.

One of the chief concessions sought is that a greater allowance be made for depreciation of property when the annual assessments are prepared. Valentine Quinn, of the Granby Consolidated Mining & Smelting Co., voices the views of mining men when he says: "There is no reason why the same procedure with regard to other tax reductions cannot be ruled with regard to development, depreciation, and depletion in the mining industry. If we are going to be taxed it is better to tax us on our real income. If the assessment is made up on the true income of any company there is no objection. What we do object to is the withholding of our right of appeal if our determination does not agree with that of the Finance Minister. We feel that we have a right of appeal and should be able to establish our protest in the court if necessary."

John Hart, Minister of Finance, said that he had no objection to appeals being made. This intimation was received with marked appreciation.

Dealing with the matter of taxation, W. R. Esling, member for Rossland in the provincial Legislature, maintains that the municipality of Rossland should be given the money it would receive were it permitted to tax the lands and improvements of mining companies. These companies pay a 2 per cent tax to the province on ore mines, and are exempted from municipal levy. He said that the producing mines had yielded in the last few years in excess of $18,000,000, and had paid into the provincial treasury $700,000. In return for the loss Rossland sustained, the provincial government handed back in special grants $140,000, or much less than could have been collected by the city from the lands and improvements of the mines.

There is no doubt that more will be heard of this question of the taxation of mines during the present session of the provincial Legislature. The problem of taxation in all its phases is to be before the legislators, it being the intention of the government to take some action toward relieving the financial embarrassment of the municipalities by granting them a greater share of the sources of provincial revenue. As to mining, the government is being assailed on the one hand by the mine operators, who are endeavoring, quite naturally, to obtain improved reductions, and on the other by the municipalities, which are insisting that their welfare shall be more adequately cared for by the dispensers of provincial funds. The situation is one not easily solved to the satisfaction of all, but there is no doubt that the government realizes the need of encouraging the mining industry and it is equally certain that the representations of those identified with it will have every consideration.

Bunker Hill Smelter Gets Ainsworth Ore

Ainsworth—Four hundred tons of accumulated ore, nearly all of which was taken out by leasers of the Florence mine, and some on company account, has been purchased by the Bunker Hill smelter, and is being shipped across the line for treatment.

Trail—Ore shipments received at the Consolidated smelter Oct. 22-31 totaled 10,963 tons, coming from the following shippers:

Josie, Rossland, B. C., 92 tons; Knob Hill, Republic, Wash., 217 tons; Rosebery Surprise, New Denver, B. C., 182 tons; Rambler Cariboo, Rambler, B. C., 30 tons; Silver Bell, Zwicky, B. C., 46 tons; Silver Standard, New Hazelton, B. C., 30 tons; Utica, Adamant, B. C., 47 tons; company mines, 10,319 tons.

Stewart—The sudden flooding of the Salmon River, as well as of other rivers and creeks in the Portland Canal district, has done much damage to roads and trails serving mining properties. Repairs will be necessary in a number of sections to permit ready access to some of the well-known mines and prospects of the country.

Ontario

First Dominion Report Shows Decrease In Mineral Output—Northern Ontario Feels Oppressed by Taxes—Enough Water For Porcupine Power Until April

Ottawa—The first semi-annual report of Dominion mineral production ever issued by the Ottawa Department of Mines, covering the first six months of 1921, shows a big falling off in value. For the full year of 1920 the value of the metallic production was $75,700,000, though for the first six months of the present year the value is only $24,300 000.

The leading metal, from the point of view of production during the six months was gold, with a value of $8,194,000, which is an increase over the previous year. The next most important ore was nickel, with a value of $5,360,000. This shows a severe decline as the value of the twelve months' production in 1920 was $[illegible]. Silver production, at $[illegible], also shows a falling off. The value of the copper production for the six months was $3,213,000, as compared with $14,244,000 for the whole of 1920. Lead, valued at $1,184,000, shows a slight increase, and zinc valued at $[illegible] shows a falling off. The report states that large quantities of nickel and cobalt are held in stock, and that the immediate prospect for the future of the industry is not bright.

Cobalt—For some time there has been a great deal of ill feeling in northern Ontario over the treatment which it believes it is receiving from mining authorities in the older part of the province. The people of northern Ontario believe that the government officials look upon this territory simply as a source of revenue to provide for extravagant expenditures in old Ontario. Government officials retort that more is being spent in the country than is being taken out in revenue.

Figures recently received for the year ended Oct. 31, 1920, show total expenditures of $5,624,000, as against a revenue of $4,642,000. Included in the expenditures, however, is a total of over $3,800,000 for lands and forests, including colonization and northern development, public works, and public institutions, a large part of which, under ordinary business methods of bookkeeping, would be charged to capital account. It is interesting to note, however, that the revenue from the mining industry was $990,000, as against an expenditure of $99,000, or a return of 1,000 per cent. For agriculture the revenue was only 9c. for each $1 expended. The mining industry feels that the interest displayed by the government in mining and agriculture is in inverse proportion to the returns. The industry is convinced that if it is not expedient to place at the head of the department of mines a man who is familiar with the industry, it is at least entitled to have a business man of sufficiently high calibre to comprehend its requirements.

Coniagas has taken options on claims in the Larder Lake district, embracing three hundred acres. Some of these claims adjoin those at present under option to the Crown Reserve and it is expected that the company will diamond drill them this winter.

Another discovery of importance has been made by the Keeley mine, in South Lorraine, on the 400 level. Where first encountered the vein was about one foot wide and of high-grade ore.

The annual report of the Hudson Bay for the year ended Aug. 31 shows a revenue of $17,498.00, against an expenditure of $37,765.00. The Cobalt property is practically exhausted, but the company places a considerable value upon its claims in Gowganda and Kirkland Lake. The company also announces that negotiations are under way for the amalgamation of the Dome Lake property, in Porcupine, which it controls, with the West Dome. The Hudson Bay has advanced about $350,000 to the Dome Lake.

During September there was shipped from Cobalt, over the T. & N. O. Ry., 230 tons of ore, of which 113 tons went to Canadian smelters and 117 tons to American smelters. This tonnage was supplied by the following companies: Bailey, 42 tons; Coniagas, 44; Hudson Bay, 32; O'Brien, 71; Keeley, 42. During the month the price of silver ranged from 62⅜c. to 71⅝c. an ounce.

Porcupine—The officials of the Northern Canada Power Co., which supplies this district, report that they now have enough water in storage to supply the Porcupine mines until the end of next March, with the same amount of power that the mines are now using. It is also stated that negotiations are under way to provide for the future needs of the camp. A greater water supply is to be secured by the diversion into the Metagami River of other streams. The company is also considering the possibility of the development of other sources of power.

General development at the Dome continues to be satisfactory. During October the mill heads ran approximately $7.50 a ton. The orebody found on the 7th level has proved to be of considerable size, and diamond drilling has indicated a depth of at least 150 ft. below the 7th.

MICHIGAN

The Copper Country

Results To Date of Calumet & Hecla's Geological Survey "Negative" — Centennial Unpromising — Operations at White Pine—Copper Shipments

By M. W. Youngs

Houghton — Progress is being made with the rather unusual geological survey being conducted by a number of eminent geologists for the Calumet & Hecla Mining Co. The purpose of the investigation is to discover, if possible, the origin of copper and how it came to be laid down in this district in native form in lodes or veins, rich in some portions and barren in others. The results to date, however, may be described as "negative." That is, if the survey were to stop now, the data available would enable a company seeking new copper deposits to determine whether to proceed with the work or stop it altogether when certain combinations of conditions were encountered. No results have yet been obtained that would lead the miner directly to the copper in the lode without chance of failure, and it is toward that goal that the survey will be continued in the hope it ultimately will be productive of positive results. The work to date is distinctly encouraging, and it has more than justified the expenditure. It has overturned some pet theories and established facts which may be depended upon. A big saving will be made in the long run by means of this original research.

Interest is manifested in mining circles here in the reported negotiations between the Anaconda and the American Brass Co. Should Anaconda obtain control of American Brass, it would be, in the opinion of prominent mining men in the Lake district, the most startling development, as well as the most constructive step yet taken, in the copper industry. It is freely admitted that such a development would mark a new era in the mining and manufacture of copper. It would, it is believed, affect copper-mining companies outside of Anaconda adversely and force them into the business of manufacturing their own product. It has been evident for some time that the trend of affairs has been toward a combination of the mining and manufacture of copper.

Centennial probably will be one of the last of the Calumet & Hecla subsidiaries to reopen. This property is one of the least promising. Its production costs during the six months it operated in 1920 were 32c. per lb., not including depreciation, depletion, smelting costs, eastern office expense and corporation taxes, which brought the total up to 36c. The rock treated in 1920 was about 2 lb. lower in copper content than that milled the previous year, running only 13½ lb. to the ton, and the character of all new ground was discouraging. The rock disclosed in the new bottom openings of No. 2 shaft, the only one in which any work was done in 1920, was somewhat below average in quality for the mine.

At White Pine, Calumet & Hecla's subsidiary in Ontonagon County, work is confined to the operation of bailers in No. 4 shaft, into which water seeps from Nos. 2, 3 and 4. Eventually some interesting geological problems must be solved in this property, as a badly faulted area has been encountered at a depth of about 1,100 ft. in No. 3 shaft. No. 4 shaft, however, will get down to 1,600 ft., it is estimated, before it encounters the fault. No. 5, farther west, may reach a depth of 3,000 ft. or more before the lode disappears, and it therefore will probably become the principal shaft. There is still considerable work to be done in No. 3 before it will be necessary to suspend operations in the shaft until contact with the lode is re-established. For upward of a year, No. 5 had been deepened by raising upward from the levels extending westward from No. 4, and only a comparatively short stretch of ground remains to be drilled before the entire shaft is holed through.

White Pine is operating on the Nonesuch series, which consists of a sandstone bed 7 ft. thick, below which is a slate formation about 6 ft. thick and containing copper in very small particles. Beneath the slate is another sandstone vein from 5 to 8 ft. thick and at the very bottom is a sandstone formation 50 ft. in thickness.

A rather extensive program of drifting and stoping is under way in all four Mohawk shafts, with the rock averaging well up to 23 lb. to the ton. Although the character of the ground tributary to No. 1 in the lower levels does not measure up to that of the south end of the mine, the results are quite satisfactory and the rock is yielding a small profit. Mohawk is using both level and drift scrapers with a large measure of success, the devices being particularly effective in the levels, where the cost of rock handling has been reduced almost 50 per cent. Both Mohawk and Wolverine will continue operations throughout the winter.

Less than another month remains of the Lake season of navigation, and to date there has been shipped, by boat, out of this district, a total nearly 41,000,000 lb. of copper. Estimated rail shipments for the same period are 10,000,000 lb., making 51,000,000 in all.

October metal shipments by water were, as expected, the largest of the season, totaling 10,840,000 lb. This compares with 7,028,000 for the preceding month, 5,176,000 for August, and 8,322,000 for October, 1920. Rail shipments last month are estimated at 2,000,000 lb.

Shipments of copper by water have been as follows this year: May (including a few days in April), 5,310,000 lb.; June, 5,850,000; July, 6,536,000; August, 5.176,000; September, 7,028,000; October, 10,840,000.

The increase shown by September shipments is attributed largely to an improved demand for the metal rather than any particular desire to take advantage of the lower freight rates via the water route.

Gogebic Range

Oliver Iron Mining Co. Stops Shipping for the Season

By Our Special Correspondent

Ironwood, Mich. — The Oliver Iron Mining Co. has closed its shipping season, having shipped about 1,350 000 tons through Ashland. The Steel & Tube Co. is shipping two cargoes in vessels that brought up coal.

The Oliver company has sold to the Seneca Copper Co. the steam hoist formerly in use at the Curry shaft of the East Norrie mine. It is a Bullock Corliss, duplex, first-motion hoist, with cylinders 24 x 48 in. and two clutched drums 8 ft. in diameter and with 9 ft.

faces grooved for 1¼ in. rope. It is being sent to Mohawk, Mich. The Curry shaft was for several years a very large producer, but owing to caving ground, was abandoned two years ago, having been replaced by a new foot-wall shaft with electric hoists.

The three 400-gal. Prescott-Menominee pumps on the 2,600 ft. level of No. 1 Davis shaft are erected and ready for operation as soon as the electrical apparatus is installed. With these pumps nearly ready for operation, it is deemed safe to begin opening up this level, and the work has started. Practically all work will be done west of the shaft toward the Newport orebody, and that is expected to be a wet district. In the Davis engine house the old 4,000-ft. compound, two stage air compressor is being replaced with modern electric-driven equipment.

The M. A. Hanna Co. have made an agreement with the Hayes Mining Co. under which the Germania property in Wisconsin will be explored underground from the workings of the Ashland. It is understood that work will be started as soon as possible. The Germania has been idle for some years, but is promising ground for exploration, lying between two good producing areas. The Ashland should be benefited also by discovery of ore on its western boundary.

Pence, Wis.—The Republic Iron & Steel Co. is sinking the Plumer shaft to the 17th level in expectation of developing a body of ore shown up by drilling. The company has been conducting a competitive test of various makes and types of sinking drills, the results of which will be used at all its properties. The shaft has three compartments and is about 7 ft. x 19 ft. 8 in., outside of sets, which are of steel. It is in the foot-wall slates and is inclined at 61 deg.

Palmer—The open-pit mines on the Cascade Range have been closed for the season. The Isabella mine, an underground property, is the only mine now being worked, and only development work is being carried on there. The pits, of which there are several, sent out very little ore in 1920, the Richmond and the Maitland being the only ones to fill contracts.

Menominee Range

West Chapin Starts Work on New Blast Furnace

(By Our Special Correspondent)

Iron Mountain—The West Chapin Mines Co. has started work on the blast furnace which is to be operated in connection with the mine. The foundations are now being put in place. A chemical plant is also planned. Local and eastern capital are back of the venture.

Iron River—The Cleveland-Cliffs Iron Co. recently received an order to ship out [illegible] tons from Spies mine. The loading is now in progress. This will be the last ore to go forward from the Menominee Range this year.

Marquette Range

Ford's Imperial Mine To Begin Operations Soon

Michigamme—The water has been removed from the west shaft of Henry Ford's Imperial mine, and it will be only a few days before the east shaft will be free of water. Mining operations will start at an early date. The construction of a 55 x 160-ft. combined carpenter shop, blacksmith shop, and warehouse is under way. Twelve dwellings for men and a house for the superintendent are being erected. There are also several other new buildings at the mine. A power house remains to be constructed. About 125 men are now employed, and many of these will take places underground when mining starts. Men are being paid $6 per day after being on the payroll for a month, the wage scale being the same for all classes of labor.

MINNESOTA

Mesabi Range

Trout Lake Washing Plant Suspends—Hill Annex To Have Screening Plant

Coleraine—The Trout Lake washing plant of the Oliver Iron Mining Co., has suspended operations for the season. In the open pits all ore operations have ceased in this district, and at present five steam shovels are at work stripping in the Canisteo pit, a property of the same company.

Marble—Plans for a screening plant to serve the Hill-Annex mine, of the Interstate Iron Co., have been drawn and it is expected that work will start soon.

Nashwauk—The mining of ore by steam shovels at the Patrick pit is to continue until winter weather prevents, according to the plans of Butler Bros., the operators. The ore, which is a washable product, will be stockpiled after it has been run through the Patrick concentrator. To meet these requirements a stockpile area is being prepared and tracks are being laid to it.

Chisholm—A fire on one of the sub levels of the Leonard No. 2 mine, operated by the M. A. Hanna Ore Co., caused the suspension of all underground work for a short time but did little damage. It is supposed to have been caused by a carbide lamp left burning on a post. It was extinguished by bulkheading the drift leading to the workings and attacking it from the sublevel above.

JOPLIN-MIAMI DISTRICT

American Metal Co. Buys Zinc Ore—Report of Unemployment in District Greatly Exaggerated—Ore Thieves Busy at Webb City

By P. R. Coldren

Joplin—The outstanding feature in the Tri-State zinc and lead field for the week ended Nov. 5 was the unexpected entrance of the American Metal Co. into the market for zinc ore. A week before a total of less than [illegible] tons of concentrates was purchased, but early last week the American Metal Co. entered the market and in the first few days bought slightly in excess of [illegible] tons of ore, paying [illegible], as against the [illegible] and [illegible] prices paid the previous week.

It is [illegible] reported that the discovery of a fresh supply of natural gas near the Blackwell smelter of the American company is responsible for this buying move, but it is also commonly believed here that the heavy purchase is an indication of an upward swing in ore prices.

Considerable interest has been taken locally in a report sent out from the national conference for unemployment to the effect that there are 15,000 idle miners in Joplin. There are virtually no idle miners in Joplin, and nowhere near this number are idle in the entire district. In fact, it is estimated that the total number of miners employed at the peak of mining activity in the field a few years ago was little in excess of [illegible]. Today about fifty-five of the largest mines are operating at least a part of the time, which means probably [illegible] normal activity, at the least. And a very large per cent of the miners who [illegible] last summer and fall have either obtained work elsewhere or are working at other occupations in this field. Richard Jenkins, secretary of the Tri-State [illegible] of the American Zinc Institute, estimates that no more than [illegible] miners were out of work at the worst period of the slump last winter, and he and others who work with him believe that the mines now operating will be able to take care of the miners now in the field during the coming winter.

It seemed like old times last week when petty ore thieving was reported from Webb City, Mo. A few miners are operating small mines in the older Missouri camps just now, or working large mines on a small scale, mostly gouging for lead ore, and it is these that suffered from the thieves. All the junk dealers in the district have been notified, and it is believed the persons who got the ore will have hard work in disposing of it. There was formerly much petty thievery of this sort, but it has almost entirely disappeared during the last two years.

COLORADO

The Canterbury Hill Project—Other Operations at Leadville

Leadville—In the effort to bring about a revival of mining activity, much attention has been given to exploration and development work in outlying districts. Early in the year a project was financed by Leadville people to drive a tunnel into Canterbury Hill. The project was backed by the Leadville Chamber of Commerce, and monthly subscriptions were secured to carry on the work.

The bore will cut at great depth a territory which, in early days, made a considerable production from surface workings, which are now filled with water and unworkable. The tunnel has been driven over [illegible] ft., and it is expected will reach the Leadville formation within the next [illegible] ft. [illegible] mining men and former residents of Leadville have recently come forward with liberal subscriptions to hasten the work, and Leadville is confidently looking forward to the opening up of a new and productive mining district in 1922.

On the [illegible] Range, development work on the [illegible] groups gives promise of a good production the coming year. On the west, a good strike was recently made on the [illegible] group on the [illegible] Range. In the [illegible] district, [illegible] properties has [illegible] the old [illegible] for many years. Much attention is being given [illegible] where arrangements are being perfected for a resumption of activity by several old properties.

ARIZONA

International Smelter To Start Ore Furnace on Miami Concentrates—Seek to Merge Arizona & N. M. Road With E. P. & S. W.

By James H. McClintock

Phoenix—One of the reverberatory furnaces of the International Smelting Co. at Miami is to be blown in about Nov. 20. It is understood that this is not be considered in any degree due to resumption of copper demand, but is simply to clear the bins of about six months' accumulation of concentrates from the Miami Copper Co.'s concentrator, which has been the only copper mill in operation within the state. The only reduction plant available for Arizona smelting ores has been at El Paso, where the smelter operated one furnace during the summer, added another in September, and will add a third this month. No copper ores have been handled at El Paso.

The smelting work at Miami will give employment to about 200 men. Inspiration will employ 100 more men on the Inspiration and Live Oak mines and will sink a working shaft on the newly acquired Porphyry property.

MINE SURFACE PLANT AND MILL OF MIAMI COPPER CO., MIAMI, ARIZ.
One of the Two Copper Companies Now Producing in Arizona.

J. Parke Channing, vice-president and consulting engineer of the Miami Copper Co., recently visited the company's property. He states that the company "has no intention of closing down or of curtailing production," adding expression of appreciation of the manner in which the employees accept neccessary cuts in wages, the company thus being enabled to keep the mine and mill running and to retain over 1,000 men. Mr. Channing expressed the opinion that copper companies of Arizona would reopen next spring, though it would take six months more to reach the pre-war scale of operations.

A carload of ore shipped to El Paso by the Superior & Boston Copper Co., of the Globe district, returned an average of 195 oz. silver to the ton.

Old Dominion at Globe is furnishing the entire water supply of the municipality of Globe, taking it from a part of the mine where the flow is of unusual purity, without copper or other contamination.

A step in the transfer of the Arizona Copper Co.'s property to the Phelps Dodge Corporation is noted in an application filed with the Arizona Corporation Commission for the scale of the Arizona & New Mexico R.R. to the El Paso & Southwestern system. The line is 121 miles long from Hachita, on the Southwestern, through Lordsburg, on the Southern Pacific, to Clifton. Outstanding capital stock of $2,770,000, with 1,330 $1,000 bonds outstanding is to be conveyed. It is stated that the consolidation is desired in the interest of economy, the branch to be operated as a part of the Southwestern's main line.

By its purchase of the Arizona Copper property, the Phelps Dodge Corporation will secure a remarkable position in paying about 92 per cent of the taxes of Greenlee County.

Kingman—Near the old Pittsburgh mine, in the Chimehuevis valley, a new find of rich silver-lead ore, in a 4-ft. vein, has been made.

At the Dean mill, in the Wallapai range, thirty miles from Kingman, a new filter press and thickener are being installed. The plant has seventy tons' daily capacity and is handling ore sampling $21 a ton in silver and gold. It is expected that the average output will be three carloads a month of concentrates running $250 a ton.

The 200-ton mill of the Highland Mining Co. is nearing completion, the work being under C. B. Bell. The plant is claimed to be one of the most modern and most efficient in the Southwest. The company's main property is the old Golconda.

The Katherine Extension is driving a crosscut on the 250 level, with expectation of picking up the Katherine vein.

The Revenue Mines Co., in the Katherine section, has installed new shaft equipment and has built its own camp of offices and living quarters.

Humboldt With reference to the statement from Phoenix appearing on p. 713 of the issue of Oct. 29, G. M. Colvocoressess, president of the Swansea Lease, Inc., writes:

"The lease on the property of the Swansea Consolidated Gold & Copper Mining Co. was not held by the Consolidated Arizona Smelting Co. This lease is held by the Swansea Lease, Inc., a concern in which the Consolidated Arizona Smelting Co. held a certain amount of stock. The Consolidated Arizona Smelting Co. is now in receivership and not in bankruptcy, and the Swansea Lease, Inc., is not involved in any financial difficulties, nor in any respect in default in regard to its lease.

"The errand of M. de Guerin is of a different character than that indicated, and no question has arisen in regard to the continuation of the rights of the Swansea Lease, Inc."

Mr. Colvocoressess states also that the application made by the Arizona & Swansea railroad for permission to dismantle is being opposed by all of the mining interests normally served by it, but which at present are inactive owing to market conditions. A revenue was derived by the railroad company from the operation of its line until last December, when the Humboldt smelter closed. There is every reason to expect that the railroad will be put in operation again, according to Mr. Colvocoressess, whenever the mines are ready to resume.

NEW MEXICO

Demand for Silver Properties Not So Much in Evidence

By James P. Porteus

Lordsburg—Dollar silver does not seem to have encouraged investments in mining enterprises in this section, as might have been expected. Interest started off nicely, but there has been a "hitch." Some lay it to the rush for 6 per cent tax-free bonds and claim the Government is getting all the surplus profits of the nation, the floating capital that has always shown a willingness to take a chance on a development enterprise. Others hold that excessive costs of operation, high freights, smelter charges and material costs are to blame and are quite outspoken in their disappointment that the threatened railroad strike was not called, holding the conviction that there cannot be a return of complete prosperity for silver mining until there is a reduction in freight costs, and that these cannot be brought about until there is a very considerable reduction in operation costs for the railroads.

It would seem that the drag on silver production that has interfered with the investment of new capital in the opening of new properties must be due to excessive taxes and surtax rates to a greater extent than to excessive operation costs. The price of silver and the demand for it are good. There are no surplus stocks of consequence on hand.

Silver production by the copper mines will not be a factor for a long time, so the silver miner has a clear field before him and an assured market at satisfactory prices for a long time, yet the demand for new properties and the money for new development are not in evidence as they should be. Unquestionably the menace of an excessive surtax is the deterrent factor. The "We dare you to succeed" air of some of our law makers who hold the tax club over the head of industry does not encourage investment.

Ore shipments from the Lordsburg district for October amounted to sixteen cars or 714 tons, consisting of copper, silver, and fluorspar ores.

UTAH

Objections Raised Against Bill For Revising Mining Law—Bingham & Garfield Ry. Wants To Stop Service—Utah Apex Fire Breaks Out Afresh

Salt Lake City—A subcommittee of the Mines Committee of the Salt Lake Commercial Club appointed to consider the Arentz bill on mining law now pending before Congress has expressed itself as being unfavorable to the changes proposed. The chief ground of opposition is that the present code has been judicially construed and that it is generally fairly well understood what steps are necessary to establish a valid location. It is felt by the committee that the enactment of a new code would cause confusion, and that laws of great practical use would be surrendered for those whose utility had not yet been demonstrated. Also, there is a feeling among practical mining men that, with the change of the time for the performance of the annual assessment work from the calendar to the fiscal year, and the elimination of the apex feature, the present law will give quite satisfactory results. The report of the committee carried a recommendation that the present extralateral right law be repealed; a more satisfactory mode of marking boundaries be adopted, and recording of mining locations in the local land office be provided. The committee took exception to the proposal that locations should conform to the four cardinal points rather than to the strike of the lode, and to Article B of Section 6, which gives the locator the choice of performing $5 worth of labor annually for each acre or of paying $5 an acre annually to the United States; also to Article B of Section 5 providing that discovery of mineral shall not be necessary to hold claims; that a claim may be held five years without discovery and that upon failure to make a discovery the locator shall have the right to hold his location for five years more by the annual payment in advance of $50 an acre, which fee shall be held in lieu of further requirement for assessment work. The objection covering the three above-mentioned points was that they would be prejudicial to the prospector of small means.

Bingham Canyon—The Bingham & Garfield railroad, which is controlled by the Utah Copper Co., has filed a petition with the Public Utilities Commission of Utah, asking that it be permitted to discontinue entirely passenger service to Bingham Canyon, for the reason that operations will not be resumed by copper companies of the camp, particularly the Utah Copper, for several months. The petition states that the railroad is at present running with an operating loss of $1,000 a month from operation of one coach daily over the line back and forth for passengers.

At the Utah Apex, the fire which started in 1917 on the abandoned 1,300 level, and which was at that time cut off from the remaining levels of the mine, has broken out between 1,400 and 1,500 levels. New bulkheads are being built and the fire will be held in check, it is hoped.

Alta—The Alta Tunnel & Transportation in Big Cottonwood Canyon has marketed 200 tons of ore from its new find.

MONTANA

Silver Butte Acquires Coal Property Near Bozeman—B. & M. Mill Said To Have Been Started.

Butte—The Silver Butte Mining Corporation is reported to have acquired coal-producing properties to the extent of 2,000 acres, situated in what is regarded as a proven field near Bozeman, Mont.

Elkhorn—The new mill of the Boston & Montana Development Co. is reported to have been placed in operation to "tune it up."

NEVADA

Tonopah Divide Makes Good Report for September—Boom at San Antone; Named Changed to Royston

Leadville—Three cars of silver-lead concentrates, averaging about $200 per ton, were shipped by the Leadville Mines Co. during October. This makes the gross output $20,000 per month. The concentrates are hauled forty miles to Gerlach, the nearest railroad station, for shipment to Salt Lake smelters.

Tonopah—Recent bullion shipments from the mills of this district, representing clean-up of operations for the first fifteen days of October, were as follows: Tonopah Belmont, $124,500; Tonopah Mining, $46,000; West End, $61,000, and Tonopah Extension, $44,000. The MacNamara company shipped $61,000 worth of bullion during September. The greater portion of the ore treated at the MacNamara mill was custom ore, although leasers in company territory are doing some profitable work on both the West End MacNamara vein and the Lower Contact vein.

The Tonopah Mining Co. has increased development footage, and considerable prospecting for faulted segments of rich veins, in addition to regular drift and raise development on low-grade and narrow veins, is being done. Leasers in the Montana Tonopah mine are shipping some high-grade ore, and lease conditions in general in this mine are said to be good.

Divide—Official announcement has been made that the September production of the Tonopah Divide mine was 1,515 tons of ore, with an average value of $29.05 per ton, or a gross value of [illegible]. This is a creditable record. The main shaft of the Tonopah Divide mine is being sunk below the 1,100 level, with the water level as the present objective. No lateral development work below the 800 level is planned until the water level has been reached. On the upper levels ore is being blocked out by raises from drifts, and at the [illegible] and 800 levels footwall crosscuts are being driven to prospect for the gold veins which outcrop several hundred feet south of the main shaft. The south crosscut on the [illegible] level from the Kernick shaft is now out 1,400 ft. A flow of warm water was recently encountered, with heavy pressure to the south. No important developments are reported, although various stringers carrying values in sulphides have been cut. The Divide Extension has picked up the faulted segment of the vein on the 200 level, and is now drifting to the north. Values are said to be low.

San Antone—The district is experiencing a small boom. Several hundred people now have interests in the district, either as claim owners or leasers, and it appears that there is a fair possibility of some real work being accomplished. The ore so far discovered is high grade, but the veins are narrow. The name of the camp has been changed, by a majority vote of the claim owners and residents, to Royston. This in recognition of the faith and perseverance of one of the earlier operators in the district.

WASHINGTON

Controversy Over Star Deal Remains Chief Topic in Northwest Mining Circles

By Hilliard W. Power

Spokane.—Litigation undertaken by the Day-Smith interests with a view to blocking consummation of negotiations involving the Hecla Mining Co. and the Bunker Hill & Sullivan company in joint acquisition of the Star mine, adjoining the Morning property of the Federal Mining & Smelting Co., near Mullan, Idaho, continues to be the most interesting topic from the point of view of mining operators of the northwest. Notwithstanding the fact that several weeks have elapsed since the first legal papers were served, the issue appears as far from a judicial termination as in midsummer. The case, moreover, appears daily to become more complicated and there is evidence of a marked distaste on the part of the courts of both Washington and Idaho to sit in judgment. It is held by the Spokane County courts that being accustomed to trying cases involving mineral rights, the courts of Shoshone County, Idaho, should assume jurisdiction, but the Shoshone County courts have held that proceedings there should be dissolved because of similar proceedings having been started in Spokane County. Under the circumstances the issue becomes more confused each week.

Another document has been added to a rapidly growing list in the forms of a circular letter just mailed by minority Hecla stockholders in the fight, and in which the claim is made that Hecla's investment in the Star carries no clear title. "If the Hecla is compelled to buy more Sullivan stock," the letter states, "the Sullivan being the holding company for the Star, Hecla must take its earnings, your dividends, to pay for the same, or possibly mortgage the Hecla mine to the Bunker Hill to raise the necessary money. The Bunker Hill can also force upon the Hecla, through the Sullivan company, other mining undertakings which Hecla might not wish to undertake."

Chronology of Mining

October, 1921

Oct. 3—Arizona Copper Co. stockholders ratified proposal of directors to sell company's property to Phelps Dodge Corporation.

Oct. 5—Superior Court at Spokane, Wash., decided Hecla injunction suit brought by Day-Smith interests was out of its jurisdiction.

Oct. 10—Hearings on freight rates on iron ore in Lake Superior district resumed at Chicago by Interstate Commerce Commission.

Oct. 17-22—American Mining Congress held annual convention in Chicago.

Oct. 21—Receiver's petition for sale of property of Consolidated Arizona Smelting Co. at Humboldt, Ariz., heard at Tucson, Ariz.

Oct. 28—[illegible] B. C., causing loss of thirty-six lives.

THE MARKET REPORT

Daily Prices of Metals

Nov.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
3	12.75	27.50	27.875	4.675@4.70	4.35@4.40	4.65@4.70
4	12.75	27.875	28.25	4.675@4.70	4.35@4.40	4.65@4.70
5	12.75	27.75	28.125	4.675@4.70	4.325@4.40	4.70
7	12.875	28.25	28.75	4.675@4.70	4.325@4.40	4.70
8	......	......		......	......	......
9	12.875	28.000	28.375	4.675@4.70	4.325@4.40	4.70@4.75

*These prices correspond to the following quotations for copper delivered: Nov. 3, 4 and 5, 13c.; Nov. 7 and 9, 13.125c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
3	66¾	67¼	73½	155¼	157½	23⅝	23⅜	25⅞	26½
4	66¾	67⅛	73½	156¾	158½	23⅝	23⅜	25⅞	26½
5	.	.	...	.	.	.	..	.	.
7	65⅞	66½	73½	158½	160	23¾	23⅜	25⅞	26½
8	66¼	66¾	73	158½	160½	23¾	23⅜	25¾	26¾
9	66	66⅝	73	157¼	159¼	23⅞	23½	25½	26

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver			Nov.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
3	392½	99¼	70	40¼	7	393⅞	99¼	67¾	39
4	393¾	99¼	69¾	39⅞	8		...	..	39⅜
5	393½	99¼	69½	39¾	9	393½	99¼	67⅝	38¾

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon.

Metal Markets

New York, Nov. 9, 1921

The metal markets have continued generally firm during the last week, with sales of satisfactory volume. Yesterday was Election Day, so that no business was done.

Copper

Last Thursday most producers were quoting copper at 13c. delivered for November and December, and a large quantity was sold at that price. On Friday some producers began quoting on a higher level, and by Monday most of them had advanced to 13.125c. or 13.25c. As the prices were advanced the business gravitated to those who were still willing to sell on a 13c. basis, so that they were quickly sold out. We know of no direction in which copper can be obtained for 13c. today, and the general quotation is 13.25c. However, little or no business is yet being done at that price, though some sales are reported at 13.125c. Consumers have not yet become accustomed to paying more than 13c., but are likely to revise their conception of the market before the end of the week if producers do not weaken.

Inquiry continues good. Orders from brass companies are particularly satisfactory when compared with expectations several months ago. During the summer months the brass companies were operating only at about 30 per cent capacity, but September business was better than August, and October was better than September. Operations are now being carried on at about 50 to 60 per cent of capacity. This improvement in business is reflected to an even greater extent in their requirements for copper, inasmuch as their stocks of scrap are being exhausted and little or no more of a desirable quality is to be had. Last week we mentioned the English stocks, and the American stocks of cartridge brass in the hands of the Government were only about 5,000,000 lb. on Oct. 1.

The price of copper for European delivery is reported to have been advanced to 13.375c. c.i.f., by the Copper Export Association, and with a freight rate of $3.50@$4 this is equivalent to close to 13.20c. f.o.b. New York. There is a fairly good demand from Germany, France, and Italy, but the Far Eastern business seems to have fallen away for the time being.

Lead

The official contract price of the American Smelting & Refining Co. continues at 4.70c. The New York market has strengthened slightly, and we are no longer advised of any sales as low as 4.65c. A fair amount of orders have been placed both at the 4.675c. and at the 4.70c. figure, but much of the business has been in small lots. The larger consumers seem well supplied for current requirements, but have no large stocks on hand, and the statistical position of lead, from every angle, continues good. In St. Louis, however, the market has weakened somewhat, and demand seems very slight. Some business continues to be booked at the 4.40c. price which obtained two or three weeks ago, and this level probably still holds for desilverized lead. Chemical lead of an excellent brand was freely offered all week, beginning Thursday, at 4.35c. and several lots were sold at that price. There was evidently more available than the market could absorb, for the best price which one seller could obtain for a lot of several hundred tons on Saturday was 4.325c., and the sale was made at that figure.

On Dec. 10, the freight rate on lead from St. Louis to New York will be reduced to 35c. a hundred. This will permit Missouri producers to compete in the New York market, something which they have not been able to do for some time. It will be noted that the difference in price is now almost exactly 35 points, so that little or no change in either market is likely as a result of the decreased cost of transportation. Missouri producers will not be able to sell lead in New York for less than 4.70c. unless the St. Louis price should be reduced.

Forward demand is still very quiet, with most producers refraining from making quotations.

Zinc

The market advanced during the week, bringing quotations higher than they have been since the latter part of May, but even at the present level of the market at 4.70@4.75c., there is little disposition to press the metal for sale.

It is not yet known whether the reduction of the freight rate from St. Louis to New York, from 49c. per hundred to 35c., will apply to zinc as well as to lead, but producers expect that it will. This reduction should directly affect the price of zinc in New York, which should be at a premium of 35 points, instead of 49 points above the St. Louis figure, if the new rate applies.

High-grade zinc is going forward in fair volume at prices similar to those quoted for some weeks—namely, 6c. per lb. with freight allowed.

Tin

In the past week the price of Straits has risen to close to 29c., with increased inquiries and buying from consumers. The 99 per cent grade continues about one-half cent under the price of Straits, though the differential may be nearer three-eighths of a cent for desirable grades of Chinese tin. Some undesirable tin, but still of 99 per cent grade, has been on the market.

Quotations on Straits tin for February delivery have been about as follows: Nov. 3d, 28.375c.; 4th, 28.375c.; 5th, 28.375c.; 7th, 28.875c.; and 9th, 28.875c.

Arrivals of tin, in long tons: Nov. 1, Straits, 5; 7th, Straits, 500.

Gold

Gold in London: Nov. 3d, 104s. 7d.; 4th, 104s. 4d.; 7th, 104s. 4d.; 8th, 104s. 3d.; 9th, 104s. 2d.

Foreign Exchange

Sterling has been somewhat stronger during the last week. Marks have continued their downward course, and a plotted curve of the value of the mark indicates that the zero hour is approaching. The next step is still in doubt. On Monday, Nov. 7, francs were 7.265c.; lire, 4.165c.; and marks, 0.345c. New York funds in Montreal, 8⅛ per cent premium. Sterling cables continue to be quoted at one-half cent premium over the figures given on page 796 for demand.

Silver

Eastern exchanges have continued to fall, but with the price of silver lower in London and New York, China has continued a moderate buyer in both markets. There is also the possibility of the Indian bazaars becoming buyers again and of bears covering sales made at the recent higher levels. Under present conditions accurate predictions are impossible, however, the market appears somewhat steadier at the lower figures.

Mexican Dollars—Nov. 3d, 53⅞; 4th, 53⅛; 5th, 53⅛; 7th, 52⅛; 9th, 52.

Other Metals

Quotations cover wholesale lots unless otherwise specified.

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 17.50@18c. with practically no sales.

Antimony—Chinese and Japanese brands, 4.80@5.25c.; W. C. C. brand, 5.25@5.75c. per lb. Cookson's "C" grade, spot, 9c. per lb. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $3@$3.25 per lb.; black oxide, $2@$2.10 per lb. in bbls.

Iridium—Nominal, $150@$170 per oz.

Molybdenum Metal—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominal, $55@$60 per oz.

Platinum $85 per oz. The market has become slightly easier. Greater supplies of metal are available, but no change is noticeable in quotations.

Quicksilver—$39@$41 per flask. San Francisco wires $41. Market dull.

The prices of the following metals remain unchanged from the figures published in these columns on Nov. 5: Rhodium, Selenium, Thallium, and Tungsten.

Metallic Ores

The market is generally exceedingly quiet, and prices on the following ores remain unchanged from the figures published in the Market Report in the Nov. 5 issue: Chrome, Iron, Magnetite, Manganese, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, Zircon, and Zirkite ores.

Zinc and Lead Ore Markets

Joplin, Mo., Nov. 5—Zinc blende, per ton, high, $[illegible]; basis 60 per cent zinc, premium, $26; Prime Western $24@$25; [illegible]; average settling price, all grades of blende, $[illegible].

Lead, high, $64.50; basis 80 per cent lead, $55; average settling price, all grades of lead, $[illegible] per ton.

Shipments for the week: Blende, [illegible]; lead, [illegible] tons. Value, all ores the week, $[illegible].

The American Metal Company, having [illegible] for the [illegible] [illegible] paid $[illegible] basis for premium [illegible]. A [illegible] was purchased [illegible] at $[illegible] basis.

Buyers were offering $[illegible] basis for [illegible] concentrates, but as sellers found a ready market for [illegible], few would accept the lower lead price level, and settlements and shipments were from previous purchases on the higher basis rate of $60. Buyers of lead expect the market to lower next week unless pig lead marks improvement.

Platteville, Wis., Nov. 5—Blende, basis, 60 per cent zinc, $30; lead ore, basis, 80 per cent lead, $60 per ton. Shipments for the week: Blende, 362 tons. Shipments for the year: Blende, 9,672; lead ore, 1,605 tons. Shipped during week to separating plants, 612 tons of blende.

Non-Metallic Minerals

Generally dull markets also exist for the non-metallic minerals, and there is no quotable change in the following from the prices published in our Nov. 5 issue: Asbestos, Barytes, Bauxite, Borax, Chalk, China Clay, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Kaolin, Limestone, Magnesite, Mica, Monazite, Phosphate Rock, Pumice Stone, Pyrites, Silica, Sulphur, Feldspar, and Talc.

Mineral Products

The prices of Arsenic, Sodium Nitrate, Sodium Sulphate, and Potassium Sulphate are unchanged from the quotations published in these columns Nov. 5.

Ferro-Alloys

No quotable changes have taken place in the following ferro-alloys from the prices quoted in the Nov. 5 issue: Ferrotitanium, Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotungsten, Ferro-Uranium, and Ferrovanadium.

Metal Products

Copper Sheets and Wire, Lead Sheets, Nickel Silver, Yellow Metal and Zinc Sheets are unchanged from the quotations given in the Nov. 5 issue.

Refractories

Prices on the following are unchanged from the figures published in the Nov. 5 issue: Bauxite Brick, Chrome Cement, Chrome Brick, Fire Brick, Magnesite Brick, and Silica Brick.

The Iron Trade

Pittsburgh, Nov. [illegible], 1921

The [illegible] in the steel market [illegible] of October [illegible]. [illegible] mills [illegible]. [illegible] 40 per cent of capacity.

[illegible] $4.75. [illegible] to $4.75, [illegible] $1.

Pig Iron [illegible] $[illegible]; [illegible] Valley furnaces, [illegible] freight to Pittsburgh.

Coke

Connellsville—Furnace, $3.35@$3.50; foundry, $[illegible] per ton.

World's Zinc Industry Becoming More Active

British Smelters Resuming Production on a Moderate Scale—Future of Silesian Zinc Industry Clouded by Politics—Australia Likely To Produce Cheap Metal

THE secretary of the American Zinc Institute has received the following discussion of world zinc conditions from its honorary foreign correspondent dated London, Oct. 21:

The zinc quotations of the London Metal Exchange do not show much variation, and for some time the price has ranged between £25 15s. and £26 12s. 6d. For the last six weeks Germany has refrained from offering at all for export, and Belgium has been a seller of small quantities at the London parity. Scandinavia appears to have now disposed of the bulk of her zinc in the hands of weak holders, and which mainly consisted of metal of German origin.

United Kingdom—The Board of Trade recently announced its willingness to make available to British smelters supplies of its Australian concentrates at a specially favorable price, conditionally upon the smelting companies and labor unions agreeing upon a scale of wages which would make zinc smelting economically possible. Negotiations between the smelters and the men have resulted in wages being fixed at approximately 50 per cent above the 1914 rates. I have reason to believe that the price will be fixed on the basis of a 47 per cent zinc concentrate and upon a sliding scale governed by the fluctuations in the official market quotations for zinc.

Wheat is available for all the cargo space offering from Australia and is paying 57s. 6d. per ton from commonwealth ports to Great Britain. Zinc concentrates from Port Pirie therefore cannot come forward in cargo lots at under 50s. per ton freight, and it follows that the government's c.i.f. selling rate to the English smelters must be drastically trimmed to enable the smelters to plan the production of zinc at £26 or better. As regards costs, supplies are certainly becoming cheaper, and industrial coal, which was costing upward of 40s. a ton at the time the smelters were last operating, is now available at 26s. delivered. Industrial coal should be obtainable soon at under 20s. per ton.

Swansea Vale and Villiers have already started up furnaces, and several other works are prepared to resume soon after the Board of Trade's price terms are known. As the total capacity of the British smelters under present conditions is under 60,000 tons of virgin zinc a year, if it be assumed that they work for the next few months at 30 per cent capacity, the British output will not amount to more than 1,500 tons monthly.

France—At present France is producing zinc at the rate of 18,000 tons a year, and this is the result of the repairing work which has been slowly proceeding since the Armistice. It must be remembered that three-quarters of the French zinc industry is situated in the extreme north and within the recent war zone. Consequently, all the plants suffered severely during hostilities, and it has proved a tedious and costly undertaking to make good the damage. The Auby smelter is producing at the rate of nearly 1,000 tons a month, or 50 per cent of its pre-war capacity of 22,000 tons annually. The plant at Mortagne-du-Nord—previously German-owned—is now turning out about 450 tons monthly, and early in 1922 will be in a position to run fifteen furnaces for an output of 20,000 tons per year if conditions warrant. The small St. Amand smelter is producing 150 tons to 200 tons of zinc monthly. There is also a smelter in the Artois district near Noyelles-Godault, which had a pre-war capacity of 7,500 tons yearly, but it is extremely unlikely that these works will be put in operation inside the next two years. For statistical purposes there is warrant for assuming the present French cost of producing zinc at £27 10s. per ton expressed in sterling.

Belgium—All smelters are running at part capacity and limiting production to 5,000 tons a month. Stocks of ore on hand are sufficient to maintain the rate of output for over six months, and as the costs of only a few favored works are within the present selling price of zinc, it is deemed desirable to limit the next six months' production to 30,000 tons unless an improvement in both price and consumption ensues. Continental demand is now absorbing the Belgian production, and in addition is now happily making a hole in the accumulated stocks of zinc sheets, which at mid-October were not nearly so formidable as three or four months back. Coal and labor are still very high if measured by pre-war standards.

Generally speaking, the cost of producing zinc in Belgium may be broadly assumed at £26 10s. on the average, but, as indicated in the foregoing, the best-placed smelters are slightly below that figure, and some look to a profit from the conversion of their metal into sheets. Of course, the big Vieille Montagne Co. does well from its large production of zinc oxide, in addition to its rolling mills.

Germany—With the revival of German trade the production of zinc in the country, including Silesia, has increased to upward of 6,000 tons a month. There has been a good domestic demand, and this has prevented stocks from becoming excessive. The London Metal Exchange feared the dumping of German zinc into England when the mark collapsed, but it is significant that practically no offers whatever have been received from Germany, and it may well be that the report generally accepted on the Continent is correct in that zinc and zinc sheets are included in the list of articles Germany has undertaken to supply to France under the agreement entered into at Wiesbaden last month providing for payment of reparations in kind.

The decision of the League of Nations as to the disputed territory in Upper Silesia has again clouded the future of the German-Silesian zinc industry. Many smelters are within the Kattowitz and Beuthen districts, which now fall definitely inside the new Polish border. These smelters are German-owned and the Polish workmen are so temperamentally constituted that they may conceivably refuse to work satisfactorily for German masters under the new conditions. I know that certain prominent zinc interests in France have long coveted the control of the Silesian industry and have looked forward to the day when the works in the disputed areas would fall within Poland's domain. Presumably these Paris interests will attempt to turn the present-day situation to their advantage, and altogether the position is too hopelessly mixed to enable one to formulate any idea as to the future of the Silesian zinc industry. But it is only reasonable to believe that until the situation is clearer the present owners of smelting works there will certainly not attempt to force production.

Expressed in terms of sterling, it would seem that the producing cost of zinc in Germany and Silesia is on an average £23 per ton.

Scandinavia—Owing to inability to sell their high-grade zinc at much, if anything, above the London quotations for "G. O. B.," and then to Britain only, and also to the fact that the production cost exceeds the present market price, Scandinavian smelters are merely marking time by keeping a few furnaces at work. Meanwhile the accumulations of German zinc in Norway and Sweden appear to have been sold.

Australia—The 5,000-ton distillation works at Port Pirie are unlikely to be again put in operation except perhaps with zinc over £30. Even then it is doubtful whether it would prove economically advisable to start up as long as high-grade zinc can be produced by more or less the same interests at Risdon at certainly £10 a ton cheaper.

It will be near the end of 1922 before the electrolytic plant at Risdon is completely finished and producing 34,000 tons of 99.95 per cent purity zinc a year. The first half of the plant is to start in the next week or two, however, so the industry can expect Australia to re-enter the ranks of zinc producers with an initial output of 1,400 tons or 1,500 tons monthly.

Cheap water power and other natural advantages, as well as the fact that the works represent the most improved technical development in zinc-plant practice, warrant the belief that the Australian Electrolytic Co. will be able to produce zinc cheaper than any other smelter in the world. Unless the management is in error in the figures published, I imagine the plant can achieve an over-all producing cost of zinc at £21 per ton when the Risdon plant is running at full capacity. Such an achievement will reflect the highest credit on the technical administration of Messrs. H. W. Gepp and Gilbert Rigg, and will denote the realization of the vision of the Baillieu-Robinson group who so early foresaw the potentialities of the Tasmanian hydroelectric program.

The United States—Notwithstanding that zinc exports from the United States are impracticable, inasmuch as the metal stands at a substantially higher price in New York than in Europe, both Britain and Belgium carefully follow the monthly statistics of United States production and stocks. The reduction of the American stocks to the extent of 11,000 tons during the last two months is doubtless regarded with the same measure of satisfaction in the United States as in Europe.

French Indo-China—Though Tonkin has produced between 25,000 and 50,000 tons of ore annually for some years, no attempt has been made at local reduction. However, a Paris company has now decided to erect a small plant with a first capacity of 1,500 tons of zinc yearly, and if this is successful the works will be extended to a total capacity of 6,000 tons per annum. Engineers have been engaged, and the erection of the first furnace will be started soon, and metal should be actually turned out in 1922.

Zinc Ores—The ore-supply position is in a troubled state, owing first to Belgium being little interested, because of her existing large stocks, and, second, to Germany's inability to purchase on account of the adverse mark exchange. All the North African producers are shut down and indeed have still some thousands of tons of calcined calamine to dispose of from stocks at shipping ports. For this material they are asking 5¼ to 5¾ French francs per unit of zinc f.o.b., which is roughly equivalent to 2s. 4d. to 2s. 6d. c.i.f., Antwerp or Swansea. This is rather more than the United Kingdom smelters can afford to pay unless some of them find it necessary—as is quite possible—to mix a certain percentage of Mediterranean ore with the Australian concentrate.

Spanish zinc mines are not working, and the blende on offer at the moment is mainly Chinese from the Sui-Kui-Shan mines. The price asked for this ore of a grade of 40 to 45 per cent Zn, 8 to 12 per cent Pb, and 8 oz. Ag [illegible] 11d. per unit of zinc, c.i.f., which is not unreasonable, and Germany has purchased some parcels at this rate. It will be remembered that these particular Chinese mines, situated in Hunan, were under the control of Messrs. Carlowitz & Co. before the war, but their contracts were cancelled at the time China joined the Allies. This mine has a plant capable of producing 50,000 tons of concentrates yearly, and, now that Japan is no longer an active zinc producer, the material must seek a selling outlet in Europe.

World Stock of Zinc—My estimate of virgin slab zinc stocks on Sept. 30, 1921, is 139,000 metric tons, made up as follows:

	Metric Tons
United States	[illegible]
United Kingdom	[illegible]
Belgium	[illegible]
Germany	[illegible]
France	[illegible]
Scandinavia	[illegible]
Other countries	[illegible]
Total	139,000

Galvanized Sheets—During September British galvanizers booked overseas orders for galvanized sheets to the extent of nearly [illegible] tons, and further substantial business transpired in October. Coal, steel, and labor all have a tendency to fall, and reductions therein will be followed by lower quotations for galvanized iron. Most of the September and October business has been booked on the basis of £18 to £19 f.o.b. for 24 and 26 gages. British galvanizers are booked up for several weeks ahead at the present scale of operations, and if export business continues to be satisfactory the manufacturers will augment their production.

There is now no Continental competition with British galvanized steel sheets, and the prospects are that Britain's position as the chief producer of this line will be as unassailable as before the war.

September Movements of Ores and Metals

Imports and exports of the more important metals and ores as reported by the Department of Commerce for September, 1921, and the figures for September, 1920, as finally revised, are as follows:

IMPORTS OF METALS AND ORES
In Pounds, Unless Otherwise Stated

	September 1920	September 1921
Antimony ore, contents	[illegible]	
Antimony matte, regulus or metal	[illegible]	[illegible]
Brass, old, only for remanufacture	[illegible]	[illegible]
Copper		
Ore, contents	[illegible]	[illegible]
Concentrates, contents	[illegible]	[illegible]
Matte and regulus, contents	[illegible]	[illegible]
Imported from		
Spain		[illegible]
Canada	[illegible]	[illegible]
Mexico	[illegible]	[illegible]
Chile	[illegible]	[illegible]
Peru	[illegible]	[illegible]
Cuba	[illegible]	
Unrefined, black and blister	[illegible]	[illegible]
Refined, in bars and plates	[illegible]	[illegible]
Old, for remanufacture	[illegible]	[illegible]
Composition metal, copper chief value	[illegible]	[illegible]
Lead		
Ore, contents	[illegible]	[illegible]
Bullion, contents	[illegible]	[illegible]
Imported from		
Canada	[illegible]	[illegible]
Mexico	[illegible]	[illegible]
Chile	[illegible]	[illegible]
Pigs, bars and old	17,125,245	2,005,049
Manganese ore, long tons	[illegible]	[illegible]
Imported from		
Cuba, long tons	[illegible]	
Brazil, long tons	[illegible]	[illegible]
British India, long tons	[illegible]	
Tungsten ore, long tons	[illegible]	[illegible]
Pyrites, long tons	[illegible]	[illegible]
Imported from		
Spain, long tons	[illegible]	[illegible]
Canada, long tons	10,700	
Tin ore, long tons	2,489	664
Tin bars, blocks and pigs	[illegible]	[illegible]
Imported from		
United Kingdom	1,064,504	1,375,549
Straits Settlements	6,034,850	3,714,741
Hongkong	1,432,739	672,296
Australia	[illegible]	[illegible]
Zinc		
Ore, contents	[illegible]	
Imported from		
Canada	[illegible]	
Mexico	[illegible]	
[illegible]	[illegible]	

EXPORTS OF COPPER, LEAD AND ZINC
In Pounds

	September 1920	September 1921
Copper		
Ore, contents	[illegible]	
Concentrates, contents	[illegible]	
Unrefined, black and blister	[illegible]	[illegible]
Refined, in ingots and bars	[illegible]	[illegible]
Exported to		
Belgium	[illegible]	[illegible]
France	[illegible]	[illegible]
Germany	[illegible]	[illegible]
Netherlands	[illegible]	[illegible]
United Kingdom	[illegible]	[illegible]
Japan		[illegible]
Composition metal, copper chief value	[illegible]	
Old and scrap	[illegible]	[illegible]
Pipes and tubes	[illegible]	[illegible]
Plates and sheets	[illegible]	[illegible]
Wire, except insulated	[illegible]	[illegible]
Lead		
Pigs and bars		
Produced from domestic ore	[illegible]	[illegible]
Produced from foreign ore	[illegible]	[illegible]
Exported to		
United Kingdom	[illegible]	[illegible]
Canada	[illegible]	[illegible]
France	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	
Other countries	[illegible]	[illegible]
Zinc		
Dross	[illegible]	[illegible]
Spelter		
Produced from domestic ore	[illegible]	[illegible]
Produced from foreign ore	[illegible]	
Exported to		
France	[illegible]	
United Kingdom	[illegible]	
[illegible]	[illegible]	[illegible]
Japan		[illegible]
[illegible]	[illegible]	[illegible]

MINING STOCKS

Week Ended November 5, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Ahmeek	Boston	53½	51	52	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*50	*36	*46		
Allouez	Boston	22	20	22	Mar. '19	1.00
Anaconda	New York	43	41	42½	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2½	2½	2½		
Ariz. Com'l.	Boston	8¾	8¾	9	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*34	*30	*32		
Bingham Mines	Boston	13⅞	13⅞	13⅞	Sept. '19, Q	.25
Calumet & Arizona	Boston	52½	50¾	52½	Sept. '21, Q	.50
Calumet & Hecla	Boston	245	235	244	June '20, Q	5.00
Canada Copper	N. Y. Curb	*30	*28	*30		
Centennial	Boston	9	8¼	8¼	Dec. '18, SA	1.00
Cerro de Pasco	New York	31¼	29½	30¾	Mar. '21, Q	.50
Chile Copper	New York	12¾	11¼	12¼		
Chino	New York	26⅞	25½	26¼	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*15	*15	*15		
Con. Arizona	N. Y. Curb	*3	*2	*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1⅛	*90	*90		
Copper Range	Boston	35	34¼	35	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*41	*37	*39		
Davis-Daly	Boston	7¼	6⅞	7	Mar. '20, Q	.25
East Butte	Boston	10	9	9	Dec. '19, A	.50
First National	Boston Curb	*75	*75	*75	Feb. '19, SA	.15
Franklin	Boston	2¼	†2¼	2¼		
Gadsden Copper	Boston Curb	*40	*40	*40		
Granby Consol.	New York	21	19¼	21	May '19, Q	1.25
Greene-Cananea	New York	24	22¼	23	Nov. '20, Q	.50
Hancock	Boston	†3	†2	2¼		
Howe Sound	N. Y. Curb	2¼	2½	2¼	Jan. '21, Q	05
Inspiration Consol.	New York	36⅛	35⅛	35¼	Oct. '20, Q	1.00
Iron Cap	Boston Curb	6¼	5½	6¼	Sept. '20, K	25
Isle Royale	Boston	†22	†20½	21	Sept. '19, SA	.50
Kennecott	New York	23¾	22½	23⅜	Dec. '20, Q	.50
Keweenaw	Boston	†1½	†1 5/16	1¼		
Lake Copper	Boston	3	3	3		
La Salle	Boston	†1¼	1¼	1⅛		
Magma Chief	N. Y. Curb			*8		
Magma Copper	N. Y. Curb	22	21	21½	Jan. '19, Q	.50
Majestic	Boston Curb	*12	*12	*12		
Mason Valley	Boston	1⅝	1⅛	1⅛		
Mass Consolidated	Boston	2	2	2	Nov. '17, Q	1.00
Miami Copper	New York	23½	22⅞	22⅞	Aug. '21, Q	.50
Michigan	Boston	†2½	†2	2¼		
Mohawk	Boston	52½	51	52	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	5¾	5½	5⅛		
Nevada Consol.	New York	13⅛	12⅞	12¾	Sept. '20, Q	.25
New Cornelia	Boston	15½	14¼	14¾	Aug. '20, K	.25
North Butte	Boston	11	10	10¾	Oct. '18, Q	.25
North Lake	Boston	†*50	†*15	*20		
Ohio Copper	N. Y. Curb	*7	7	*7		
Old Dominion	Boston	24	23	23	Dec. '18, Q	1.00
Osceola	Boston	30	29¼	30	June '20, Q	.50
Phelps Dodge	Open Mar.	†180	165		Oct. '21, Q	1.00
Quincy	Boston	40	40	40	Mar. '20, Q	1.00
Ray Consolidated	New York	13⅞	13½	13¾	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*26	*21	*23		
St. Mary's Min. Ld.	Boston	39	38	38	June '20, K	2.00
Seneca Copper	Boston	20⅞	19¾	20¼		
Shannon	Boston	1	1¼	1⅛	Nov. '17, Q	.25
Shattuck Arizona	New York	6¼	6	6¼	Jan. '20, Q	.25
South Lake	Boston	†*51	*50	*75		
Superior & Boston	Boston	1⅛	1⅛	1⅛		
Tenn. C. & C. cfs.	New York	8⅜	8	8	May '18, I	1.00
Tuolumne	Boston	*41	*38	*40	May '13	10
United Verde Ex.	Boston Curb	27	25¾	26½	Nov. 21, Q	.25
Utah Consol.	Boston	3	3	3	Sept. '18,	.25
Utah Copper	New York	56½	54¾	55¼	June '21 Q	.50
Utah Metal & T.	Boston	1¼	1 3/16	1 3/16	Dec. '17,	.30
Victoria	Boston	1⅞	1⅞	1¼		
Winona	Boston	*60	*40	*50		
Wolverine	Boston	12	11	11		
		NICKEL-COPPER				
Internat. Nickel	New York	14¼	13¼	13	Mar. '19,	50
Internat. Nickel, pf.	New York			74	Nov. '21, Q	1.50
		LEAD				
National Lead	New York	77⅞	76⅞	76¼	Sept. '21, Q	1.50
National Lead, pfd.	New York	104⅞	104	104	Sept. '21, Q	1.75
St. Joseph Lead	New York	13¼	13¼	13¼	Sept. '21, Q	25
		QUICKSILVER				
New Idria	Boston	†*50	....	*50		
		ZINC				
Am. Z. L. & S.	New York	9	8	8½	May '20,	1.00
Am. Z. L. & S. pfd.	New York	33	33	33	Nov. '20, Q	1.50
Butte C. & Z.	New York	5	4¼	5	June '18,	.50
Butte & Superior	New York	14⅞	13⅞	13⅞	Sept. '20,	1.25
Callahan Zn-Ld.	New York	4⅛	4	4	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	124½	124	124	Aug. '21, Q	2.00
Success	N. Y. Curb			2	Dec. '16,	03
Yellow Pine	Los Angeles	*35	*35	*35	Sept. '20, Q	03

*Cents per share. †Bid or asked. ‡Quotation missing. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	½	½	½		
Alaska Juneau	New York	¼	½	⅝		
Carson Hill	Boston	13¾	12¼	12⅞		
Cresson Consol. G.	N. Y. Curb	1⅞	1 13/16	1⅞	June '20, Q	$0.10
Dome Extension	Toronto	*68	*68	*68		
Dome Mines	New York	18¼	18⅛	18¾	Oct. '21, Q	.25
Florence Goldfield	N.Y. Curb	*39	*35	*35		
Golden Cycle	Colo. Springs	*67	*67	*67	June '21, Q	02
Goldfield Consol.	N. Y. Curb	*5	*5	*5	Dec. '19,	05
Hollinger Consol.	Toronto	7.50	7.46	7.48	Nov. '21, 4 wks.	.05
Homestake Mining	New York	55	55	55	Oct. '21, M	.25
Kirkland Lake	Toronto	*39½	*26	27		
Lake Shore	Toronto	1.24	1.19	1.23	Aug. '21, K	.02
McIntyre-Porcupine	Toronto	1.90	1.86	1.89	Sept. '21, K	.05
Porcupine Crown	Toronto	*15	*12	*13¼	July '17,	.03
Porcupine V. N. T.	Toronto	*17¾	*15	*17		
Portland	Colo. Springs	*35	*35	*35	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb			*4	May '19,	.05
Schumacher	Toronto	*26	*22	*25		
Silver Pick	N. Y. Curb		....	*8		
Teck Hughes	Toronto	*15¾	*15	*15½		
Tom Reed	Los Angeles	*44	*34	*35	Dec. '19,	.02
United Eastern	N. Y. Curb	2 1/16	2¼	2 1/16	Oct. '21, Q	.15
Vindicator Consol.	Colo. Springs	*24	*24	*24	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*5	*5	*5		
Yukon Gold	N. Y. Curb	1¼	1⅛	1¼	June '18,	02½
		SILVER				
Arizona Silver	Boston Curb	*20	*17	*18	Apr. '20, M	.03
Batopilas Mining	New York	⅜	⅜	⅜	Dec. '07, I	12½
Beaver Consol.	Toronto	*25	*21	*22	May '20, K	.03
Coniagas	Toronto	1.50	1.20	1.40	May '21, Q	.12½
Crown Reserve	Toronto	*13	*10	*12	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3¾	3⅛	3⅞	Oct. '21, Q	.12½
La Rose	Toronto	*35	*33	*33½	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*20½	*16	*19	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.15	1.00	1.10	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	5½	5½	5¼	Oct. '21, Q	.03
Ontario Silver	New York			4	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb			*12	Jan. '12,	10
Temiskaming	Toronto	*28	*22	*26	Jan. '20, K	04
Trethewey	Toronto	*13	*10	*11	Jan. '19,	05
		GOLD AND SILVER				
Boston & Montana	N. Y. Curb	1 1/16	*94	*96		
Cash Boy	N. Y. Curb	*4	*4	*4		
Consol. Virginia	San Francisco	....	....	*36		
Dolores Esperanza	N. Y. Curb	1½	1½	1½		
El Salvador	N. Y. Curb	*16	*15	*16		
Jim Butler	N. Y. Curb			7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*4	*3	4	June '16	05
Louisiana Con.	N. Y. Curb	....	....	¼		
MacNamara M.& M.	N. Y. Curb	*14	13	14	May '10,	.02½
N. Y. Hond. Rosar.	Open Mar.	...	...	4	Jan. '21, Q	30
Tonopah-Belmont	N. Y. Curb	1⅛	1 1/16	1 1/16	Apr. '21, Q	05
Tonopah-Divide	N. Y. Curb	*70	*66	*70		
Tonopah-Extension	N. Y. Curb	1½	1 1/16	1½	Oct. '21, Q	05
Tonopah Mining	N. Y. Curb	1⅛	1⅛	1 3/16	Oct. '21, SA	05
West End Consol.	N. Y. Curb	*97	*95	*96	Dec. '19, SA	05
		SILVER-LEAD				
Caledonia	N. Y. Curb	*8	*8	*8	Jan. '21, M	01
Cardiff M. & M.	Salt Lake	1.00	1.00	1.00	Dec. '20,	15
Chief Consol.	Boston Curb	3½	3⅜	3¼	Aug. '21, Q	05
Consol. M. & S.	Montreal	18	17	17½	Oct. '20, Q	62½
Daly Mining	Salt Lake	†3.00			July '20, Q	10
Daly-West	Boston	2	2	2	Dec. '20, Q	25
Eagle & Blue Bell	Boston Curb	†3	†2½	2	Apr. '21, K	05
Electric Point	Spokane	*5	*4	*5	May '20, SA	03
Eureka-Croesus	N. Y. Curb	*48	*40	*45		
Federal M. & S.	New York			7½	Jan. '09,	1.50
Federal M. & S., pfd	New York	25½	25	25½	Sept. '21 Q	1.00
Florence Silver	Spokane	*9	*4	*9	Apr. '19,	01½
Grand Central	Salt Lake	†*30	†*11	..	June '20, K	03
Hecla Mining	N. Y. Curb	4¼	4¼	4⅛	Sept. '21, Q	10
Iron Blossom Con.	N. Y. Curb			*17	Apr. '20, Q	02½
Judge M. & S.	Salt Lake	†3.00	†2.00		Sept. '20, Q	12½
Marsh Mines	N. Y. Curb	*3	*3	*3	June '21, I	02
Prince Consol.	Salt Lake	†*7	†*5	*7½	Nov. '17,	02½
Rambler-Cariboo	Spokane	*1	*1	1	Feb. '19,	01
Rex Consol.	N. Y. Curb	*10	*9	*10		
South Hecla	Salt Lake	†*40	†*20		Sept. '19, K	15
Standard Silver-Ld.	N. Y. Curb	*10	*10	*10	Oct. '17,	05
Stewart Mining	N. Y. Curb			*4	Dec. '15	05
Tamarack-Custer	Spokane	1.95	1.80	1.95	Jan. '21, K	04
Tintic Standard	Salt Lake	1.95	1.87½	1.95	July '21, Q	05
Utah Apex	Boston	2 11/16	2½	2½	Nov. '20, K	25
Wilbert Mining	N. Y. Curb	....	....	*1	Nov. '17,	01
		VANADIUM				
Vanadium Corp.	New York	33¾	31¼	31¼	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	62½	53¼	62	Oct. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	80¾	74	80¼	Oct. '21, Q	1.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	40½	38⅛	39	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	80	76½	80	Sept '21, Q	1.75
Am. Sm. pf. A.	New York	81¾	78	81¾	Oct. '21, Q	1.50
U. S. Sm. R. & M.	New York	33½	32¼	33⅛	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	New York	39¼	39¼	39⅛	Oct. '21, Q	.87½

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, November 19, 1921 *Number* 21

The Disarmament Conference

WE ARE JUSTIFIED in believing that the Disarmament Conference in Washington is one of the most critical events of modern times, and one of the great pivotal periods of all history. We have witnessed in our time the greatest of all human cataclysms, the World War; we have witnessed the drama of the Peace Conference and its pathetic evidence that human nature is apt to be too low in stature, and too weak, to carry out heroic rôles and wise universal plans. These were the first two parts of the great drama set for our times, large enough in import to interest even the Martians, if they be by any chance intelligent onlookers. The third act, in Washington, may close the play, and let us go home to peace and the welfare of the period that has no dramatic history. It depends on the actors. For ourselves, we are optimistic.

Mr. H. G. Wells, with probably the most detached and broadest of the intellects of our period, joined to the acute observation and logical deduction of the scientist (he began as a zoologist and astronomer), has recently pictured the stage setting with his own unrivaled force and sincerity. Mr. Wells is on the whole, perhaps, not optimistic. He sees civilization as sinking at the present time—he sees us slowly and surely submerging, as the civilization of the Roman world did at the beginning of the Dark Ages, when, had it not been for the monasteries, those lighthouses and fortresses of culture, we should not have had even the kindling to start the fires of modern learning.

There is no question that we have just escaped such a complete shipwreck, and by a series of miracles which might be dramatically at least featured as divine interventions; but we do not visualize, with Mr. Wells, the ship as settling under her injuries at the present moment. We visualize her as slowly rising, and with good handling well able to weather the waning storm. This does not minimize the grave and decisive character of the Washington Conference. But there are certain advantages which warrant optimism. We have the advantage of experience and of past mistakes, and, therefore, we have certain reefs well charted. And we have the greatest of all advantages, that of the co-operation and guidance of public sentiment.

In Paris, national thought and sentiment was not asked for, even from democratic and enlightened America; even our own representatives sent us word to mind our own business—that supermen were on the job. Well, we are individually very limited, the greatest of us. Feisal, now king of Arabia, was in Paris at the Peace Conference, and met the great figures of the world—Lloyd George, Wilson, Clemenceau, and the rest. He was asked his impressions of them. "They loom up larger," said the Arab, "from the desert."

It is, we believe, the solemn truth; and, moreover, there is no justification for democracy unless it be true, that the collective thought and aspirations of the people are wiser and safer than those of its chosen leaders, paradoxical though the axiom may superficially appear. Therefore, the press and the various other methods the people possess to make themselves vocal should be vociferous, in America, in Europe, and in Asia. Let the leaders ask, "Do we want war?" and listen; and they will hear the thunderous reply of Noes which will decide the question. There never would have been a world war if the leaders had asked the people, and listened. There never will be another if they hear the voice of the multitudes. Therefore, let it be raised without invitation.

Is this an editorial for a mining journal? Man, the working of your mines, your bread and butter, depends on it. You may have lived high for a few years, while your products were being used for destroying wealth. But you are just now weathering the bitter reaction; and if the poisonous stimulant is repeated, it will kill you, quite as Mr. Wells has told you.

The Proposed Mining Law

AN ESPECIALLY VALUABLE CONTRIBUTION to the discussion of the proposed new mining law bill is that by Mr. H. G. Moulton, which will be found on page 804. Mr. Moulton writes from an earlier extensive background of experience as a surveyor; and has, moreover, as we happen to know, investigated through the Government Land Office the present conditions as to resurveys, before setting his pen to paper. His presentation is so careful as to go far toward being practically conclusive in regard to the surveying requirements of the law. It is clear that they should be modified according to existing circumstances and in the interests of simplicity and practicability. It is also clear that when these minor requirements of the law are adjusted, the bill should be strongly supported by every one, from prospector to capitalist, and passed, for it is a simpler and more equitable machine than the old law with which we have so long struggled.

The Gold Bonus

SECRETARY MELLON and Senator Oddie, of Nevada, have each made long declarations regarding the gold bonus, Secretary Mellon severely criticizing it and Senator Oddie making a rebuttal. There is still much that can be said on both sides of the controversy, which has had its period of intense discussion and then of quiet.

Outside of the American Mining Congress, champion of the gold bonus, interest in the issue has subsided. Engineers to whom we have spoken lately are of the opinion that the bonus has a small chance of becoming law. In these expressions the wish has obviously not been father to the thought, and possibly we are too frank in stating so. Frankly speaking, the possibility of the enactment of the McFadden Bill does not appear as good as when the bill was first promulgated in March, 1920. The irrefutable argument that commodity prices have come down and that the trend is still downward has dampened the powder of the gold bonus advocates.

The increasing interest manifested in gold mining in the United States and Canada, and the possibility of gold mining being one of the first metal mining industries to revive, are also considerations that have affected the probability of the passage of the legislation sought. It is becoming increasingly problematical whether, in view of greatly altered domestic business conditions, legislation which was considered eminently fair a little over a year ago has not now changed in character.

The McFadden Bill, it will be recalled, ostensibly provides for the protection of the monetary gold reserve of the United States, protection that is no longer required and which would be very weak were its sole strength in a greater gold production. The stimulation of domestic gold mining is secondary. The act provides for a $10 bonus per ounce until May 1, 1925, and an annual adjustment of the bonus thereafter based upon a commodity index number. Presumably the provisions of the bill are to be in force until the act is repealed or modified. In its present form it would provide an assurance to gold producers for an indefinite period of a fixed price for their product plus a premium whenever the general price level is unusually high.

The question may naturally be asked, Is it necessary to compensate gold miners for the next five years and longer for the losses sustained during the war? Would not such legislation create resentment among the producers of other metals who do not benefit by the advantage of a fixed price for their product? Copper, zinc, and lead producers were extraordinarily prosperous during the war, but their profits have been dug into greatly by the present curtailment of activity. Should a revival be deferred much longer, it is doubtful if the copper companies—to take an outstanding example—will have profited greatly by the war and its aftermath. Whereas gold mining was depressed during the war, it has reached the stage in a cycle looking to increased activity.

Gold unquestionably derives a great advantage from its ready marketability, its fixed price, and the freedom it consequently gives the gold miner from the marketing worries that ordinarily beset the non-ferrous metal producer. Surplus stocks of gold do not disturb the gold miner; they perturb the financier. A willing consumer is always available to the gold miner in his own and other governments. Of course, gold miners have paid a heavy price for their advantage, but we fancy few would be willing to surrender this advantage in return for the speculation that would be introduced in their operations by a fluctuating price for gold—assuming such a fluctuating price to be possible. The benefit which gold miners obtain in normal times is doubtless a stimulant to the present activity in the North American gold mines.

We do not know whether the McFadden Bill will be passed, but we do not advise any operator placing too great a reliance on that event. If it should become law, so much the better for the gold-mining industry; but if it should fail, our composure should not be too much disturbed, as conditions in gold mining are returning to normal. The improvement is not shown in production necessarily, but in the preparations that are being made to reopen closed mines and the increased attention given gold by prospectors.

Possibly the McFadden Bill would stand a better chance in a modified form. March, 1920, was the psychological time to press the passage of the McFadden Bill. Then relief was urgently demanded by existing conditions in the gold-mining camps; but many changes have taken place since.

Universities and Commencements

THE MOTIVES which send a student to one university or college and not to another may be comparatively superficial or inspired by logical reasoning. In any event, when he elects to attend a given school both he and the school assume certain responsibilities. On his part, he agrees to accept the prevailing order of things as it is in the school. On the part of the school, there exists by implication at least the responsibility for developing the student's latent possibilities to the greatest extent, within obvious limitations. The student is in the position of a buyer who makes a preliminary payment and expects to receive his purchase in installments, continuing his payments as he goes along.

Some schools endeavor to make clear to the student just what they purpose giving him. This is usually done by assembling the students who have entered a given course, at which time either the dean or other person in charge outlines to them the entire course in a more or less comprehensive way. Sometimes excellent advice is given and often the rules of the game are laid down. Other schools by a system of advisers induct the student into the mysteries of schedules and courses, and still others leave it to him to ferret out these matters from catalogues and printed directions. There thus appears to be a real need to describe in some way the purchase the student is about to make.

Granting that the student has survived the many vicissitudes of the four or more years required, he at last reaches the finale. The student has made his payments in cash, brawn, brains, and other ways, and the school has delivered the goods. Both parties have a grand celebration, much more elaborate than the passing of a good cigar or the "eats" and the cigars which occasionally enliven a commercial transaction. You know all about commencements, the preliminary student marching around the campus, the official program, with its music, its academic procession, its speeches, and the university president passing the sheepskins, and lastly the "doings" of the brand-new graduates.

So far, this is all very well and is strictly in good form, but we venture to raise the question whether the school has completely met its full obligation and whether part of the relatively large amount of time devoted to commencement festivities cannot be utilized in a more practicable way. There exists in every well-established school a nucleus of the teaching force in each department which consists of mature men who have spent considerable time in acquiring knowledge of their several specialties and in understanding the conditions which their end-product or graduates must face. We believe that these men should visualize the after-career of their graduates and prepare a brief that would embody a consistent scheme of future study extending out the various avenues which have been partly built and paved in the school work.

As an exemplification, a number of successful careers should be presented, together with detailed analyses of the ways by which success has been achieved in each instance. The brief should be concise, pithy, and comprehensive. These briefs should not be standardized, but each should reflect the personality of the man preparing them.

As a student approaches commencement there is an emotional period during which he is especially susceptible. Let advantage be taken of this by having each major instructor present to the particular group of students his plan for future development and his analysis of the elements of success. In our judgment such a procedure would add an important element to the commencement which it now lacks.

Service Information

THE MINE OPERATOR, generally speaking, is fairly resourceful, making the most of the equipment that he has and conducting the management of his property to the best of his ability. The extent of his operation usually determines the number of his subordinates, each of whom is given the responsibility of a part of the work to be performed. Naturally, a great organization, with its various ramifications, is able to conduct certain research work that must be left undone by smaller companies, which, either through lack of capital or by reason of limited needs, do not find it convenient to do so. On the other hand, many problems—particularly those relating to the operation of machinery—have concerned others than those that actually make use of such; and it is the privilege of the small- as well as the big-scale operator to take advantage of the research work done by the manufacturers.

We have at different times called attention to the information disseminated by manufacturers with regard to their particular products. Such information is not scattered broadcast without study, for the results presented represent much painstaking research under actual conditions.

It must be remembered that the mine-machinery manufacturer faces competition at every turn, regardless of the merits of his product. His existence depends not only on his ability to "produce the goods" but to keep step with, or a little in advance of, the requirements of the mine operator. And this he does by an intense study of the latter's problems. Any doubts on this question may be settled by casual questioning in any of the mining districts, where it will be found that the distribution of "service" engineers, representing the various manufacturers, is a liberal one.

Nor does the work stop there. Information relating to mine problems is carefully compiled and reported to the general manufacturing plants, where careful investigations are made, the findings resulting in new machines, appurtenances, methods, or suggestions.

Recently we had an opportunity to study a number of "service information sheets" which are issued periodically by a large manufacturer of mining machinery, and we were impressed with the thoroughness that this company is showing in promoting the interest of the users of its products. The following are a few of the points mentioned: Increasing the life of pistons by replacement of rotation sleeves; reducing hammer drill piston breakage, proper lubrication, the mistake of using dull drill bits, disadvantages of high pressure; proper assemblage of parts, the tempering of drill steel, and the general care of drill machines.

Some of these pointers may be "old stuff," but, for the most part, they are all worthy of the consideration of every mine operator, for these service bulletins have not been prepared without careful consideration of the multiplicity of detail with which the miner must deal.

We recall a certain slogan used extensively by a well-known automobile concern: "What comes after the purchase price?" Obviously, in this case, *service*, for our drill-machine friends are not content to place their wares in the hands of the mine operators and let it go at that. Rather, they realize that by assuming a responsibility in the operation of the machine that they produce they will not only be aiding the miner but themselves.

Engineer Member, California Industrial Accident Commission

THE ENGINEERING COUNCIL of San Francisco has passed a resolution indorsing the idea of having an engineer as one of the members of the Industrial Accident Commission of California. The Metal and Mineral Producers' Association of California and other engineering and business organizations are also indorsing the same suggestion. A committee has been appointed to present the resolutions to Governor W. D. Stephens and to enlist his attention.

Hitherto the Industrial Accident Commission has represented in its membership business and labor men and one political affiliant. It seems to us that at least one engineer should be upon this commission, as an engineer is peculiarly fitted by reason of his contact with industry and the nature of his work to participate in the administration of the industrial compensation act.

We can see no reason for political representation on this board. We express the hope that Engineering Council and other organizations will succeed in getting an engineer on the commission.

Marketing

THERE ARE IN GENERAL two kinds of buyers, the one indifferent and the other shrewd enough to get greater value for his money. There are also two kinds of merchandising, one charging a high price on account of the number of indifferent buyers and the other making a price that produces a large volume of sales. In the mining industry, as well, this situation no doubt prevails.

In the buying and selling of metals in the major-metal markets, most of the transactions are between principals who have made an intimate study of conditions, metal stocks, trend of prices, and industrial needs. On the one hand, is the desire to sell at the highest price, and on the other the desire to buy at the lowest. The differential between the two desires is not 100 per cent, as in the instance of the retail merchants noted before, but is exceedingly small. The advantage is with the seller when demand is keen and with the buyer under reverse conditions. This intelligent marketing restricts the profits of a mining company in the direction of the sale of its product. Only by an equivalent shrewdness in buying and directing its supplies can additional "profit" be made by the company. Good management will add still another "profit." The two combined are necessary in many instances to tide over a buyer's market, and in the case of low-grade properties may make the difference between success and failure.

WHAT OTHERS THINK

Revision of the Mining Laws

House Resolution 7,736, introduced by Mr. Arentz last July, represents a praiseworthy attempt to revise the mining laws of the United States so that they will be in line with modern conditions. In general principles the measure is thoroughly sound, and it is entitled to the support, in principle, of the mining fraternity. As to some minor points, however, it would appear that modifications should be made in the interest of prospectors and mine owners.

I am most fully in sympathy with the fundamental thoughts which have found expression in this legislation, but I have also in mind the specific problem of the prospector or locator of small means unable to employ engineering talent in connection with the original location of mining claims. This letter is written from a background of early professional experience as a United States deputy mineral surveyor and in connection with mine surveying, railroad location, and such work, involving location and tracing of land lines in the western United States and to some extent in Canada. It is also written from a background of sympathy with, and understanding of, the operations and limitations of the average prospector and small operator.

I think all can agree on the wisdom of dropping from our mining law the requirement of discovery during the first five-year period. The common practice in the past has been to locate mining claims in more or less regular blocks, making technical discoveries to fill the requirements of the law. It is much better to recognize in law the custom sanctioned by long practice, which accepts the most nominal mineral showing as satisfying the requirements. Locators and United States mineral surveyors should not be compelled to stultify themselves by making statements as to the existence of mineral, direction of vein, and similar matters which are only technically true and which may have no substantial basis in fact.

The limitation of the length of time for which a claim may be held without discovery and application for patent to a period of five years, with an extension for a further period of five years on payment of $50 per acre annually, is based on sound theory; the terms should, however, be given thorough consideration in the light of all objections that may be raised, and perhaps it may be better either to extend the five-year period or to reduce the annual payments for the extension period, so as not to put too great a burden upon the man of small means who must of necessity work slowly. On the other hand, it must be recognized that the prospecting and development of mines in the United States in the future will be carried on in a different way, and on a more extensive and expensive scale, than in the past, and that the real importance to the mining industry of the individual prospector and small operator will not be as great from now on as during the earlier days of the development of mining districts. Nevertheless, full justice should be done to the man prospecting or operating on a small scale and with limited resources so far as is consistent with the best interests of the mining industry as a whole, which is unquestionably the inspiration of the spirit of this measure.

To require that when mining claims are located upon surveyed lands they shall conform to the subdivisions of the public-land surveys is not of enough importance to insist on its inclusion in the bill, and, on the other hand, it would impose real hardships on locators. The system of public-land surveys represents a gradual development, and though much of the work of the early surveyors was creditable when considered in the light of the instruments available, the difficulty of operation in remote districts, and other handicaps, the technique and results of the old methods seem rather crude when compared with modern surveying practice. Even where the old corners were set with reasonable accuracy, they have often been destroyed by the action of the elements, by forest fires, or by lumbering operations and other human agencies. It is difficult enough for a United States deputy mineral surveyor to retrace land lines and connect mineral surveys with corners, and the prospector should not be put to the expense of hiring surveyors for this purpose.

Surveys made since June 30, 1910, and also resurveys since that date, are in first-class condition and marked with permanent monuments, normally consisting of iron pipes driven into the ground, filled with concrete and capped with brass. On land surveyed or resurveyed since June 30, 1910, it would be entirely practicable to locate in accordance with land lines, but surveys and resurveys since that date represent only a small proportion of the total surveyed areas in the western mining states. If this requirement is to be left in the law at all, it should not be made mandatory except in cases where land has been surveyed since June 30, 1910, and discretion given to the General Land Office to designate districts in which locations must conform, and others in which locations need not conform, to the lines of the public-land surveys.

In connection with patent proceedings, the bill provides that where claims are upon surveyed land and conform to legal subdivisions no further survey or plat shall be required. This provision may well open the way to much litigation. The law as to boundaries is that monuments govern as against courses and distances. It has also been thoroughly established that the original corners established by the Government surveyors must stand as the true corners which they are intended to represent, whether in the places shown by the field notes or not, and that, with certain exceptions, the quarter-quarter corners not established by the Government surveyors shall be placed on the straight lines joining the section and quarter-section corners and midway between them. Therefore, let it be assumed that title has been established through location to the southwest quarter of the southwest quarter of a given section, and that after many transfers and elapse of a considerable period of time the ground becomes part of the property of a large mining operation, and either through the discovery of a body of high-grade ore or through the location of permanent improvements the exact determination of the boundary lines may become a matter of the first importance. By that time the west quarter corner, and perhaps even the southwest section corner, may have disappeared, and the same may hold true of the quarter corners and section corners on any of the other sides. As the boundaries of the fractional part must be determined by lines connecting points halfway between the original locations of the section corners and quarter corners, there may be ground for much litigation over the original positions of these corners, with consequent effect on the boundaries of the claim.

To prevent such possibilities, the land office should issue patent not to an aliquot part of a section by description but to a given area of ground suitably and permanently monumented, so that thereafter, under law, monuments may govern and the boundaries always may be subject to determination as straight lines joining existing monuments established by the authority of the United States Government at the time patent was issued. It would not be enough to make such survey and plot optional on the ground that the locator could assume the risk if he should so choose, for the reason that transfers of titles might ultimately affect the position of innocent parties having no option in the matter. In determining questions of ownership in which an exact establishment of boundaries may be of importance, no locator should be given an option to neglect necessary precautions in establishing such boundaries. As the law now reads, though clearing most of the ambiguities which have in the past been fruitful of much litigation, it has left here an opening through which much unnecessary litigation might conceivably result.

The requirement that where patents have been or shall be issued for claims upon unsurveyed lands, the Surveyor General, in extending the public survey, shall adjust the same to the boundaries of said patented claims so as in no case to interfere with or change the true location of such claims as they are officially established upon the ground, is right in spirit in that it recognizes the ownership of ground in accordance with existing monuments, but it is ambiguous in wording. Presumably the intent is that the land lines stop at the intersection with the boundaries of the patented ground and pick up again at the further boundaries. If this specific wording has not already received the approval of the General Land Office, it might be advisable to make sure that it is submitted to that office for consideration, to make sure that nothing in it modifies existing laws and regulations governing the surveys of public lands, for the practices and regulations of the General Land Office represent in every detail the results of long experience and gradual development, and for many yars it has functioned smoothly and efficiently; therefore, the language of this bill, in so far as it affects the public-land surveys, should be subjected to the scrutiny and await the final approval of the General Land Office, so that it may as far as possible harmonize with existing practices and regulations.

I wish it understood that none of the above observations are to be taken as other than friendly criticisms of certain details of an otherwise admirable measure; also, that the foregoing comments as to the difficulty of retracing the lines of early land surveys are in no way intended as reflections upon the past work of the land office—only as a recognition of the difficulties under which such early surveys were carried on and a recognition of the fact that the possibilities of error were greater then than today, and that aside from any question of the possibility of really careless work, the lapse of time has destroyed much necessary evidence, and therefore in many sections locators cannot find the lines of the public-land survey without going to expense prohibitive to the average prospector. H. G. MOULTON.

New York.

Drilling Results and Dredging Returns

In your issues of Oct. 22 and 29, there appears an article, "Drilling Results and Dredging Returns," by Charles W. Gardner. After reading this article it seemed to me that, according to Mr. Gardner, it would not be wise to put much reliance in results that were arrived at by drilling. At least this is the impression the article gives, but I really don't think that Mr. Gardner intended it to be as strong as this, because in one of his recent reports on a placer mine that I happen to have before me he states: "By using this drilling factor in computing our results, we believe them conservative, and our experience is that its use is likely to give an estimate fairly close to the actual results to be obtained by dredging." This conclusion certainly does not agree with Mr. Gardner's long list of drilling discrepancies.

In his article, Mr. Gardner first tells us that he will consider the various conditions and causes affecting the accuracy of the results obtained, but he does not do so, and we are left where we were in the beginning. Drilling results were more or less inaccurate when drills were first used for this work, but I do not see why this should be so now, when the apparatus has been much improved and we have become more experienced.

It seems to me that the factor of 239 ft. as equaling a cubic yard, which Mr. Gardner states Mr. Martin used in drilling with the Empire drill, accounts for some of the differences. Whenever I work with Empire drills, I always use the factor 385, which is found by taking the inside diameter of the cutting shoe instead of the outside, from which the factor of 239 was evidently computed. The factor of 385 is the one in general use with all the Empire drill work that I know of, and the inside of the cutting shoe is used in determining this factor.

Mr. Gardner has certainly collected a lot of data on drilling, and it is a good subject to bring up for discussion; but so far he does not get us anywhere as to the real reasons for the discrepancies, and the whole matter is all the more confusing when one considers that from Mr. Gardner's data the same drill, the Keystone, was used in almost all instances.

I think that it is simply the personal element that is to blame for most drilling discrepancies in many instances cited by him, excepting in Mr. Martin's case, where it is clearly evident to me that he used the wrong factor in figuring his drill results.

New York E. F. WILSON

In *Engineering and Mining Journal* of Oct. 22 appears the first installment of my article on "Drilling Results and Dredging Returns," and I notice in the eighth line of the first column of page [illegible] that you have used the word "inexperienced" when in the text the word "experienced" was used. The sentence should read: "The drill operations are frequently left entirely to a crew of *experienced* men, as the general conditions are well known and no close supervision is given to the work."

San Francisco, Cal. CHARLES W. GARDNER

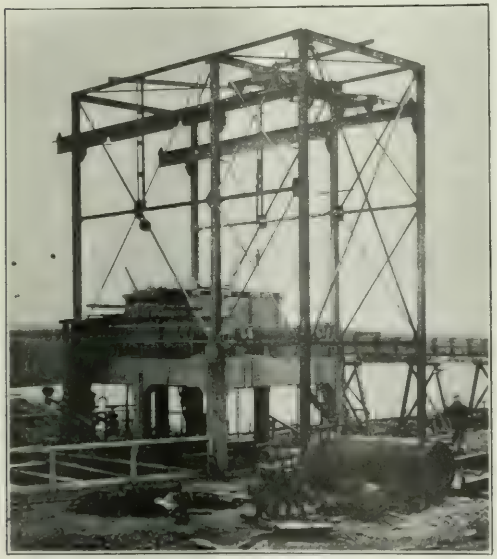
The Tailing Air Lift of the Chino Copper Co.

Recently Developed Plant Capable of Raising Over 12,000 Dry Tons Per Day a Distance of 40 Ft. Exceeds Expectations, Saving 50 Per Cent of the Operating Cost of Bucket Elevators

By H. G. S. Anderson
Assistant General Manager, Chino Copper Co., Hurley, N. M.

Written for *Engineering and Mining Journal*

THE AIR LIFT has been receiving increased attention recently in the metallurgical and chemical industries, owing to its simplicity and reliability. It is somewhat of a paradox, however, that the very factors which are strongly in its favor are often the indirect cause of its being condemned. The most important of these factors is the presumption that it requires too great an amount of power compared with other types of pumps and elevators often used for the same service. This impression is commonly traceable to the fact that the simplicity of the system has made it possible for many installations to be made without a sufficient knowledge of the important details necessary for efficient operation.



SUPERSTRUCTURE
GENERAL VIEW OF THE AIR LIFT, SHOWING

It is not my intention in this article to contend that the power consumption of the air-lift system is less than, or even equal to, that of other systems for the same service. The following description of results achieved should, however, be of great interest to millmen having similar problems, as the data are taken from a plant which is probably the largest of its kind in operation and which was designed to keep the power costs as low as possible, as well as for the purpose of obtaining continuity of service and freedom from excessive repair costs.

During 1918 a bucket-elevator plant was designed to elevate the tailing discharge from the concentrator of the Chino Copper Co. at Hurley, N. M., a height of approximately 40 ft., to transport this tailing through launders to an area where additional tailing disposal space was available. Construction work was begun and a large pit was excavated to provide for a sufficient number of bucket elevators to elevate a maximum of 12,000 tons of tailing daily. Concurrently with this preliminary construction work, the theoretical and practical considerations involved in an air lift to elevate the same amount of tailing were discussed. The problem of tailing disposal was one destined to become increasingly important throughout the life of the mill, and it was decided to investigate carefully the economical possibilities which the air lift offered, before construction of the bucket-elevator plant had progressed too far. Cost data covering the operation and records of bucket elevators handling the same class of material were available from past operations. The air lift seemed to be a radical departure from current practice, but the final estimate of the probable cost of operation indicated that a sufficiently large saving would be made to justify the installation of the air-lift plant instead of the bucket elevators. The air-lift installation would also be of considerable experimental value for future use, as successful operation might indicate that it would pay to abandon elevators for future installations in the mill and perhaps replace some of those already in use.

The final cost of the air-lift plant, as it stands on the construction accounts, is the same as the estimated cost of the bucket-elevator plant, for the reason that the site already selected was used for the installation of the air-lift plant, and all of the initial construction costs, primarily chargeable to the partly finished bucket-elevator plant, were charged against the air-lift installation. If the advisability of using an air lift had been more apparent when construction work was begun upon the bucket-elevator plant, the tailing air-lift site would have been changed to a location more favorable to that type of installation, and the original estimate of 75 per cent of the cost of the bucket-elevator plant would have been more nearly approached.

Comparative estimates of the bucket-elevator and tailing air-lift plants to handle the 12,000 dry tons of tailing daily indicated that the first cost of the air-lift plant would be approximately 75 per cent of the first cost of the bucket-elevator plant, and that the cost of operation of the tailing air lift would amount to approximately 72 per cent of the cost of operating the bucket elevators. The advantage, from all points of view, indicated the desirability of installing air lifts instead of bucket elevators.

The air-lift plant was installed and placed in operation in July, 1919. During July and August of that year extensive tests were carried on to determine the most economical operating conditions, the efficiency that could be obtained, and such other useful information as might develop. During the succeeding sixteen months, from September, 1919, to December, 1920, inclusive, accurate costs were kept on the operation of the air-lift plant and on a bucket-elevator plant operated under practically the same conditions of lift and capacity, in the mill itself.

Table I illustrates a comparative estimate that was made in 1918 on a basis of 12,000 dry tons' daily capacity, and Table II the actual comparative costs based on an average capacity of 5,000 dry tons daily for the sixteen-month period beginning September, 1919, and ending Dec. 31, 1920.

TABLE I. ESTIMATE MADE IN 1918 [illegible] 12,000 DRY TONS DAILY CAPACITY

Type	Estimated Life Twenty Years Tons Elevated in Twenty Years	Estimated Operating Cost per Dry Ton	[illegible]	[illegible]
Elevators	87,600,000	$0.011756	$[illegible]	$[illegible]
Air lift	87,600,000	.008483	[illegible]	[illegible]
Estimated saving		$0.003273	$[illegible]	$[illegible]

(a) [illegible]

TABLE II. BASED ON ACTUAL AVERAGE [illegible] 5,000 DRY TONS DAILY FOR SIXTEEN MONTHS

Type	Tons Elevated in Sixteen Months	Actual Total Operating and Repair Cost, Sixteen Months	Average Cost per Dry Ton Elevated	[illegible]	[illegible]
[illegible]	2,45[illegible]	$48,07[illegible] 47	$0.01[illegible]	$[illegible]	$[illegible]
Air lift	2,207,922	21,798.90	[illegible]	[illegible]	[illegible]
Actual saving			$0.009[illegible]	$[illegible]	$[illegible]

(a) [illegible]

The operating costs per dry ton for both the air lift and the elevators, shown in Table II, are higher than the estimates of Table I, owing to the increased cost of various factors entering therein, but the difference in costs realized by the air-lift plant—practically one-half of the costs of the elevator—proved to be even greater than that expected when the original estimate was made in 1918.

In designing the plant, the compressors were equipped with recording tachometers, recording air gages, meters on the electrical auxiliary equipment for the condensers, and all necessary instruments so that accurate daily records could be kept. All costs of labor required for operation and repair of the plant and compressors were carefully kept and included in the detailed costs shown. More detailed figures covering a summary of the conditions under which the air-lift plant operated during the sixteen-month period are given in Table III, Table IV, and Table V.

The actual dry tonnage handled was determined definitely by subtracting the tons of concentrate from the tons of ore milled. The revolutions of the air compressor were determined from the tachometer and speed-counter readings, and the cubic feet of air and isothermal horsepower, which vary in direct proportion with the speed, were ascertained by the use of proper factors. The number of gallons of pulp handled and the consequent water horsepower depended entirely upon the dilution of the pulp itself, which averaged about 15 per cent solids by weight. This factor of 15 per cent solids by weight was used throughout, and

TABLE III. [illegible] AIR-LIFT OPERATION, 1919-1920

Period	Average Wet Tons	Average Dry Tons	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Air [illegible]	Pulp [illegible]	Air per Gallon [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1919																
September	33,30[illegible]	4,726	A-B	[illegible]	21.9	[illegible]	1,311.7	1,082	4,700	0.227	131	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
October	[illegible]	3,908	A-B	[illegible]	[illegible]	[illegible]	1,311.7	[illegible]	[illegible]	0.274	131	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
November	36,445	5,473	A	[illegible]	[illegible]	3.80	[illegible]	1,240	5,514	0.225	130	[illegible]	165.0	[illegible]	40.6	[illegible]
December	[illegible]	4,434	A	[illegible]	[illegible]	3.08	1,311.7	1,082	4,472	0.242	131	[illegible]	[illegible]	42.6	37.9	[illegible]
1920																
January	22,675	3,401	A	67	[illegible]	2.36	1,171.8	967	3,431	0.282	117	[illegible]	128.7	[illegible]	[illegible]	29.6
February	26,827	4,024	A	76	18.6	[illegible]	1,338.0	[illegible]	4,059	0.272	[illegible]	[illegible]	[illegible]	45.0	33.8	30.7
March	34,725	5,209	A	[illegible]	[illegible]	3.62	[illegible]	1,269	5,254	0.243	[illegible]	[illegible]	[illegible]	56.4	[illegible]	[illegible]
April	34,895	3,234	[illegible]	97	24.2	[illegible]	1,696.5	1,400	5,280	[illegible]	170	[illegible]	187.0	[illegible]	[illegible]	31.[illegible]
May	35,907	5,386	[illegible]	[illegible]	[illegible]	3.74	[illegible]	[illegible]	5,433	0.273	180	[illegible]	[illegible]	[illegible]	33.6	30.6
June	32,982	4,947	[illegible]	93	22.9	[illegible]	1,626.6	[illegible]	4,990	0.269	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
July	35,260	5,289	[illegible]	95	24.5	[illegible]	1,661.6	[illegible]	5,334	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
August	34,[illegible]97	[illegible]	[illegible]	100	23.7	[illegible]	1,749.0	[illegible]	5,160	0.279	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
September	[illegible]	5,878	[illegible]	[illegible]	27.2	[illegible]	[illegible]	1,470	5,928	[illegible]	[illegible]	[illegible]	195.8	[illegible]	37.0	[illegible]
October	34,7[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,269	[illegible]	0.240	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
November	31,[illegible]	4,796	A-B	[illegible]	[illegible]	[illegible]	[illegible]	1,240	4,819	0.257	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
December	18,700	2,805	B	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.336	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	14,719,480(a)	2,207,922(a)														
Average	31,723	4,758		[illegible]	[illegible]	[illegible]	[illegible]	1,242	4,793	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(a) [illegible]

TABLE IV. OPERATING COST [illegible] AIR-LIFT PLANT

Period	Dry Tons Lifted	Power: Steam	Power: [illegible]	Compressor [illegible] Operating	Plant Repair Labor	Supplies: Compressor	Supplies: [illegible]	Supplies: Total	Cost per Ton [illegible]
1919									
September	127,121	[illegible]	$120.97	$[illegible]	$5.16	$2[illegible]	$[illegible]	$[illegible]	$0.00[illegible]
October	[illegible]	328.44	[illegible]	[illegible]	1.33	[illegible]	[illegible]	[illegible]	[illegible]
November	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
December	[illegible]	[illegible]	[illegible]	[illegible]	5.84	[illegible]	[illegible]	[illegible]	[illegible]
1920									
January	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
February	116,7[illegible]	805.83	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
March	[illegible]	[illegible]	122.78	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
April	[illegible]	[illegible]	[illegible]	168.36	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
May	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June	[illegible]	[illegible]	149.76	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
July	[illegible]	[illegible]	[illegible]	101.64	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
August	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
September	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	[illegible]	[illegible]	7.40	[illegible]	[illegible]	[illegible]	[illegible]
November	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
December	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total [illegible]	2,207,[illegible]	$[illegible]	$2,20[illegible]	$[illegible]	$[illegible]	$[illegible]	$[illegible]	$[illegible]	
Average per dry ton lifted		$0.00[illegible]	$0.00[illegible]	$0.00[illegible]	$0.000[illegible]	$0.00[illegible]	$0.00[illegible]	$0.00[illegible]	

variations above and below this amount, which occur at times, are the principal cause of the variation in efficiency, or quantity of air per gallon of pulp, shown in this table.

In the table of operating costs (Table IV), the charges for steam consumed and auxiliary electrical power were taken from the regular power-house records. The compressors operated condensing and were equipped with a barometric-type condenser plant of the proper size to serve them. They were also connected to the service condensers, serving the large generator engines in the power plant, and, in so far as possible, were served by these condensers, the auxiliary power being proportioned. The operating labor charge covers two hours of the time of one operator on each shift. This operating labor was practically constant, regardless of the tonnage of tailing lifted, and for that reason the cost per ton lifted tended to decrease as the mill tonnage was increased. The items of labor and repair and supplies include lubricating oil, grease, and like necessaries for the air compressors, all repairs necessary for occasional cleaning of the submergence pits, and material and labor used in making slight alterations in piping found by experience to be advantageous for convenient operation.

TABLE V. COMPILED FROM TABLE III

Year	(a) Duty, Foot Pounds Per 1,000 Lb. Steam, Compressor Only	(a) Duty, Foot Pounds Per 1,000 Lb. Steam, Including Auxiliaries
1919		
Sept	54,900,000	49,900,000
Oct.	45,500,000	41,300,000
Nov.	55,300,000	50,450,000
Dec.	51,500,000	46,850,000
1920		
Jan	44,250,000	40,200,000
Feb.	46,050,000	41,900,000
March	51,800,000	47,100,000
April	46,900,000	42,600,000
May	45,550,000	41,400,000
June	46,500,000	42,250,000
July	48,500,000	44,100,000
Aug.	44,500,000	40,450,000
Sept.	50,250,000	45,700,000
Oct.	51,500,000	46,850,000
Nov.	48,700,000	44,250,000
Dec.	37,100,000	33,750,000
Average	48,050,000	43,700,000

(a) Duty computed on basis of 14.6 lb. average water rate for compressor and approximately 10 per cent additional for condenser auxiliaries. Steam conditions 170 lb. gage pressure; no superheat; 4 in. Hg absolute back pressure

INLET GATES

Before making a careful study of these tables, the design and operation of the air-lift plant should be understood thoroughly, for that will assist greatly in an understanding of the characteristics of the air lift in general, as well as of this particular installation.

The tailing is carried from the mill through a tunnel about 300 ft. long and discharged into a large sump shown in elevation in Fig. 1. The discharge of this tunnel, shown at the left of the drawing, is provided with a fall of about three feet to accommodate a sampler operated by compressed air. From this point the tailing flows through a launder to the submergence pit shown at the right of the elevation drawing. A shaft was first sunk to a depth of 103 ft. 4 in. This shaft was then lined with concrete, and six submergence pits, each 42 in. in diameter, were constructed within this space. This design was adopted because it was thought that the solid material might settle around the bottom of the air-lift discharge columns, causing them to choke, and that it would therefore be necessary to provide other individual pits so that any one of them could be discontinued and cleaned independently of others that might be in operation. Individual launders and gates were provided for each pit, so that any one or any combination of pits could be operated independently of the others. This arrangement is shown in the plan on Fig. 1, the arrows indicating the flow of the material to the proper right-hand pit as the gates are set.

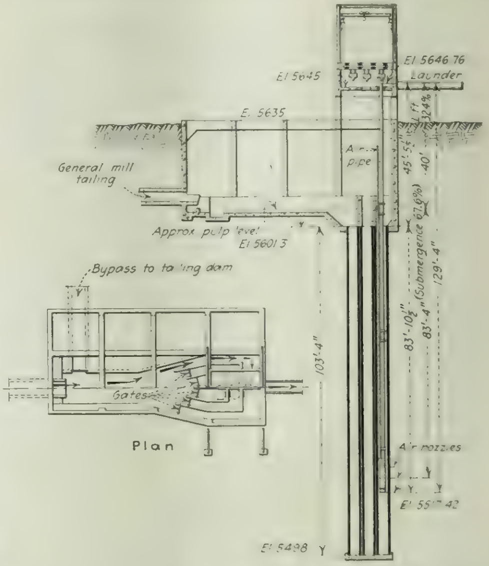


FIG. 1. GENERAL ARRANGEMENT OF TAILING AIR-LIFT PLANT

During the tests, and also in subsequent operations, it was demonstrated that the air lifts were practically free from the danger of choking. The pits cleared themselves after as much as thirty-two feet of sand had been allowed to settle above the bottom of the foot piece. It is evident from the experience gained in this installation, that individual submergence-pit construction is unnecessary and that a single submergence pit, large enough to accommodate all of the various sizes of pipe required for flexibility of service, would be much cheaper in first cost and just as satisfactory in operation.

All of the discharge columns empty into a common, concrete discharge box. Each discharge column is provided with a concrete, umbrella-type deflector, which is suspended from timbers fastened to the top of the concrete box by a yoke and wedge. A steel superstructure, as shown in the illustration, carries an overhead crane, which serves the six pits, so that the pipe can be removed from any one of the pits without disturbing any of the others which may be in operation. The handling of the discharge columns by this superstructure has not been as satisfactory as it should be, and in another installation the design would be altered materially.

The air-lift discharge columns are made up of standard wrought-iron pipe, flange coupled. They have been in operation for sixteen months, but show no appreciable wear, either from abrasion or chemical corrosion. To take care of the varying tonnages, three sizes of discharge-column pipe are installed, as shown in Fig. 2. For each one of these discharge columns there is a corresponding set of efficiency curves, similar to Fig. 3, which shows column "A" only, which have been compiled from tests and which show the economical range of capacity. These curves are based on data taken during the tests made in July and August, 1919. The capacities at that time were accurately measured in a 63,000-gal. displacement tank which was provided for that purpose. The indicated horsepower was taken from both the air and steam cylinders of the compressors. Samples of the pulp handled were taken and the specific gravity and percentage of solids by weight carefully determined. For publication, the curve was plotted on the basis of:

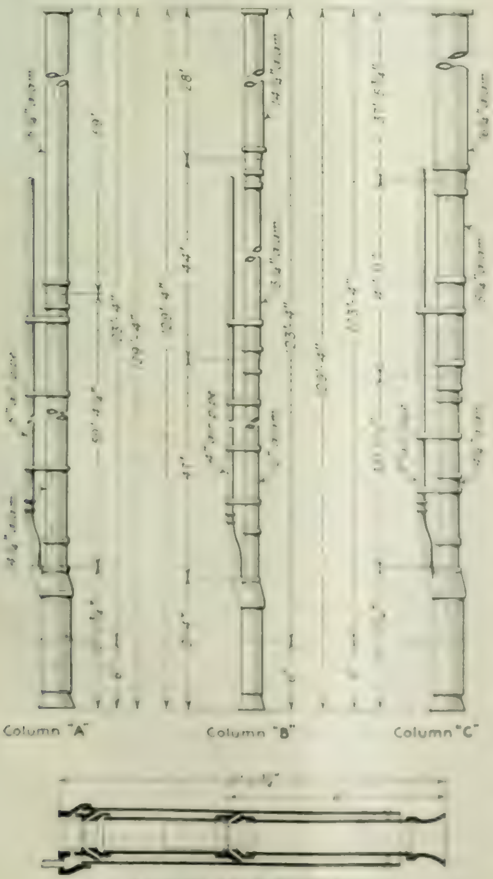


FIG. 2 ARRANGEMENT OF LIFT COLUMNS

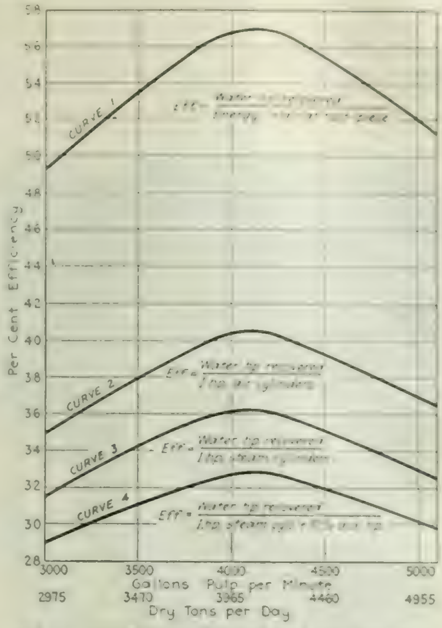


FIG. 3 EFFICIENCY CURVES FOR COLUMN "A"

1. Water horsepower referred to isothermal horsepower in the air entering the foot piece.
2. Water horsepower referred to indicated horsepower in the air cylinders.
3. Water horsepower referred to indicated horsepower in the steam cylinder.
4. Water horsepower referred to indicated horsepower in the steam cylinders, plus 10 per cent for condenser auxiliaries serving the compressor.

This was done for the convenience of the reader, as there is some confusion of the term "air-lift efficiency." To the practical man, Curve No. 3 is of principal interest, including as it does the over-all efficiency of the compressor. This should be the accepted basis of comparison, but as a matter of fact, Curve No. 1 is more commonly used. From a theoretical standpoint, Curve No. 1 is of interest because it shows the efficiency of the air lift as a pump, and gives the percentage of energy actually recovered from that supplied, although, unlike other pump efficiencies, there is no way of segregating pipe friction from the static head to be overcome, and no credit is given the pump for this factor. It is also of interest that tests were run with clear water under the same pumping conditions, and it was found that about 10 per cent better results, or from two to four unit percentage better efficiency, could be obtained with the clear water than when handling pulp. In the series of eighty tests made to determine efficiencies, a submergence of [illegible] per cent was found to be the most desirable.

Examination of these curves shows that each discharge column has a peak efficiency at some fixed capacity, but the range in either direction at which acceptable efficiency is obtained is sufficient to provide for ordinary fluctuations in the tonnages treated in the mill. It is possible to obtain the same peak efficiencies when using a constant diameter discharge column lifting a somewhat less tonnage of material, but the curve will drop more sharply on either side of the peak whenever the tonnage is increased or decreased than when a tapered discharge column is used. The principal reason that there is a wider range of capacity without much loss in either direction away from the peak efficiency is due to this tapered discharge column. As shown in Fig. 2, the increases in diameter in the discharge columns have been made at convenient joints, but if the diameter of a discharge-column pipe had been uniformly increased from the foot piece to the point of discharge, the efficiency would have been further increased. One and sometimes two mill sections are frequently placed in operation, or vice versa, without changing discharge columns or without any readjustment of the air compressor, and the increased or decreased load is taken care of automatically by the air lift without particular attention. This increase or decrease in tonnage is likely to involve as much as 3,000 to 4,000 dry tons of tailing. When lifting the smaller tonnage of tailing, as illustrated by the discharge column "A" shown in Fig. 3, so large an increase or decrease as stated above is somewhat too great to keep the efficiency at the highest point, and should not be practiced on these smaller discharge columns. However, on the larger discharge columns the change in efficiency by such a large increase or decrease in the flow of tailing will not be so great and would be permissible without changing to a larger or smaller discharge column.

DISCHARGE DEFLECTORS

The curve shown in Fig. 3 was taken from Table III, discharge column "A," and shows that the range of capacity, at an acceptable efficiency, is between 3,500 and 4,800 gal. of pulp per minute. Between these points, the highest efficiency to be obtained by this particular column is only 2 per cent lower than that of the maximum efficiency to be obtained by this discharge column as shown in Curve No. 4. The equivalent tonnage of tailing corresponding to the number of gallons of pulp per minute is from 3,470 to 4,600 dry tons per day. This air lift may be operated within lesser or greater limits, depending upon the range of efficiency desired. When a greater or lesser capacity than that shown to be most economical is desired, a larger or smaller discharge column should be used. It will be noted in Table III that during the sixteen months' period of operation, the discharge columns were changed only a few times.

The Kimball type of foot piece, illustrated at the bottom of Fig. 2, consists of an inner discharge tube surrounded by an annular air chamber and equipped with nozzles leading from the air chambers to the discharge columns. The open bottom in this type of foot piece seems to be the secret of the freedom of the air lifts from choking, as it permits all solid matter to drop out of the air chamber when the column is in operation, and when it is not in operation the sand settles on the outside. This same sand seals the bottom of the air chamber and keeps the air passage open and ready to start the air lift when the air is turned into it. The only appreciable wear that has occurred in the entire plant has been in the foot pieces, two of which have worn badly around the air nozzles, owing, apparently, to the high velocity of the entering air and the resultant sand-blast effect. It is thought that this can be overcome to a large extent by the proper selection and design of material of which these nozzles are made.

The Ingersoll-Rand Co. designed a foot piece and discharge column for the purpose of increasing the efficiency of the air lift. This foot piece and discharge column was installed, but has not yet been tested exhaustively, for the reason that the present industrial depression has caused a gradual decrease in the tonnage milled, so that the tonnage of tailing was by far too small to permit the foot piece and discharge column to be tested out at its rated capacity.

The Ingersoll-Rand foot piece is shown in Fig. 4 and is of somewhat the same general design as the foot pieces previously described. The special features consist of a long, bell-shaped inlet permitting easy entrance of the liquid at the bottom of the foot piece and gradual acceleration up to the point where the air is introduced. In the main body of the foot piece, a slight Venturi effect is used and the air is introduced through numerous small air nozzles located above the neck of the Venturi. The object of this was to prevent sudden acceleration of the column at the point where the air was introduced and the volume consequently increased, and to permit a much more gradual increase in velocity than is obtained by the use of one or two rows of nozzles only. The increased diameter of the column at this point also assists in eliminating this sudden increase in velocity and the consequent hydraulic shock. Above the foot piece, standard 14-in. outside diameter piping was used for a distance of 43 ft., and from this point to the discharge a special welded pipe was installed, increasing uniformly from 14 to 16 in. outside diameter, this special piping being 76 ft. long. The object of the design of this entire column was to eliminate to the greatest possible degree any sudden changes and consequent hydraulic shock due to the admission of air at any one point in the column and to the sudden change in diameter obtained with ordinary increasers.

As stated above, up to the present time it has not been possible to make accurate tests to determine the increase of efficiency that this design would effect, but it is expected that the power consumption will be cut down from 5 to 10 per cent and the efficiency increased from 2 to 4 unit per cent.

The plant supplying compressed air to this air-lift installation is in the main power house, is 530 ft. from the air lift, and consists of two Ingersoll-Rand, Imperial Type XPV-4 steam-driven air compressors having compound steam cylinders 13 and 29 in. in diameter and duplex single-stage air cylinders 22 in. in diameter by 20 in. stroke. Either of these air compressors is capable of operating the air lift to very nearly maximum capacity. In selecting these machines, careful consideration was given to economy; this type being chosen because of the low water rate which it showed and the practically flat economy curve down to half speed or somewhat less at which the compressor might be operated a large part of the time. One of the most interesting and valuable features of the entire plant is the method by which these machines automatically maintain the most economical speed to take care of the variations in the tailing tonnage from the mill.

These compressors are usually fitted with oil-pressure governors acting on the high-pressure steam cut-off, and controlled both by the speed of the machines and the air pressure. In ordinary service, as the air pressure decreases, the governor acts to increase the speed of the machines, and vice versa. In this case exactly the reverse action was required, and the governor was altered so that an increase in pressure would increase the speed of the machine, and a decrease in pressure would cause the machine to slow down. By this action, the pulp level, shown in Fig. 1, is maintained constant within one or two feet, regardless of the fluctuations of the tailing tonnage from the mill. As the air pressure depends entirely on the hydrostatic pressure, and varies as the pulp level rises or falls in the submergence pit, the method of control operation may be readily understood. As an example, if an additional mill section were placed in operation, the tailing would come to the submergence pit much faster than the air lift had been handling the tailing, and the pulp level would gradually rise. The resultant increase of pressure acts immediately on the air compressor, increasing its speed until a sufficient volume of air is supplied to lift the increased tonnage and until the air pressure and the pulp level again become normal. This feature practically eliminates constant attendance. The mill shift foreman makes an inspection trip every two hours, and the power-plant engineers make occasional inspections of the air compressor. This attendance is all that is necessary for the entire installation.

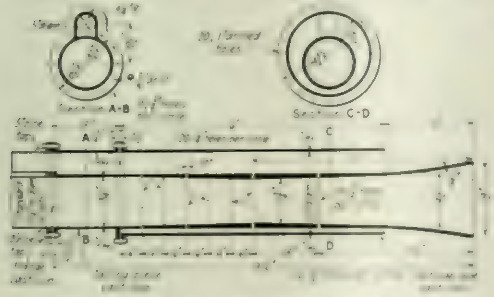


FIG. 4. THE INGERSOLL-RAND FOOT PIECE

AIR COMPRESSORS

The automatic governor control eliminates the necessity for any elaborate float system or throttle system in the air lines, which are wide open from the air compressor to the air lift at all times. The entire controlling device is in the power house at the compressors, and the power-house operator can tell at all times very closely the conditions under which the air lift is operating, merely by looking at the pressure gage and tachometers attached to the air compressors.

The operation of this air lift and the economy which it has demonstrated over that of the bucket elevators has considerably exceeded expectations, and it is evident that this device, when properly installed, is one of the cheapest methods of lifting pulp or other solutions, judged from an operating standpoint. The first cost, compared with other methods, will have to be determined for each installation. Difficulties in operation which it was expected might develop have been conspicuous by their absence, and it has not been found necessary to change materially any of the important details of the installation.

In conclusion I should record the fact that during the sixteen months of actual operation it has been demonstrated that the operating cost by the air-lift plant is only 50 per cent of that of the bucket elevators lifting the same material in the mill. This plant has the additional advantage of occupying less floor space and of possessing a greater range of capacity, and therefore greater flexibility, and greater continuity of service. It most thoroughly deserves, to my mind, more consideration in future designing of mill plants than it has been given heretofore.

Acknowledgment is hereby made to [illegible] Franklin, consulting mechanical engineer for the Chino Copper Co., who supervised the general design of the air lift and who directed personally a very comprehensive series of eighty tests to determine efficiencies; to H. T. Abrams and H. A. Campbell, of the Ingersoll-Rand Co., whose helpful suggestions have contributed largely to the success of this installation; to Henry Meyer, formerly chief draftsman for the Chino Copper Co., who collected and compiled the data for this article; and to those many other employees of the Chino Copper Co. whose keen interest and aid have so largely influenced the successful operation of the air lift.

The Discrepancy Between Drilling and Dredging Results

The Nature of the Clay, Gravel, and Gold, the Operating Methods Employed, Crew Efficiency in Dredging and Other Factors Exert Important Influences — Prospecting Not Entirely To Blame — Dredge Recovery Should Be Studied

BY R. G. SMITH*

Published exclusively in *Engineering and Mining Journal*

AFTER considering Mr. Gardner's paper,[1] with its numerous instances of wide variation between prospecting and dredging results, it is little wonder that the question "Why?" is so often propounded in connection with dredging operations. As an argument against the theory advanced by Mr. Hutton and also against the prevailing belief that the drilling results are in error whenever the recovery and prospecting disagree, I wish to bring out a few points to substantiate the statement that the drilling should not be held responsible for the whole burden of failure in all cases.

There are only two possible causes for the variation which the practical operator is endeavoring to overcome: first, incorrect drilling results; second, incorrect recovery factor; or a combination of the two. The two interlock in a way, for as far as the valuation of a property is concerned, it is immaterial what drill factor is used, provided the proper recovery factor is chosen to go with it. However, the prospected value of a piece of ground *should* represent the actual gold content, and the recovery factor the percentage of that value recovered in dredging. General practice does not adhere to this principle. The operator is usually inclined to use a drill factor varying from .27 to .33 on a $7\frac{1}{2}$ in. drive shoe and a recovery factor of 80 to 100 per cent. Instances of over 100 per cent recovery are frequent, and the drilling results are credited with the joy they caused in the same manner that they are blamed for the gloom that is spread when the recovery is only 50 per cent.

In defense of drilling, it becomes necessary to take up first the second stated cause of discrepancy, "incorrect recovery factor." Under conditions existing at present two cases are to be considered—recoveries under 100 per cent and recoveries over 100 per cent. In outlining the conditions that cause a loss of precious metal or a lowering of the recovered value per cubic yard, no special attempt will be made to prove or verify the statements, for the facts are well known to all familiar with dredging operations.

NATURE OF FORMATION

First: Presence of Clay.—As a general rule gold is not found in the clay, but a concentration often occurs above the clay bed. The two are mixed and carried into and through the screen. Samples of the larger clay balls taken from the stacker generally show little or no gold, but these larger balls of clay, being lighter and larger, do not roll in the screen with the material with which the gold associates. It is the smaller particles, sliding along with the fines in the screen, that may be expected to carry particles of gold, and a sampling of the fines that pass through the screen onto the stacker is a difficult operation. Under such conditions, it is unlikely that 100 per cent of the gold will get into the distributor. That clay is a gold robber on the tables is a conceded fact, and the small balls of clay, with the particles of gold which they pick up, will be carried beyond any riffles on a dredge. With a clay and gravel formation, the efficiency of the save-all is lowered, for the spill from the buckets is not broken up, and large amounts of unwashed material will find a resting place in the bottom of the pond.

Second: Presence of Clay and Soil Overburden.—This is a condition that causes muddy water, and muddy water as an element of gold saving is far from being 100 per cent efficient. The effects of muddy water are probably more conspicuous in this field than elsewhere, and it is not difficult to realize what such a condition implies. On one occasion where the overburden consisted of about 50 per cent of the total depth, it became necessary to shut the dredge down until the pond could be cleared up. The thickness of the water can be realized from the fact that it would not flow in a wooden flume set on a grade of one-half foot in 100. The pump suction, four feet below the water surface, picked up material $\frac{1}{8}$ to $\frac{3}{16}$ in. in diameter. The recovery may be expected to vary directly with the condition of the water.

Third: Cemented Gravel.—Seldom does the condition arise where a dredge is able to dig cemented gravel which will not be disintegrated in the screen. It is possible, however, and may contribute to the loss.

Fourth: A Hard Bedrock.—Where this condition occurs, there is generally a concentration on bedrock, and unless some of this bedrock can be dredged it is impossible to clean it thoroughly. The gold in crevices will not be recovered, nor will it be possible to clean out all potholes. Where abrupt depressions in the bedrock run parallel with the face, it will often be impossible to follow them.

NATURE OF THE GOLD

First: Fine and Flakey Gold.—It is hardly necessary to mention this occurrence. All practical operators are familiar with the difficulties in saving this class of gold. Fine gold is carried in suspension in muddy water and is even known to be lighter than the mud, the latter settling first and leaving the gold concentrated on or near the surface.

Second: Rusty or Coated Gold.—Where the method of gold saving relies to a greater or less extent on amalgamation, the presence of rusty or coated gold signifies a lowering of the percentage of recovery.

The conditions encountered in the operation of dredges are undoubtedly responsible for the greatest losses or lowering of the unit of value. Among them are:

---

*Address delivered before the California Dredge Operators' Association, Sept. 27, 1921, Natoma, Cal.

[1] "Drilling Results and Dredging Returns," by Charles W. Gardner, published in *Engineering and Mining Journal*, Oct. 22 and 29, 1921.

First: Gravel Left Between Cuts.—The gravel that is left on the bottom between the various cuts of the dredge is often responsible for a wide variation between prospecting expectations and recovery. This is a hidden condition, and one therefore often neglected. The slope of the sides of a dredge cut in tight clay and gravel is about ½ to 1. The angle of repose of loose tailings is less than 45 deg., which is a 1 to 1 slope. In 54 ft. depth of ground, therefore, the width of the cut has been decreased 13½ ft. on each side, a total of 27 ft. over possibly a face of 360 ft. or 7.5 per cent of the bedrock area. The greater the angle between the dredge and the side of the cut when the bucket line is in the corner, the greater will the slope of the side become. Wide swings, where the spud sets farther away from the side of the cut, cause this condition and materially increase the triangular block of undredged ground.

Second: Gold Saving.—The conditions imposed on the art of saving gold make the results obtained seem remarkable. In recovery of gold by dredge, no quartz-mill practice is possible. The product is fed to the tables in a most uneven manner. It is generally either a "feast" or a "famine" of material. The grade of the tables is constantly changing. The quicksilver is soon coated with the various substances passing over it, so that it is unfit for the duties which, in efficient operation, it must perform. And even after the precious metal has been retained, it is again subjected to the raking, scratching and hosing down of the clean-up crew, which is seldom 100 per cent efficient.

Third: Depth of Digging.—Unless the method of measuring the digging depth is determined with care and accuracy, the resulting value per cubic yard is bound to be uncertain and unsatisfactory. The dredge crew will generally see to it that the yardage figures are up to expectations. Moreover, the method of calculating the average depth is often in error. It is quite common practice to record the depths on each shift, regardless of the number of times the dredge was stepped ahead, and the average depth calculated as the means of the three shifts. With two cuts varying in depth, this method will always result in giving a greater average depth than is actually the fact. It works only one way. Where the bedrock is soft and the digging easy, the tendency is to dig deeper than is necessary by swinging into the higher bedrock and uncalled-for distance. In shallow ground an extra foot or so may be dredged to allow for flotation. All such actions tend to reduce the recovered value per cubic yard.

Fourth: Water Supply.—From the time pumps are installed until they are replaced, their efficiency is constantly diminishing. This is more noticeable where the pond water is muddy. The result of such a condition is twofold. First, the gravel in the screen is not getting the washing it would with pumps in good condition. Second, the diminished supply of water on the tables indicates that gold-saving conditions are hampered. A given class of material will give the best recovery while flowing over riffles with a certain grade and a certain amount of water. Vary either the grade or the amount of water, and the recovery is bound to be adversely affected. Both of these conditions are present on a dredge.

Fifth: Crew Efficiency.—This is an item that may mean much in the amount of gold saved or lost. A dredge crew seldom consists of men familiar with gold saving. Their main purpose and object is to keep the dredge running and to deliver the maximum amount of gravel. It matters little to them whether the tables are piled high with sand and no water is present or whether the pumps are kept going and scouring the riffles when the bucket line is idle. Oil and grease present no terror to them. An instance of this came up a few days ago. A bucket of grease and waste collected from drip pans was taken off the dredge and emptied on the ground ahead of the dredge. When discovered the bucket line was about to carry enough grease into the screen to give it a thorough covering from end to end. The oil and grease that is left on the ground to be dredged all goes into the screen and onto the tables. It would be far better to throw it into the pond. Are the winchmen pulling into the corners; are they cleaning the bedrock correctly, or are they doing things in the easiest manner? These are items that cannot have personal supervision all the time, and hence the efficiency of the crew influences to a marked degree the recovery per cubic yard.

PRACTICAL EXAMPLES

Examples of measured losses are not as common as examples of estimated recovery factors, but the following denotes what may be expected if the subject is given careful consideration. In making the computation the assumptions have been that one cubic yard of loose gravel is equivalent to 0.75 cubic yard in place, and that the ratio of screened to unscreened material is 1 to 1. These assumptions are approximately correct.

On an Oroville dredge, two samples taken from the entire discharge from top to bottom gave average value of sands of 10.2c., equal to 5.1c. loose or 6.8c. per cubic yard in place.

On another Oroville dredge, two samples from the entire discharge of one side gave average value of sands of 3.9c., equal to 1.95c. loose, or 2.6c. in place. The dredge recovered about 15.0c. per cubic yard, or 85 per cent of the total.

The sand pile of one of the dredges which had sunk in the Natoma field was systematically sampled. The sand averaged 5.8c., equal to 2.9c. loose, or 3.9c. in place. The dredge was recovering 8.5c. per cubic yard, or 69 per cent of the total.

Several samples from the entire discharge of one side of a Natoma dredge, while digging in gravel only, gave average value of 3.7c., equal to 1.85c. loose, or 2.5c. in place. The dredge was recovering 7.8c., or about 15.0c. from the gravel only, or 85 per cent of the total.

Extensive samples of the entire discharge of another Natoma dredge gave an average value of 11.7c., equal to 5.85c. loose, or 7.8c. in place. The dredge was recovering 19.0c. per cubic yard, or 71 per cent of the total.

In redredging tailings of the Oroville field where no virgin ground was encountered, the recovery was 2 to 3c. per cubic yard of tailings, or 2.7 to 4.0c. in place. The original recovery estimated at 12.0c. per cubic yard represents 75 to 82 per cent of the total. In this instance the same methods of operation and gold saving were employed as in the first working.

Charles Janin, in his Bureau of Mines Bulletin 127, "Gold Dredging in the United States," says: "The loss of gold in tailings is less than the loss in front of the boat both from bucket spill not caught on the hopper and save-all and from failure to properly clean bedrock." If this statement were made from known facts, there is reason for assuming a considerable loss in front of the boat.

THEORETICAL RECOVERY SELDOM ATTAINED

The only deductions or conclusions that can be made from all these facts are that the actual percentage of recovery is far less than supposed. In cases where the recovery is estimated at 75 to 100 per cent, the actual recovery is possibly nearer 50 to 75 per cent. In other words, the value of the drill holes is low. The fact is borne out by numerous instances of recoveries exceeding 100 per cent. It is just as logical to assume that the drill results are low in such cases as that the drill results are not reliable. A fluctuating recovery factor, depending on conditions as enumerated, should not be made a constant and the drill factor a variable.

In substantiation of the deductions set forth, note the following results obtained by sinking shafts over drill holes and rocking the gravel from the entire shaft very carefully. These drill holes were put down by various drillers in a firm gravel, containing some clay. No water was present, and the shafts stood without timbering. Drill values were figured with the factor 0.30.

Depth in Feet		Value in Cents per Cubic Yard		Per Cent of Drill Value
Drill	Shaft	Drill	Shaft	
56	55½	4.8	4.6	96
57	56	3.6	4.0	111
52	52	4.7	7.5	160
50	49	5.4	10.3	191
48½	48	5.2	7.4	142
Average (5)		4.75	6.76	142

Depth in Feet		Value in Cents per Cubic Yard		Per Cent of Drill Value
Drill	Shaft	Drill	Shaft	
49½	48½	12.3	16.6	135
49½	48½	14.6	16.6	114
54	54	11.6	21.2	182
Average (3)		12.83	18.13	141

In similar but shallower ground, two miles distant, the following results were obtained:

Depth in Feet		Value in Cents per Cubic Yard		Per Cent of Drill Value
Drill	Shaft	Drill	Shaft	
29½	30	6.8	8.0	118
34	34	5.7	6.7	118
27½	27½	6.1	8.0	131
35	35	7.4	10.5	142
Average (4)		6.52	8.34	128

Depth in Feet		Value in Cents per Cubic Yard		Per Cent of Drill Value
Drill	Shaft	Drill	Shaft	
35	35	10.3	15.7	152
38½	38½	20.5	27.8	136
32	32	20.6	25.0	121
Average (3)		17.13	22.94	134
Total average (15)		8.63	12.03	139

The significant fact to me is not the variation from 96 per cent to 191 per cent, as pointed out in Mr. Gardner's paper, but the fact that groups of three to five checks varied less than 10 per cent from the general average of percentages. Note the following results obtained by the dredge previously cited as shut down on account of the muddy condition of the pond. The dredged area, consisting of some 224 acres, was drilled systematically. The north and south halves were dissimilar only in the amount of overburden:

Acres	Dredge Conditions	Recovery per Cubic Yard	Per Cent Recovery Over Drilling
113	Much soil, muddy water	[illegible]	89
111	Water conditions good	6.8	106

The 111-acre area also contains several high holes. Does the 17 per cent difference in the recovery factor mean that the drilling was necessarily in error?

It is not the intention to create an impression that the results of one drill hole or even several drill holes will give reliable information of the value of the ground any distance away. In fact, even shafts around drill holes show a wide variation in value comparisons. The following variation in different depths was the rule rather than the exception in the tests noted in preceding paragraphs:

Depth	Value per Cubic Yard — Drill	Value per Cubic Yard — Shaft	Per Cent of Drill Value
0–19	2.6c.	6.4c.	245
19–28	15.6	9.8	63
28–34	0.9	3.4	380
0–34	5.7	6.7	118

Such results are due mainly to the uneven distribution of gold through the gravel, and no method of computation can be expected to eliminate this condition. The actual or nearly actual gold content of any firm gravel deposit, however, can be determined primarily by drilling, for the law of averages will compensate for the discrepancies in individual drill holes. The plan of drilling to a constant average, as suggested by Mr. Hutton, is highly indorsed, for the accuracy of results relies almost entirely on averages.

INCORRECT DRILL RESULTS

The nature of some deposits practically precludes the possibility of driving casing and consistently removing anywhere near the correct amount of core and gold content. Such are loose sand and gravel deposits of present river channels and old tailings, and especially those containing water. The operations are subject to many obstacles.

The results of several shafts put down over drill holes in loose tailings were generally much higher than the drill values, but no consistent method of figuring by using core or measured volumes could be deduced. This was to be expected, for no one hole could be indicative of the value of the surrounding gravel.

Another instance occurred in dredging loose river bar gravel. The drilling was done as carefully as possible, measured volumes were considered in determining the value of the holes, and subsequent dredging gave 50 per cent recovery. Dredging conditions were practically ideal.

Some deposits have a very uneven distribution of the gold. Drilling can easily be in error if the constant average has not been reached. The presence of heavy gold subjects drill values to much the same error as does spotted ground.

In view of the above-mentioned conditions and factors inseparable from the prospecting and dredging of auriferous gravels, it appears to be useless to endeavor to derive a factor or method of computing drill values that will compensate for the variable recovery factor. As previously stated, the present factor used in computing drill values serves its purpose sufficiently well, provided the proper recovery factor is used in conjunction with it. It therefore appears that a study of dredge recovery might yield far greater results for future valuation of dredging ground than would a study of drilling. The drilling factor varies with the different formations encountered, but it can be approximately determined by the engineer for any block of ground under consideration. The factor which he cannot assume, with any great degree of accuracy, is the recovery factor.

The study of this subject will undoubtedly yield no definite figures, for a determination of actual loss is impossible when the contents are unknown, but it may tend to decrease the unexpected discrepancies so often encountered in the gold-dredging industry.

The Re-treatment of Rand Tailings

A plant for the re-treatment of Rand tailings with a view to the extraction of the remaining gold and other minerals has been erected at the dump of the old May Consolidated Mine, according to the *South African Journal of Industries.* The plant has passed from the experimental stage, and has now only to be proved on a commercial scale.

The cleaning of the sands and classification of the concentrates form the basis of the system. The sand from the dump is tipped into two hoppers which feed two Ondra patent concentrators. These concentrators consist of inclined planes, divided by projecting ribs into five compartments. The sand on entering the concentrator is projected up the inclined plane by water issuing from nozzles situated at the base of the concentrator. The object of the concentrator is to classify the projected particles according to their weights. Thus, the heavier particles are caught on the lower ribs and the lighter particles are projected further up the inclined plane. Above every rib the collected material is drained off through a slot in the floor of the concentrator and flows over a sieve which is rocked sharply. The sieves vary in mesh from about 1,200 per inch in the uppermost one to about 800 in the lowest one, and serve to classify particles of a similar weight according to their diameters or specific gravities.

The overflow from the sieves is practically pure silica. The underflow contains a certain amount of silica, the metals, and heavier valuable minerals. According to the inventor, the underflow from the three divisions is much richer than that of the top two divisions. The overflow is collected in a sump and pumped to four dewatering cones. The clear water from the cones is collected and used again. The underflow from the Ondra concentrator is gravitated into two cones: one for the lower three divisions, and another for the upper two divisions—upward currents of water in these cones serve to effect a further concentration. The overflow goes to the dewatering cones, and the underflow is pumped onto Wilfley tables. Four of these are installed: one to serve the underflow for the cone serving the top two divisions of an Ondra concentrator, and three for the cone serving the bottom three divisions.

The concentrates obtained from the underflow of the cones are then divided by the Wilfley tables into high-grade concentrate, middlings, and tailings. The tailings are pumped to the dewatering cones.

The middlings are stored in the meantime, and will be treated again later on with the aid of tube mills.

The high-grade concentrate is, according to the inventor, to be further classified. This unit of the plant is not yet installed and made [illegible]. In any case the final concentrate from here will contain most of the gold, which will be extracted by amalgamation in trommels. Two of these are at present installed.

Occurrence of Platinum in South Africa

Found in Diabase Alloyed With Platinoids and Possibly Iron—Chromite Absent as Well as Minerals Usually Associated

By E. M. Weston

Written for Engineering and Mining Journal

I RECENTLY had the opportunity of inspecting properties in the northeastern portion of Cape Colony known as the Transkei, and situated south of Natal and between Basutoland and the sea. The area examined lies about eighty miles north of Queenstown and around the villages of Cala and Ingobo. The country rock consists of a series of mudstones, sandstones, and shales, including the cave sandstones and other rocks of the Stormberg series, a part of the Karoo series.

Exposed beds show seams of anthracite coal with only about 3 per cent ash and lying apparently about 800 ft. lower than the impure coal seams worked for some time near Indive. Ironstone beds also occur. These beds are traversed by numerous younger dikes of apparently the ordinary diabase and gabbro so common in South Africa. These dikes were apparently connected with overlying sheets now largely removed by denudation.

The area lies at an elevation of from 2,500 to 4,500 ft. and forms one of the flanks of the southern continuation of the Brakensberg Mountains, which rise to about 8,000 ft. It is bisected by many valleys and gorges, resulting in numerous tabular plateaus and hills and giving every facility for mining by adits and open workings. Water is plentiful, as is also native and imported timber, and the reserve furnishes abundant native labor.

About 180 miles north of this lie the Insiza norites and other intrusive rocks, the occurrence of which strikingly resemble that at Sudbury, Canada. In these rocks attempts have been made to work magmatic segregations of sulphide ores bearing copper and nickel, with gold, silver, and platinum; but so far the deposits exploited have proved too patchy to be payable.

Recent discoveries of platinum, however, present novel features. This metal occurs in certain of the diabase dikes near Cala in the native state alloyed with iridium and other platinoids, and also apparently alloyed with a large proportion of native iron. Except for the fact that in a few samples panned a heavy amber-colored mineral, probably zircon or topaz, was observed, no notable accessory minerals were found. There is very little pyrite present and no trace of chromite or other minerals usually associated with platinum. No microscopic examinations of the rocks have yet been made. These may disclose clues to an [illegible] [illegible].

With regard to the economic [illegible] of the discovery, assays and pannings have been taken over very great widths in various places [illegible], which have shown average values of [illegible] pennyweights per ton. Part of the dikes are soft and decomposed, and the deposits can be worked cheaply. The platinum can easily be recovered by concentrating the [illegible] and passing the slimes over blankets or treating by oil flotation.

It is certainly a novel [illegible] to break up good metal, which on panning shows a tail of [illegible] platinoids. Most of the platinum is very fine but nuggets up to three grams in weight occur. Too little work has been done as yet to permit any definite estimates of tonnage and values.

Old Tyopa

An Account of the Accidental Discovery of an Ancient Gold-Mining Camp in Northern Chihuahua — The True Tyopa, Famous for Its Bells, Situated in Sonora

By Donald F. McCarthy

Written for *Engineering and Mining Journal*

THE STORY OF OLD TYOPA, with its wealth of hidden gold stored away in the workings of an old mine, will bear further repetition, as well as the tale of the famous Tyopa bells, which are said to have been cast from an ore that contained the elements essential to their making, and of which I had heard much, years ago in southern Sonora. That there were many rich mines in that section of the Sierra Madre in the early days, there is little doubt, but the difficulties of successful development were too great to be overcome by the men who were in the country and knew of them at the time, and no success could have attended any mining venture there, owing to the hostile Apaches, who then overran the country.

Nor are the conditions any less formidable today than they were then, and though the Apache menace has long since disappeared, one equally as bad, if not worse, took its place, in that it then became a safe retreat for Mexican outlaws; and such it still remains.

It was about the time the Bisbee mines were found, and when the excitement of their discovery was at its height, that a man named John Carey found the ruins of an old mining camp near the main divide of the Sierra Madre, and a few miles from the Casa Blanca, an old landmark dating back to early Spanish occupation, and from which the ruins of Old Tyopa are but a few miles distant.

Carey had heard the old story of a fabulously rich gold mine in that section of country, that had been worked by the early Spaniards, who were afterward overcome by the Indians, their camp being destroyed and all of them killed, and that the gold so mined was stored away in the underground workings, and was still there if it could be found. He had gone in there alone with a saddle and pack outfit by way of the Janos trail, from Silver City, N. M., to the old town of Janos, in Chihuahua, and there took the Casa Blanca trail, which intersects the Janos trail at that point and bears west across the divide into Sonora.

The third day out from Janos, Carey reached the Casa Blanca, and beyond there a few miles, in the direction the trail was going, he sighted the ruins of Old Tyopa and camped there that night. But the loneliness and desolation of everything, as he beheld it the next morning, and the dread of being discovered by the Indians, the possibility of which dawned on him only then, caused him to become so uneasy and fearful for his safety that he stayed only the first day, left there after dark, and traveled all that night on his way back to Janos.

That the old mine he sought was in the heart of an Apache stronghold everybody knew, and just how he got in there and back as he did, was something on which he never cared to speculate. He said he never realized the desperate chances he had taken until he reached the old ruins, and how hopeless his plans had then become.

Carey described the place as being on the side of a basin on the main divide, and said that the bed of the creek which runs through the basin had been terraced with a series of cement dams, stretching up the creek farther than he cared to go, to hold back the water, which evidently came only when it rained, and on the bank of the creek he found a place where he thought the ore had been ground in arrastres, but he said that the arrastres themselves were buried under wash caused by cloudbursts.

He did some panning below the old workings, which bore evidence of having once been worked as placers, and found considerable gold, but as to the mine itself he knew nothing, except what the float told him, and that disclosed but little in the way of gold.

The main workings, as he outlined them, might cover three or four acres, he thought, or more, though there were other places in line with them that showed signs of having been worked to a considerable extent also; but everything had caved in and was covered up with wash and overgrown with brush. He discovered nothing on the surface that would indicate the size or character of the vein or orebody, except that the float showed it to be a free gold ore.

Everything was in such ruin and so overgrown with vegetation that he could tell little about it; but that it had been extensively worked at one time could be readily seen, and from the size of the trees that had grown there since its destruction, it was apparent that it was very old.

The Casa Blanca, according to Carey, stands on high ground and commands a wide view of the surrounding country, and might have been a lookout post and possibly a fortification for the main camp, which is a few miles to the west and in plain sight. It derived its name, which means the White House, from the color of the rock of which it is built, and though it has long ago fallen into ruins, it remains the best-known mountain landmark on the trails crossing from Chihuahua to Sonora.

Old Tyopa met its fate at the time of the Indian insurrection of 1680, when the Pueblo tribes throughout the Southwest, beginning in and about Santa Fé, rose against the Spaniards, who had enslaved them for generations in the mines. The comparatively few who escaped massacre at the hands of the Indians were driven out of New Mexico and Arizona and far into Mexico. It was this retribution, so to speak, that overtook not only Old Tyopa, and brought about the destruction of that old camp and the annihilation of its inhabitants, but of all the others that are known to have been in existence throughout that section of the Sierra Madre up to that time, and which later disappeared.

The country I refer to covers the northern half of Chihuahua and Sonora, and is confined as a whole to the high slopes of the main divide of the Sierra Madre, and has long been known to the Mexicans as the *terraino incognito*, from its unknown character.

The Casa Blanca trail, which one time led across from the eastern to the western foothills of the Sierra Madre, was one of many such trails that crossed that divide, and these trails were old and well-traveled Indian highways when the Spaniards first came. It was due to those trails and the guidance of the friendly Indians who inhabited the valleys and high plateaus of the Sierra Madre that the Spaniards were so successful in their mining discoveries.

Old Tyopa, so called, is about sixty-five miles in an air line west of the old town of Janos, in northern Chihuahua, and is the beginning of the Casa Blanca trail going west.

TYOPA FAMOUS FOR ITS BELLS IN SONORA

The true Tyopa, whose history is one of the cherished traditions of the people of southern Sonora for the sweet-toned mission bells that were once cast from its ores, is on the headwaters of the Rio Mayo, in Sonora, about a hundred miles north of the town of Alamos, and well within the *terraino*, so called. It did not produce the character of ore generally believed to be in the mine at Casa Blanca, its ore being a chalcocite or copper glance containing about one-fourth gold and silver and three-fourths copper after being smelted.

The Tyopa bells, whose fame traveled far and wide, were distributed in chimes to many of the West Coast missions and were hauled with ox teams across the desert to the more remote missions of Arizona and New Mexico, and were even carried to Sitka, Alaska, where the Franciscans once maintained a mission settlement. But a later generation dismantled them, melted them down, and recovered the gold and silver they contained.

Principal Features of the Bulgarian Mining Law

Several Advantageous Provisions Characterize the Location and Holding of Claims—Services Of Legal Profession Limited

BY PAUL R. COOK

Written for Engineering and Mining Journal

MY experience in working under Bulgarian mining law has convinced me that it is the best mining statute in the world. It was passed in 1910, after a thorough study of similar statutes of various countries, and seems to have escaped the defects of the older mining laws, including those of the United States. Bulgaria, being a young nation, the same observation applies to most of the country's laws.

Mineral right is separate from surface right, so that it is possible to locate mining claims without regard to the surface ownership. Previous mineral discovery is not required, as in America, and this stipulation enables one to locate any ground on which one might think there was a chance of finding valuable coal or mineral products, the law allowing two years of search to find mineral. Under present conditions it is possible to get this two-year period extended. When mining becomes more active, these extensions of time will probably not be granted so freely.

During the two years or extended period the locator is expected to make a serious effort to find mineral and develop to the stage where production is possible. Having demonstrated to the satisfaction of the government that he has performed the last-noted requirement, the locator is granted a "concession," which is the same as a United States "patent," giving him perpetual title to the property, whether he does any more work or not. Though the government is at present lenient about extending time, so that the locator does not lose ground for lack of work, on the other hand it is strict about granting "concessions," as this is considered an official approval by the government that the property is a producing mine.

Properties are forfeited upon failure to do the required work or otherwise to comply with law, in the following manner: The locator is first given formal notice by the Bulgarian Department of Mines, stating in just what respect he has "failed" to comply with the law; a date is set by which time he must begin work, and another date set by which time a certain prescribed amount of work must be completed, or the other requirements of the law observed. Failing to comply with the stipulations of this formal warning, the claims are officially declared void, a notice is published in the state's journal to this effect, and a day named (usually eight days ahead) on which the claims are open for relocation. If, upon the day set, at the opening of business at the district office at 8 a.m., there is more than one applicant, lots are drawn between those applicants holding conflicting location applications. During my stay in Bulgaria I obtained considerable ground under "failed perimeters." The term "perimeter" is synonymous with our "claim," as "concession" is synonymous with our "patent."

In many ways it is evident that the Bulgarian mining law was framed with the idea of avoiding all dispute and chance of litigation. There is no extralateral right dispute and litigation, and overlapping claims are forbidden. Any possibility of litigation over the right to locate is prevented by requiring each locator to establish formally such right before the Department of Mines before he can begin locating ground or even own mining ground by purchase. When such right is once established it is not later subject to question. The government records of ownership are kept up to date and are a guarantee that the person shown is the real owner. Legal transfer has to be made through the mining department.

Lawyers are considered "non-producers," and the necessity for their services is limited as far as possible, in other lines as well as in mining.

Coloring Jewel Stones to Order

Investigations now being conducted at the Rare and Precious Minerals Experiment Station of the U. S. Bureau of Mines at Reno, Nev., promise the development of a process for giving to naturally colorless gems the special tinting demanded by the jewelry trade and the fancier of precious stones. The method employed is the exposure of the stones to the emanations of radium. After several weeks' exposure to the emanations, yellow Cape diamonds have been converted to a beautiful light grass-green shade. Colorless Colorado topazes have been given a rich yellow tinting. The successful conclusion of the experiments should give impetus to the development of deposits of colorless gem material found in various parts of the West.

Metallurgists of Note

Alfred James

FOR MANY DECADES British engineers have been predominant in the mining and metallurgy of gold, as Americans have been in the realm of copper. There are few gold camps in which British mining engineers cannot be found or which do not owe some valuable improvement in process or machinery directly to their work or advice. One of the outstanding personalities in this field of endeavor for the last thirty years has been Mr. Alfred Trewartha James. Back in the times of the ancient Egyptians, prussic acid is said to have been used for poisoning those who were guilty of divulging the sacred mysteries of the priests. As far as we know this was the first commercial utilization of this deadly arrangement of the carbon and nitrogen atoms. Mr. James has devoted most of his life to putting them to better use. Though the cyanide process, essentially as we know it today, was devised by J. S. MacArthur, it is to Alfred James that credit must be given for a large part of its commercial development. At Oxford, Mr. James was an honor student in Latin and Greek. This classical training, however, evidently did not prove the handicap for a scientific career which some modernists assume. We have always believed that it helps an engineer to surmount a difficulty if he can swear in more than one language. Doubtless Latin and Greek are as good as any others.

ALFRED JAMES

Mr. James' professional career began in 1886, when he was nineteen years old, with a job in the chemical laboratory of the Cassel Gold Extracting Co., Ltd., which was exploiting an electro-chlorination process. Later J. S. MacArthur joined the company and introduced his cyanide process, patented by himself in conjunction with R. W. Forrest and W. Forrest. In 1888, Mr. James was sent to South Africa to investigate and report as to the field there for the MacArthur-Forrest process. On his return to Glasgow he designed, for erection at the Salisbury Battery, the first cyanide plant in South Africa, with which a demonstration was to be conducted on refractory ores and concentrates by paddle agitation with cyanide solution in vertical cylinders. In 1890 he returned to Johannesburg and contracted to treat 100 tons of Salisbury buddlings and to demonstrate what he could do on Robinson pyritic concentrate and other material. These demonstrations were made before Messrs. Eckstein, von Hessert, Phillips, Jennings, Dormer, Davis, Williams, and Mitchell. The results were entirely satisfactory. The attention of Mr. James was next taken up with design of the first cyanide tailing plant in the world, at the Robinson mine, with a capacity of 120 tons a day, by gravitation percolation. This brought about the invention and designing of an automatic extractor box to handle 2,000 gal. per hour. Later, at the request of Mr. Jennings, he designed a plant for the Ferreira Co. New Zealand was the next step, Mr. James going there in 1892. In two years he had firmly established the cyanide process in that country, after which he came to Denver, Col., to consult with Philip Argall and others regarding the erection of a demonstration plant in the United States. On his return to South Africa in 1895 he was struck by the ineffective precipitation which had developed since his departure, which he remedied. Later, the method of clean-up was also greatly improved owing to Mr. James' efforts. He was also largely responsible for the adoption of tube mills into South African practice.

For many years Mr. James has made his headquarters in London in consulting work, but he has paid frequent visits to South Africa, Australia, New Zealand, Mexico, Canada, and the United States. He has thus kept in close touch with developments in all parts of the world and has himself been responsible for many improvements. Always glad to give others the benefit of his experience, both by personal contact and by numerous published articles and a book, he has been in the vanguard of those who have opposed secrecy and mystery concerning metallurgical development and improvement in technical processes.

Alfred James has been a prominent member of the Institution of Mining and Metallurgy, of which he was president in 1908. He is also a member of the American Institute of Mining and Metallurgical Engineers.

CONSULTATION

Bentonite, Its Production and Utilization

"Will you kindly tell me where bentonite is found, its market and uses?"

Engineering and Mining Journal is the occasional recipient of inquiries similar to the above. The following information taken from a recent Report of Investigation of the U. S. Bureau of Mines by R. B. Ladoo will serve as an answer to all of them:

The name bentonite has been applied to a group or series of claylike materials characterized by an alkaline oxide and alkaline earth content of 5 to 10 per cent, fine grain size, high absorptive powers, and usually very strong colloidal properties.

Bentonite probably represents no mineral of fixed composition, and its physical properties vary considerably. The type material from Wyoming is light yellow or greenish yellow in color, but from other localities it may be cream colored, white, gray, pink, dark brown, or even black. It is exceedingly fine grained, very plastic, and highly absorbent. The appearance may be dull or powdery, but a freshly cut surface usually has a waxy luster. Some varieties have the appearance of wax and may be cut into very thin, translucent shavings. The fracture of the type material is roughly conchoidal, that of other varieties is platey and shalelike, and still others have no typical fracture. Bentonite is highly absorbent; when wetted it will absorb more than three times its weight or seven times its volume of water. Some varieties when wetted with water expand to more than six times (some experimenters report eight times) their original volume. The wetted material is exceedingly smooth and soft and feels like soft soap. Unlike most clays, bentonite is easily fusible at a comparatively low temperature.

Under a high-power microscope bentonite seems to consist of extremely small, more or less rounded, grains of uniform size, but the texture of most varieties is so fine that individual grains cannot be distinguished.

Bentonite Used to Soften Water

Some, and perhaps all, of the minerals of the bentonite group have the property of allowing easy replacement of the alkaline and earth oxides, one with another. This property has been utilized by at least one company for the softening of certain types of hard water. If hard water containing calcium sulphate be passed through a mass of bentonite containing sodium, the calcium sulphate is changed to sodium sulphate (soluble) and the sodium in the bentonite is replaced by calcium. The process is reversible and the bentonite may be rejuvenated by passing through it a solution of sodium chloride. The sodium is restored to the bentonite and the calcium is in these operations removed as a chloride.

In Wyoming, bentonite occurs in the lower Benton formation of Cretaceous Age in many parts of the state, but the most important localities have been found to be in the Laramie and Big Horn basins. It occurs in beds varying in thickness from a few inches to more than five feet, usually both overlain and underlain by a shale of very dark color. The beds usually lie nearly flat and are exposed over wide areas. The commercial deposits are covered by only a few inches of weathered material so that little stripping is required. Rough joints perpendicular to the bedding permit the material to be broken down easily.

The clay is removed by hand, shoveled into wagons, and hauled to the nearest railroad siding, where it is loaded into box cars without further preparation. Some of the Wyoming bentonite is shipped to Chicago for grinding. The principal producers in Wyoming are at Rock River, Newcastle, Cheyenne, and Medicine Bow.

In California many deposits of bentonite have been reported, and at least one has been worked. In San Bernardino County, between Barstow and Daggett, a deposit of excellent, white, highly colloidal material has been opened by underground methods. The product is shipped to Los Angeles, where it is ground, sized by air separation and bagged for shipment. Near Otay, San Diego County, are found deposits of an exceedingly fine-grained waxy material, white or pink in color, resembling the typical bentonite in composition, grain size, and general characteristics, but lacking the property of staying in suspension indefinitely. Experiments have been made with this material as a substitute for fuller's earth in oil refining.

At Ardmore, in South Dakota, the Pierre shales contain strata of a gray, fine-grained, claylike material in nearly horizontal beds six inches to three feet thick. This material was originally known as bentonite, but as it differed somewhat from the Wyoming bentonite the name ardmorite has been applied to it. The principal difference seems to be that it will not stay in suspension indefinitely. The beds are overlain by two to six feet of black soil and usually underlain by thin bedded black shales. In mining, the surface material is stripped with a steam shovel. The beds of ardmorite are then drilled by hand, blasted with dynamite, and the loosened material is shoveled into motor trucks which transport it to the mill at the railroad. This material is used for the manufacture of a water softener, and the milling process is more complicated than is common in most bentonite treatment.

Treatment of Bentonite Simple

The following description of the process was furnished by the company: The raw material is first allowed to age and weather in stockpiles in the open air. From the stockpiles the material is placed in thin layers on steam coils, where it dries and partly disintegrates. From the steam coils it goes to a hammer mill for coarse crushing, thence to screens to remove impurities and thence to disintegrators. From the disintegrators it is conveyed to a pug mill where it is mixed with water and kneaded. The plastic clay is then fed to an extrusion press, where it is forced out through a die in small strings, $\frac{1}{16}$ to $\frac{1}{8}$ in. in diameter, resembling noodles. The strings of clay are placed in wire-bottom trays, racked on cars and slowly passed through a continuous steam-heated drying tunnel. The dried strings are sent to a hammer mill and thence to a screen to remove the fines, which are sent back for reprocessing. The product then passes through a [illegible] oil-fired rotary kiln where it is baked at a high temperature. The baked material is then rehydrated, [illegible], in large steel vats heated by steam coils. The rehydrated material is washed with water in cylindrical wooden tanks 8 ft. in diameter by 12 ft. high, again screened [illegible], drained and either packed in barrels or put in storage vats.

At Belle Fourche, S. D., there is found a [illegible], fine-grained, exceedingly plastic bentonite closely resembling the Wyoming material, especially when washed. In suspension in water it forms the peculiar jellylike mass common to the Wyoming bentonite.

Deposits of bentonite have been reported at various localities in Montana, Nevada, Utah, Texas, and Tennessee. Near [illegible], Idaho, is found a pure [illegible] material, closely resembling the Wyoming bentonite in every way except in color. The [illegible] is apparently not due to organic material. This clay forms the characteristic gelatinous suspension.

In New Mexico, about thirty-five miles north of Santa Fé, near the Denver & Rio Grande R.R., are deposits of bentonite three to five feet thick. This material is of a pink or flesh color and has a waxy luster. It disintegrates rapidly in water to a soapy, flocculent mass, but it does not stay in suspension.

A deposit of bentonite about nine feet thick has been reported at Merritt, British Columbia. It is also stated that other deposits are known in the Nicola and Similkameen divisions of British Columbia.

Considering the unusual physical and chemical properties of bentonite, production has been remarkably small. From 1888 to 1895, the production averaged sixty tons per year, valued at about $25 per ton f.o.b. cars. In 1902, the production rose to 1,200 tons, but the price dropped to $5, later rising to $6 or $7 per ton. In 1919, the Wyoming production was at the rate of about twenty-five cars per year, valued at $7 per ton. During 1920 and 1921, interest in bentonite increased greatly, new deposits were opened, and it is expected that the production will expand more or less rapidly. It is reported that powdered bentonite from Wyoming and California would sell in eastern markets at $25 to $30 per ton in car lots.

USES OF BENTONITE EXPANDING

Until recently the uses for bentonite were few and relatively unimportant. These seem to have been principally in the manufacture of the medical dressing, antiphlogistine; in the manufacture of a packing and dressing for horses' hoofs; as a retarder in the manufacture of gypsum wall plaster; as a filler in the manufacture of paper (at a mill in Denver); as a filler in soap; and as an adulterant in drugs and candies.

Within the last few years the unusual properties of bentonite have attracted considerable scientific attention, and systematic research has been undertaken to study this material and to develop the best methods for its utilization. The Forest Products Laboratory, of the Department of Agriculture, at Madison, Wis., has made rather exhaustive tests on the use in paper making of a high-grade variety of light yellow, colloidal, Wyoming bentonite, known as wilkinite. Their tests seem to show that the addition of small amounts of bentonite to the clay used as a paper filler greatly increases the percentage of filler retention in the finished product. Thus, in one test the retention with clay alone was 45 per cent; with 10 per cent bentonite and 90 per cent clay, 58 per cent; with 20 per cent bentonite and 80 per cent clay, 64 per cent; and with 100 per cent bentonite, 84 per cent. Some paper companies that have tried out this material claim the additional advantages of complete suspension in water and the production of a paper of superior "feel." Other paper companies admit some of the advantages of using bentonite but object to the yellow color of the Wyoming material and submit that the advantages are not sufficient to warrant the increased cost involved. It is reported that the Forest Products Laboratory is also experimenting on the use of bentonite for de-inking news print. Bentonite seems to absorb all the ink without affecting the pulp.

BENTONITE USED IN SOAP

In the manufacture of soap it has been proved that some bentonites can actually replace 25 to 30 per cent of the soap substance, producing a soap equal or superior to the ordinary soap. It should be noted that bentonite is not used in soap as an adulterant or scouring agent, but actually replaces part of the soap substance and increases the lathering and detergent properties.

Owing to the extremely fine-grain size of bentonite, the suggestion has been made that it would be suitable as a filler for rubber. It might also be used as a filler for phonograph records, textiles, cordage, and pressed and molded electrical insulation. It seems to have interesting possibilities in the manufacture of paint.

As an ingredient in gypsum and lime plasters, bentonite should add plasticity, but it would probably increase the drying shrinkage. Its high plasticity suggests its possible application in ceramics, thus enabling smaller quantities of bonding clay to be used; and the possibility of replacing the bonding clay used in electrical and chemical porcelain, abrasive wheels, and graphite crucibles with bentonite is being considered.

It is reported that some bentonites make a superior adhesive paste, particularly for sticking paper to metal. It is claimed that labels pasted on iron with bentonite will not curl up and drop off.

The great affinity of bentonite for water has suggested the possibility of devising a method for using it to dewater crude petroleum.

The use of material of the general nature of bentonite as a water softener has already been partly described above. It is not definitely known whether all bentonites possess the property of softening water, but the usual presence of the alkaline oxides suggests this possibility. If this property is common to all varieties, it is probable that other uses based thereon may be devised.

Other uses suggested for bentonite are: as a base for massage creams, a base for the precipitation of lake colors; a base for printers' ink; as a heavy lubricant or grease (mixed with oil); and as a filler or dressing for leather.

ANALYSES OF BENTONITE

	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8
SiO_2	60.64	57.98	58.68	59.84	60.18	63.20	54.00	55.22
Al_2O_3	23.26	22.46	25.91	11.84	26.58	12.90	24.48	21.00
Fe_2O_3	3.92	3.80	3.97	3.26	.....	2.46	3.00	3.61
TiO_2	0.12	.....	......	.....	.....	0.11	.....	......
CaO	0.59	1.92	1.45	2.90	0.23	0.82	2.08	4.94
MgO	2.19	3.24	1.49	2.32	1.01	2.09	2.75	3.04
K_2O	0.37	1.35	......	2.34	1.23	0.26	.....	......
Na_2O	4.33	.....	1.39	2.13	.....	0.66	1.74	1.56
SO_3	.....	0.75	0.11	.....	.....	......	.....	0.43
CO_2	.....	.....	Tr.	.....	.....	3.50 (a)	.....	Tr.
Cl	.....	.....	0.10	.....	....	0.20 (b)	.....	......
P_2O_5	.....	.....	0.06	....	.....	......	0.71	......
Ign. loss	.....	7.93	......	10.50	....	......	.....	......
H_2O	2.83	.....	6.84	.....	10.26	13.80	9.12	10.28
Totals	98.25	99.43	100.00	95.13	99.49	100.00	97.88	100.08

(a) Sand and like material. (b) Water soluble

No. 1—Yellow, colloidal. Belle Fourche, S. D. Analyst, W. A. Selvig, U. S. Bureau of Mines.

No. 2—Yellow, colloidal. Medicine Bow, Wyo. Analyst, A. G. Van Eman, Owyhee Chemical Products Co., Chicago, Ill.

No. 3—White, colloidal. Near Barstow, Cal. Analysis from California Master Products Co., Los Angeles, Cal.

No. 4—White, fine grained. Otay, San Diego County, Cal. Analysis from Otaylite Products Co., Los Angeles, Cal.

No. 5—Type material from near Rock Creek, Laramie Basin, Wyo. Analyst, T. T. Read, Cassa Mining Co.

No. 6—From Big Horn Basin, Wyo. Analyst, R. C. Wells, U. S. Geological Survey.

No. 7—Supposed bentonite. Near Shelbyville, Tenn. Analyst unknown.

No. 8—"Ardmorite," probably variety of bentonite. Ardmore, S. D. Analysis from the Refinite Co., Omaha, Neb.

Vanadium in Arizona

M. A. Allen and G. M. Butler, of the University of Arizona Bureau of Mines, have issued a bulletin (No. 115) on vanadium, with especial reference to its presence in the Southwest. The only Arizona mine actually producing vanadium concentrates at the date of the publication was the C. & B., controlled by Wilson & Stone, of Christmas. The mine is in Dripping Springs district, with Christmas as its shipping point. Most of the ore is vanadinite, returning, on 500 tons milled, from 1 to 3 per cent V_2O_5. Ore claimed to run from 3 to 5 per cent is found on the claims of the U. S. Vanadium Co., near Kelvin, vanadinite in granite, associated with wulfenite.

In the famous Cataract Canyon of northern Arizona the Northern Arizona Mining & Electric Power Co. has vanadium deposits of apparent importance, in connection with other oxidized lead ores. The mineral is reported from mines in at least nine of Arizona's fourteen counties and the bulletin gives a list of about forty claim owners.

HANDY KNOWLEDGE

Filter Notes

By Algernon Del Mar

Written for Engineering and Mining Journal

The cylindrical or drum type of filter, represented by the Oliver and Portland varieties, is well known and universally used. On account of its continuous action it has practically supplanted all other filters for certain purposes, but there is one detail of operation which often causes trouble. I refer to the means of keeping the pulp in suspension in the filter.

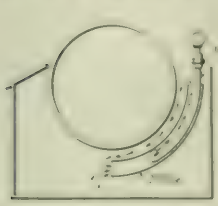


FIG. 1

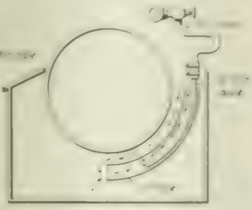


FIG 2

When treating a colloidal slime or a pulp approaching this condition there is no difficulty in keeping the slime in suspension, but when filtering a heavy quartz or concentrate slime the thick pulp will sometimes settle under the filter, particularly if the filter be inactive for a short time. When the pulp has once settled so that neither the paddles nor the air lifts will move it, the drum soon rides on the packed slime, the filter loses capacity as the packed slime is pressed against the face, then the belt slips, and the filter must be drained or dug out, depending upon what kind of material is being filtered.

Usually a filter is provided with a revolving shaft under the filter drum, to which are attached paddles which keep the pulp churned. Likewise, air pipes are provided on both sides, and in some instances under the paddles. All filters are not so fitted, for I have seen them with the paddles and without the air lifts; likewise without paddles but with air lifts. In one instance a filter had the usual paddles, on a solid shaft revolving at 75 r.p.m., and air lifts on both sides, but if for any reason the filter was idle for ten minutes, the zinc concentrate packed so tightly under the drum that the paddles could not turn, and the filter had to be cleaned out with a stream of water from a hose. At another mill where the filter had no air lifts, but had paddles, the pulp would at times pack and put the filter out of operation while the machine was running.

At another mill two 10 x 12-ft. filters were not provided with paddles but had air lifts as illustrated in Fig. 1. The air lifts were made of 2-in. pipes extending down and under the drum, the upper ends being a little below the level of the center of the drum. A ½-in. pipe with a 180-deg. turn at the inserted end, and connected to the air main by a union at the other end, extended into the 2-in. pipe about two-thirds its length. Four air lifts of this description on the opposite side of the filter from the discharge worked very well so long as there was no interruption in the supply of air, but if for any reason the air supply failed for a short period, the lifts gradually "froze" and would not work. It was then necessary to disconnect the air pipes, clean them, and push them back into the 2-in. pipes. Often the lift would not work because the 2-in. pipe was also clogged. The only remedy for this was to drain the filter. Usually this was not an irksome job, as one filter was always in reserve and the filter could be drained into a sump tank, but at times the reserve filter was not in working condition.

This circumstance finally led to the method illustrated in Fig. 2, in which all the air lifts were made by inserting in the 2-in. pipe a ½-in. air pipe, joined to the air line with a hose so that the air pipe could be withdrawn or pushed down into the 2-in. pipe as far as was necessary, to start the circulation. This method of using air lifts without paddles worked well, but better results could be obtained with the use of comparatively high-speed paddles in connection with this air lift; then if the air supply ceased the paddles would keep the pulp in circulation, or if the filter stopped the air lifts would be operative. The paddle shaft should be independent of the filter gears, so that the paddles can revolve when the filter is not turning.

As drum filters, owing to the difficulties outlined, must at times be drained, it is important, when designing a mill, that the position of the filter be such in relation to the other machinery that this drained material (which may be in a highly dilute form, from washing out the filter) can be introduced into the flow sheet so as not to interfere with the continuous operation of the mill.

A few examples of current practice are here illustrated as hints to those operators who care to gain by the experience of others. Fig. 3 shows the position of the filter in a fifty-ton all-sliming cyanide plant in Nevada. And, as will be seen, the filter can be drained into the last Dorr thickener, and so does not interfere with the capacity of the system. The filter must be of comparatively small diameter, as the diaphragm pump cannot lift a heavy pulp over 3 ft. above the surface of the pulp in the tank in ordinary conditions. Previous to the installation of this system the pulp was drained into a tank and returned to the system with a centrifugal pump, but this was unsatisfactory, as the tank had no means of agitating the drained pulp and so

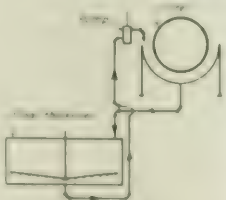


FIG 3

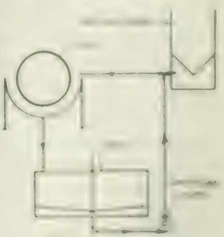


FIG 4

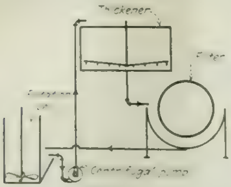


FIG.5

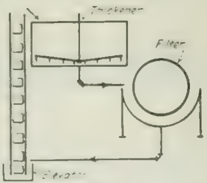


FIG.7

had to be washed to the intake with a stream of water, and this thin pulp used for wash water in the last thickener.

Fig. 4 illustrates the system in practice at a large all-sliming cyanide plant in Mexico. The filter was drained into a cement tank with a revolving-arm agitator, which tank took the thickened pulp from two Dorr thickeners and from which the pulp was elevated by centrifugal pumps to the Pachuca tanks. In this case the filter pulp, which had been fully treated, was returned to the system and either cut down the capacity of the mill or shortened the time of treatment of the pulp with which it was mixed in the Pachuca tank.

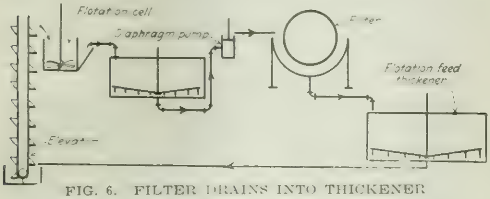


FIG. 6. FILTER DRAINS INTO THICKENER

When filtering a flotation concentrate somewhat the same conditions are present as in an all-sliming cyanide plant. The filter should be drained so that the concentrate may be returned to the filter without interfering with the continuous feed of ore to the frothing machines and with the least possible labor.

In Fig. 5 is shown a lead-zinc mill flow sheet of the filter system in which the drained pulp from the filter goes to the first cell of the flotation system and must be re-treated. This is similar to the arrangement in Fig. 6, in which the drained pulp re-enters the system in the thickener feeding the flotation machine.

As a filter, to have capacity, must be fed with a thickened pulp, a Dorr thickener should precede the filter. All that is necessary is to have an elevator alongside the thickener which can be set in motion when required and by this means elevate the drained pulp into the thickener. Fig. 7 illustrates the method. I believe an elevator superior to a centrifugal pump for this purpose.

Using Slide Rule in Surveying Calculations

By Paul H. Keating

Written for *Engineering and Mining Journal*

For rapid calculation of latitudes and departures of four significant figures or less, an ordinary 10-in. Mannheim polyphase slide rule is ideal. For example:

Departure = Distance × Sin θ

Without reversing the slide, set the bearing angle on the S scale to the cross hair on the back of the slide rule. The sine is automatically set off on the *B* scale, under unity at the right end of the *A* scale. Set the glass indicator on the measured distance on the *A* scale, and read the departure on the *B* scale.

A similar operation for latitude is accomplished by using the complement of the bearing angle. The results may be instantly checked by setting the departure over the latitude on the *C* and *D* scales, respectively, and the *T* scale shows the bearing angle on the reverse cross hair.

For example take the following: S. 35° 30′ E. 72.5 ft. Set the *S* scale to 35° 30′ on the cross hair on the back. The sine is under 1 at the right end of the *A* scale, .0581. On the *A* scale set the glass indicator to 72.5, and under it on the *B* scale is the departure, 42.1 ft.

For the latitude use the complement of the angle, 64° 30′. Or, which is as easy, set the bearing angle on the *T* scale to the cross hair on the back; set the glass indicator to the departure already determined on the *C* scale. The latitude is on the *D* scale under this departure.

Draining Water From Conveyor Belts

By Roy H. Poston

Written for *Engineering and Mining Journal*

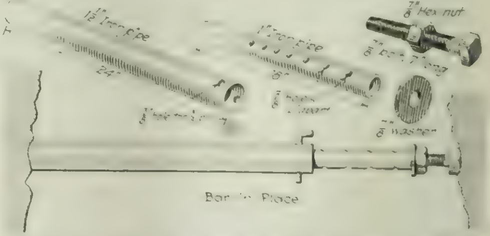
When conveying crushed rock, gravel, or other material that is water soaked it is usually desirable to get rid of as much water as practicable as soon as possible. If a belt is used, this may be accomplished by sloping it to one side for a horizontal distance of about 25 ft. The proper inclination should be determined by trial.

Telescope Bar for Narrow Stopes

By Charles Labbe

Written for *Engineering and Mining Journal*

In a western mine where stringers of high-grade ore have to be followed off the main stopes and the width of such stringer stopes varies from 2 to 4 ft., little timber is used. For hand drilling and sampling the platform is supported by two telescope bars which can be quickly adjusted to any width of the stope. Two 2 x 12-in. boards 4 ft. long complete the platform. The bars are shown in the accompanying cut.



TELESCOPE BAR FOR SUPPORTING DRILLING PLATFORM IN NARROW STOPES

Insurance Benefits

Not so long ago the mining town of Britannia Beach, B. C., had a fire which destroyed the mill of the Britannia Mining & Smelting Co. Last week it suffered from an even more disastrous flood. This brings to mind a story that is told of two enterprising New Yorkers: "Such a policy I have!" said Ikey to Izzy, "It insures me against fire, *und* I had a fire; against *gonufs, und* I was robbed; against water, *und* yesterday I had a flood." "Izzy," replied Ikey after deep thought, "How do you have a flood?"

THE PETROLEUM INDUSTRY

Laws of Mexico Affecting Oil Development*

THE MINING LAWS of Mexico of Nov. 22, 1884, June 4, 1892, and Nov. 25, 1909, were based upon the constitution of 1857, and recognized the principle that the exclusive ownership of the petroleum deposits was vested in the owner of the land. These laws also provided for the acquisition of petroleum rights by foreign companies. It was in conformity with these laws that American capital purchased and leased petroleum lands in Mexico, expending more than $200,000,000 in lands, leases, pipe lines, camps, pumping stations, tank ships, wharves, and other necessary equipment. On Feb. 5, 1917, a new constitution was promulgated which made a radical change in the petroleum laws of Mexico.

The Attorney General of Mexico has given the following opinion as to Article 27:

> 1. All landed property, whether of national or private ownership, urban or rural, comprised within the confines of the republic, shall be considered as covered by the term "lands and waters of the nation."
> 2. Only Mexican individuals and Mexican associations have the right to acquire lands, waters, and their appurtenances in the republic.
> 3. Alien individuals may acquire such property, either directly from the nation or from individuals—Mexican or alien—on complying with the conditions prescribed in Section 1 of the seventh paragraph of Article 27, when authorized by the state. Hence, even though compliance be had as hereinbefore provided, the state may deny aliens this right under the discretionary power vested in it by this provision.
> 4. Alien corporations shall in no event acquire such property.

As probably indicating the intentions of the government toward enforcing the nationalizing provisions of Article 27 of the constitution, notices have been sent to revenue collectors and registrars in the State of Vera Cruz instructing them not to receive for registration deeds wherein the owner of the land agrees to sell or lease to companies or individuals for the exploitation of subsoil products. The circular which was sent out by the government states that the Mexican government alone can legalize such transfers, "being of its direct domain all oils and minerals in the subsoil of the republic."

GOVERNMENTAL DECREES AND PROJECTED LAW

The executive sent to the Mexican Congress in December, 1918, a bill embodying a petroleum code, intended to put into effect the nationalizing provisions of Article 27 of the new constitution. To date the Congress has not passed this or any such measure. On Feb. 19, 1918, the President of Mexico, under authority of a congressional resolution conferring upon him extraordinary powers in the Department of Finance, issued the first of a series of decrees to enforce Article 27. The decree provided for the payment of rentals and royalties to the nation by the owners of petroleum lands, the registration of petroleum lands under penalty of confiscation, and the opening of lands not registered to the filing of claims by third parties. Against this decree the United States, Great Britain, The Netherlands, and France made diplomatic protest. The taxes levied by this decree were referred to as "rentals" and "royalties," which terms by their very meaning must have conceded the national ownership mentioned in the new constitution, if the decree had been acknowledged by the property owners. On July 8, 1918, a decree was issued, which, with the amendments of Aug. 9, 1918, provided the means of terminating the present titles to oil lands under certain conditions, and the issuance by the government of licenses to drill on the lands, the title of which had been terminated. On July 31, 1918, the decree of Feb. 19 was reissued in a slightly different form, the date of Aug. 15, 1918, being set as the time limit for filing a statement of title.

In an attempt to enforce the provisions of these governmental decrees and the payment of the taxes exacted by them, others were issued later which suspended the drilling of new wells. In the meantime the companies had sought relief in the federal courts of Mexico, where the cases were decided against them. The cases are now being decided by the Supreme Court of Mexico on *amparo* proceedings instituted by the principal companies engaged in the petroleum industry. Pending action by the Mexican Congress, the principal oil companies on Jan. 4, 1920, petitioned the President of Mexico for the issuance of provisional permits to drill new wells and to complete those already begun, it being understood that the granting of such permits would in no manner affect the contentions of either the oil companies or of the government on the questions then in controversy.

PROVISIONAL PERMITS FOR DRILLING

A presidential order dated Jan. 17, 1920, provided for provisional permits to drill on the following basis: First, permits to be valid only until Congress enacts an organic law to carry out the provisions of Article 27 of the Mexican constitution; second, permits may include wells begun since May 1, 1917, whether finished or not; third, with the grant of a permit the Mexican government abandons no right or judicial principle which it desires to sustain and companies acquire no new rights; fourth, if companies do not comply with the organic law when enacted, their [illegible] under permits will cease; fifth, permits will not affect questions now before the courts concerning the application of Article 27 of the constitution and of executive decrees and orders relating to petroleum, nor will they affect the discussion of pending petroleum legislation.

PROTECTING PROVISIONS OF NEW CONSTITUTION

Article 14 of the new constitution states: "No law shall be given retroactive effect to the prejudice of any person whatsoever." It is the contention of the Mexican government that this constitutional provision will fully protect the companies already interested in the petroleum industry in Mexico. However, it is difficult to determine the [illegible] effect of the various decrees issued to carry out the provisions of Article 27 of the new constitution with the protection guaranteed by Article 14. It is to be hoped that any new petroleum legislation based on the constitution of 1917 will include an endeavor to bring the provisions of Articles 14 and 27 into harmony, to the end that oil properties legally acquired by foreign interests under the constitution of 1857 and the laws of 1884, 1892, and 1909 will receive the protection and guarantees afforded them by Article 14 of the constitution of 1917.

---

*[illegible]

No American companies are developing oil in Mexico on any but privately owned property, legally acquired under laws of Mexico, and no American company, with two minor exceptions, possesses any rights to drill on any lands conceded by any government of Mexico. The American companies have in practically all cases made their contracts of lease or purchase with private owners of the land. There are probably between fifty and one hundred American companies which have holdings of supposed oil lands in Mexico acquired either by lease or purchase from the original owners. The amount of land so held is not less than 3,000,000 acres, and possibly double that amount. A conservative estimate is that 10 per cent of these lands contain oil.

SUPREME COURT INTERPRETATION OF ARTICLE 27

More than 150 cases of *amparo* were filed by the oil companies during 1918 and 1919. An *amparo* in the Mexican law corresponds in our laws to a request for an injunction on constitutional grounds. The *amparo* proceedings brought in 1918 were instituted against the decrees of Carranza, which made the nationalizing provisions of Article 27 of the constitution retroactive and confiscatory of properties owned before the constitution of 1917 was adopted. The *amparos* filed in 1919 were directed against a specific decree of Carranza, which provided that the lands of those companies which refused to file manifests, practically acknowledging a transfer of their properties to the government, would be subject to denouncement or filing and seizure by such other parties as might be authorized by the government.

On Sept. 26, 1921, the Supreme Court of Mexico officially handed down a decision on the proceedings in *amparo* brought by the Texas Co. in 1919. The decision, signed by the entire court, reads in part as follows:

> Paragraph 4 of Article 27 cannot be regarded as retroactive, either in its text or its spirit. It does not attack acquired rights. No attack upon those rights is made in the text of the article, because it does not contain an express mandate regarding its retroactivity, nor can any such implication be read into it. No attack is made in the spirit of the article, because it acts in the same spirit manifested in other articles of the constitution, which, as a whole, recognizes the old principles upon which are based the rights of man, granting ample guaranties.
>
> Considering Article 27 non-retroactive, we find it is in harmony with the principles set forth in the paragraphs immediately preceding it. These deal with private property. We also find it in harmony with the sections relating to petroleum, which follow it. From all this it is understood that according to universally applied rules which have been accepted for the interpretation of laws, Paragraph 4 of Article 27 is not retroactive in that it does not impair rights previously and legitimately acquired.

The Chief Justice in rendering the decision says:

> Today's decision is as specific and far reaching in matters relating to oil as a judicial tribunal can render, and should establish the principle of law upon which the other *amparo* cases pending should be adjudicated.

It is believed that this decision in the Texas Co. case establishes a judicial acknowledgment that petroleum lands acquired prior to May 1, 1917, for purposes of mineral development, on which denouncements were made subsequent to such date and in accordance with the Carranza decrees, are held to be not subject to such denouncement and not subject to any of the regulative decrees concerning denouncement. An *obiter-dicta* decision issued at the same time states that the lands above referred to are subject to the decrees relating to taxation, and that the president, in the use of his extraordinary powers and by proper decrees issued, may effect the taxing basis of the properties in question. The Supreme Court, however, did not find that President Carranza exceeded his powers when he issued the decree resulting in the denunciation of properties of the Texas Co. under the provisions of Article 27.

NEW LEGISLATION BASED ON ARTICLE 27

A proposed new petroleum law based on the nationalizing provisions of Article 27 of the constitution has recently been presented to the Chamber of Deputies of the Mexican Congress, by a committee of the Congress. This proposed law provides that petroleum taxes will be of two kinds: A tax on the lands in which exploitation is carried on, and a tax on the production obtained. The tax rate is to be fixed once each year "by the respective income law." According to this proposed law there will be no future concessions granted for private pipe lines, such becoming common carriers. Article 19 states: "The parties interested in petroleum concessions executed after May 1, 1917, must subject themselves to the terms of this law within the term of one year from its date."

In the enactment of laws governing the development of any natural resource, such as petroleum, there are certain fundamental principles which should not be ignored. Before development can successfully proceed it is essential that the laws of a country shall fairly protect both the national interests of the government and the capital which it hopes to attract. Particularly should the mining laws affecting petroleum development be favorable to the industry, on account of the highly speculative character and prospective nature of the business.

The mining laws of a country usually have as their object the accomplishment of one or both of the following purposes: Revenue to the government or a development of the natural resources. The objects are not antagonistic, but the former may be, and sometimes is, made to defeat the latter purpose. Taxation for purposes of revenue may be made so high and onerous, and administrative restrictions so numerous, that development does not take place, the law thereby defeating the results desired, for neither is revenue derived nor is development accomplished. It is to be hoped that methods will be worked out by the Mexican government which will make the oil resources of the country available to the needs of mankind through means which will be fair to both the Mexican people, bringing them stability and prosperity, and to the foreign capital legitimately invested in Mexico.

Japan Importing Persian Oil

A contract for 50,000 tons of crude oil per annum has been made by the Teikoku Oil Co., of Japan, with the Anglo-Persian Oil Co., says the *Japan Gazette*. For the transportation of this oil two ships of 8,800 tons each have been constructed.

Book Reviews

Waste in Industry. By the Committee on Elimination of Waste in Industry of the Federated American Engineering Societies. First Edition; cloth; pp. 409; illustrated. Federated American Engineering Societies, Washington, D. C. McGraw-Hill Book Co., Inc., New York, sole selling agents. Price, $4.

Taking oneself by the nape of the neck and holding oneself at arms' length and looking oneself over honestly and critically is worth doing once in a while. This introspection is wholesome for the individual. It gives a keener sense of values and is a corrective for that time-worn aphorism of the street—"swelled head." We are a great nation, yet a little honest introspection is not without its value to us individually and collectively. The recent report of Waste in Industry by the Committee on Elimination of Waste in Industry of the Federated American Engineering Societies is just that. It is a frank statement of findings in several of our industries by our own engineers. Herbert Hoover, referring to the report, says:

"We have probably the highest ingenuity and efficiency in the operation of our industries of any nation. Yet our industrial machine is far from perfect. The wastes of unemployment during depressions; from speculation and overproduction in booms; from labor turnover; from labor conflicts; from intermittent failure of transportation of supplies and power; from excessive seasonal operation; from lack of standardization; from loss in our processes and materials—all combine to represent a huge deduction from the goods and services that we might all enjoy if we could do a better job of it."

Six industries were studied in more or less detail. They were sampled and assayed. The report says that "management has the greatest opportunity and hence responsibility for eliminating waste in industry. The opportunity and responsibility of labor is no less real though smaller in degree. The opportunity and responsibility chargeable to outside contacts cannot be so clearly differentiated or evaluated." The report states that: "Over 50 per cent of the responsibility for these wastes can be placed at the door of management and less than 25 per cent at the door of labor, while the amount chargeable to outside contacts is least of all."

Engineers generally should read this report. For mining and metallurgical engineers there is little of direct value. For them, reading between the lines and visualization of their own industry in parallel is necessary. Nevertheless, I believe that the mining industry can profit considerably by a similar introspection. Can we truthfully state that management of mining enterprises is all that it should be? We know that labor has been responsible for waste in the industry. We also know that the methods of financing wildcat and other dubious ventures are open to considerable censure. So we cannot say that the mining industry is unlike other industries in respect to management waste, labor waste, and capital waste. Then there is room for improvement.

The principal value of this report is that it is a challenge to engineers. It opens up a vista of opportunity. If there is so much yet to be done in eliminating waste in industry, I can see the need for better and more engineering. I am of the opinion that engineers should study the following extract from this report:

"Engineers come in contact with and influence every activity in industry and as a body possess an intimate and peculiar understanding of intricate industrial problems. They are in a position to render disinterested service, and their peculiar responsibility is to give expert judgment wherever engineering training and technical skill are needed to reach a just decision.

"This report brings forward certain pressing problems concerning the solution of which engineers should hasten to assist. The assays of waste show first the need of definite and quantitative industrial information on a multitude of points. Science has pushed ahead in some directions; it lags behind in others. The duty of the engineer is pre-eminently a duty to enlarge the boundaries of knowledge. His lifelong training in quantitative thought, his intimate experience with industrial life, leading to an objective and detached point of view; his strategic position as a party of the third part with reference to many of the conflicting economic groups—and, above all, his practical emphasis on construction and production—place upon him the duty to make his point of view effective.

"It is peculiarly the duty of the engineers to use their influence individually and collectively to eliminate waste in industry."

G. J. Y.

Recent Patents

Flotation Reagent—No. 1,394,639. C. L. Perkins, Pittsburgh, Pa., assignor to Metals Recovery Co., New York. A compound flotation agent comprising a solution of a solid amine compound in a liquid amine compound readily miscible with water. No. 1,394,640 covers the use of a mixture of several amine compounds. It is understood that the flotation agents covered by these patents have shown great promise in the treatment of Utah Copper Co. and other ores, and that they will likely be used on a commercial scale at an early date.

Flotation Machine—No. [illegible]. Yasuchi Otsuka, Tokyo, Japan. A mechanically agitated flotation machine in which [illegible] are adapted to [illegible] and flotation agent without [illegible] agitation. Whether the [illegible] are provided with means for delivering air into the pulp.

Metallurgy of Vanadium—No. [illegible]. A. H. Carpenter and G. A. [illegible], [illegible], Col., assignors to The American Vanadium Corporation, [illegible]. A method of precipitating vanadium compounds from solution by the use of an alkali metal acid sulphate.

Technical Papers

Metallurgy of Copper—In the *Proceedings of the American Institute of Mining and Metallurgy*, No. 42 [illegible] is a description of a new metallurgical process for copper ores devised by W. H. Coolbaugh. The process requires that the ore [illegible] ratio of sulphur to copper [illegible] consistent with the production of sulphuric acid [illegible] conditions. The essentials of the process are as follows: (1) [illegible] to 30 mesh in a special type of [illegible], something on the order of a Symons disc crusher or a Braun pulverizer. (2) Agitation with acid solution produced within the process by electrolysis. (3) Purification of a portion of the "mother liquor" and electrolytic deposition of the contained copper, thereby producing sufficient free sulphuric acid in solution for the next charge of calcine and further requirements. (4) Partial purification of the remaining "mother liquor" together with the first wash solutions, and precipitation of the copper concentrates as hydrate by milk of lime. (5) Dissolution of the copper in the hydrate precipitate by means of a solution of ammonia, followed by distillation of the ammonia liquor, producing pure copper oxide, and recovering the aqua ammonia by condensation. (6) Reduction of copper oxide to metallic copper. (7) Treatment of the residue from (5) for the production of a byproduct and the recovery of any remaining copper. (8) Treatment of the washed slime residues from the ore charge for gold and silver by the cyanide process. (9) Use of producer water gas for the whole of the metallurgical operation as heating gas and to provide sulphate of ammonia.

Petroleum Engineering—The U. S. Bureau of Mines has just issued a report entitled "Petroleum Engineering in the Deaner Field, Okfuskee County, Oklahoma," by M. J. Kirwan and F. X. Schwarzenbek. The report includes a history of the development and a description of the producing formations and geological structure of the Deaner field, and is amply illustrated with maps, cross-sections showing the underground conditions, and drawings of various mechanical systems used in operating. The report has been issued in cooperation with the Bartlesville, Okla., Chamber of Commerce, which will distribute it at a price of [illegible] per copy. Persons desiring copies should address the Bartlesville, Okla., Chamber of Commerce.

Map of Alaska—The U. S. Coast and Geodetic Survey has completed a new official map of Alaska on the Lambert conformal conic projection, scale 1:5,000,000, dimensions 41 x 59 in. The map extends from the Arctic Ocean to the State of Washington, including all the Aleutian Islands and a part of Siberia. It is intended mainly as a base map to which may be added any kind of special information that may be desired. For this reason, only national boundaries, the adjacent Canadian provinces, and the names of a few of the islands and places are given. The new map may be obtained for $1 from the U. S. Coast and Geodetic Survey, Department of Commerce, Washington, D. C.

ECHOES FROM THE FRATERNITY

San Francisco Section, A.I.M.E.

The San Francisco section of the A.I.M.E. held a meeting on Nov. 9, with the mining students of the College of Mines, University of California. W. J. Loring, president of the American Mining Congress, and James M. Hyde, professor of metallurgy of Stanford University, made short addresses to the students and members.

Puget Sound Section of A.I.M.E.

A meeting of the Puget Sound section of the A.I.M.E. was held on Oct. 27 at the Engineers' Club, Seattle. Officers elected for the ensuing year were: Amos Slater, chairman; Charles Simenstad, vice-chairman; J. G. Murphy, secretary-treasurer, and H. Y. Walker and L. A. Levensaler on the executive committee.

The question of closer association with student associate members at the University of Washington and the problem of getting in closer touch with members of the institute in British Columbia and Alaska were also discussed. It was suggested that a meeting of the Puget Sound section be held in Vancouver, B. C., to increase contact with members who live in and near that city, but it was deemed advisable to find out, through members in Vancouver, the feeling of the Canadian Mining Institute, as the section wishes to co-operate with the Canadian Institute and not do anything the object of which might be misinterpreted.

British Columbia Mining Acts To Make New Provisions

Conditions in British Columbia indicate that there will be no legislation of great importance in its relation to the mining industry before the session of the provincial Legislature now in progress. There is a possibility that in the general adjustment of taxation, a problem which the legislators are soon to consider, some action will be taken with regard to mining. Even this, however, is but speculation and will come only if the mine operators are able to impress the government with the necessity of relieving them of some of the burden which, they claim, threatens to seriously hamper development.

Both the Mineral Act and the Placer Act are to be considered, but only for amendments of minor interest. The purpose in connection with these statutes apparently is to make provision for the realignment of the boundaries of some of the mining divisions of the province. Section 112 of the Mineral Act is to be made so to read as to give the Lieutenant Governor in Council power "to constitute any part of the province a mining division and declare by what local name it shall be known, and may establish therein a mining recorder's office, and may from time to time extend, reduce, subdivide, or annul any existing mining division or merge it in whole or in part in the consolidation of two or more mining divisions." No doubt has existed of the power to create new divisions, but this will give authority specifically to annul present divisions and to merge annulled divisions with others. Section 114 sets out the procedure that shall be followed with reference to records and documents in the charge of officials of a division when it annulled or merged. The Placer Act is to be altered in the same manner, the idea clearly being to make the law apply similarly both in respect of placer and lode mining, where it is deemed expedient to alter existing mining divisions.

MEN YOU SHOULD KNOW ABOUT

Bulkeley Wells is in New York.

M. A. Newman is in San Francisco.

H. V. Winchell was recently in Salt Lake City.

Dr. C. K. Leith will be in New York on Nov. 22.

P. G. Spilsbury has returned to Phoenix from a visit to Clifton, Ariz.

George H. Garrey, consulting geologist of Philadelphia, is in Tonapah on professional business.

Thomas L. Chapman, of Los Angeles, has returned to Phoenix from a trip to Globe and to Lordsburg, N. M.

M. F. Fairlie, manager of the Mining Corporation of Cobalt, has returned from a visit to New York.

A. G. Larson, of Spokane, and **R. H. Stewart**, of Vancouver, B. C., were in Alaska on professional business during October.

G. C. Bateman, of Cobalt, recently addressed the Associated Boards of Trade for Northern Ontario on "The Mining Industry."

John V. W. Reynders has been elected chairman of the iron and steel committee of the A.I.M.E., succeeding the late Prof. J. W. Richards.

Kuno B. Heberlein, formerly president and general manager of the Penoles Mining Co., Mexico, has opened offices at 42 Broadway, New York.

Edwin E. Chase and son, **R. L. Chase**, of Denver, have been in the Katherine district of Mohave County, Ariz., and have gone to Tucson on mine examination work.

C. H. Brandes, formerly chief mechanical engineer and general purchasing agent of the American Metal Co., New York, has opened offices at 42 Broadway, New York.

George A. Morrison is now residing at Cranbury, N. J., following the cessation of mining at the International Nickel Co.'s. Creighton mine, in Ontario, of which he was superintendent.

J. A. MacKillican, formerly superintendent of inspection for the Meriden Iron Co., has been promoted to the position of manager for the Meriden Iron Co. and the Mace Iron Mining Co. Mr. MacKillican fills the vacancy caused by the death of O. B. Warren.

A. H. Fahrenwald, of the U. S. Bureau of Mines, University of Idaho, left Moscow early in November for Reno, Nev., to which point he had been called for consultation upon some of the problems incidental to flotation of Nevada ores.

Graham B. Dennis, Frank M. Smith, Frank A. Ross, Frank C. Bailey, Leigh Nicholls, Oscar Cain, and W. H. Linney, all of Spokane, have been re-elected to the executive committee of the Northwest Mining Association for the ensuing year.

Sherwin F. Kelly, representing C. & M. Schlumberger, Prospection Electrique, of Paris, has been carrying on a series of experiments with Schlumberger's method of applying electricity to the prospection for certain ore minerals, on the copper deposits of the Ducktown Sulphur, Copper & Iron Co., and of the Tennessee Copper Co., in the Ducktown basin.

Mining and metallurgical engineers visiting New York City last week included: **Archibald Little**, Detroit, Mich.; **J. Gordon Hardy**, Brookline, Mass.; **F. H. Kay**, Caracas, Venezuela; **J. M. Longyear, Jr.**, Marquette, Mich.; **Samuel E. Doak**, Philadelphia, Pa.; **H. A. Kee**, Cobalt, Ont.; **Chester A. Fulton**, Baltimore, Md.; **G. Sessinghaus**, Denver, Col.; and **C. L. Coburn**, Pittsburgh, Pa.

SOCIETY MEETINGS ANNOUNCED

American Institute of Chemical Engineers will hold their annual winter meeting at the Southern Hotel, Baltimore, Dec. 6-9.

The Petroleum and Gas Committee of the A.I.M.E. has postponed its meeting scheduled for Dec. 10 until the annual convention of the institute in February.

Mining and Metallurgical Society, New York Section, will hold a meeting on Nov. 22 at the Harvard Club. The subject to be discussed will be, "Foreign and Domestic Mining Policy."

The American Petroleum Institute will hold its second annual meeting in Chicago, Ill., on Dec. 6, 7, and 8. Among the speakers will be Van. H. Manning, R. D. Benson, Frank A. Howard, N. A. C. Smith, R. E. Wilson, Dr. C. K. Francis, Thomas A. O'Donnell, Walter Teagle, Amos L. Beaty, D. W. Moffit, Edward L. Doheny, Edward Prizer, Frank Haskell, Paul Shoup, Louis Sands, and Edward C. Finney.

The American Society of Mechanical Engineers has announced a five-day meeting, Dec. 5 to 9, to discuss the following: The elimination of industrial waste, as recently reported by the American Engineering Council's committee headed by J. Parke Channing; education and training in the industries; management and gas power; fuel and material handling; professional engineering education for the industries, and textile, ordnance, and aeronautic sections.

OBITUARY

William Hatfield, pioneer mining man of Utah, died on Oct. 31, at the age of seventy-three. Mr. Hatfield was identified with the discovery of the Swansea and Bullion Beck mines.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

The study that is being given to the problem of finding new uses for copper is reflected in the current news in various ways; a factory is said to be planned in northern Michigan for making automobile gears of hardened copper after a process devised by Bruce A. Middlemiss. New Cornelia, it is said, may build a copper-rolling mill.

Reduction of freight rates on necessary supplies would aid mining communities. The Southern Pacific Ry. is said to be planning such a cut, affecting various camps in the Southwest.

The bill for liberalizing the War Minerals Relief Act was under fire in the House last week. Representative Rhodes, chairman of the Committee on Mines and Mining, was forced by the opposition to propose an amendment that may cripple the measure.

Need for relieving the unemployed has finally become urgent in the Michigan copper country, and a scheme long planned is being put into effect. Industrial conditions in general are thought to be slowly improving, however.

The Interstate Commerce Commission has been asked to reconsider its important decision in the Gold Hunter freight rate case.

Southern Pacific Planning Cut In Rates To Aid Mines

Mining Towns on Branch Lines May Get Main-Line Traffic

A cut in freight rates is being formulated by the general traffic manager of the Southern Pacific R. R. These rates will apply upon iron and steel products, timber, coal, coke, and oil for mining camps in the Southwest. As soon as combinations with branch roads can be worked out, application will be made to the Interstate Commerce Commission to have the new rates made effective. Mining camps on branch lines like Clifton-Morenci, Globe-Miami, Ray, Ajo, and Jerome, in Arizona, and Santa Rita-Hurley and Tyrone, in New Mexico, will be given what is substantially main-line rates, effecting a saving in some instances of as much as $8 per ton. The timber rates will apply from Pacific Coast points also.

Plan Factory To Make Gears Of Hardened Copper

Bruce Middlemiss Said To Have Devised Process Employing 3 Per Cent Alloy

It is reported from the Michigan copper country that a factory, in which more than a million dollars will be invested, is planned for the manufacture of automobile gears of hardened copper after a process worked out by Bruce A. Middlemiss. Mr. Middlemiss recently returned from Chile, where he was employed by the Guggenheim interests and where he conducted his experiments. His product, which consists of a 3 per cent alloy, is declared to be ideal for automobile gears and other important industrial uses. It has been subjected to severe tests and strains to show its hardness and toughness. It is declared to be capable of withstanding great wear and will not chip or break.

Gold Prince Company Sued

The Gold Prince Mining Co. of [illegible], Ariz., has been sued in [illegible] by Louis McAvoy for $11,[illegible], alleged due for material and for [illegible].

Boston & Montana Starts New Concentrator

The new 750-ton mill of the Boston & Montana Development Co., at Elkhorn, Mont., began milling operations on Nov. 12.

Unemployment Relief Now Urgent In Copper Country

Calumet & Hecla To Regulate This Work With Aid of Business Men

The Calumet & Hecla Mining Co. and subsidiary mines, which have decided not to resume operations this winter, will aid their former employees, tiding them over until such time as the price of copper warrants a reopening of the properties. Several thousand men are without means of support. The majority of them have been idle since April 1. Many were able to find temporary work during the summer or managed to live on their savings, but the time has come when assistance will be needed.

It is generally believed operations will be resumed in the spring in most of the Calumet & Hecla mines, but until that time the Calumet & Hecla will extend whatever aid is necessary. The cost of relief work will be large, but it is better, it is contended, to take this means of helping the men instead of resuming the mines at this time, which would only pile up copper for which there is no market and prolong the period of market stagnation.

Calumet & Hecla will use its organization in regulating the work of relief and will have the coöperation of the business men of the Calumet and Torch Lake districts. Men not formerly in the employ of the company and who are out of work will be assisted from a community fund.

Relief will consist of orders on stores for the necessities of life, such as food, clothing and fuel. [illegible] An employment committee will [illegible] from time to time as work is found. The entire plan of relief will begin to function at once.

New Cornelia May Build Refinery And Rolling Mill

Proposed New Railroad to Tidewater Would Save Much in Cost of Hauling Fuel

J. C. Greenway, general manager of the New Cornelia Copper Co., recently stated at Ajo that his company, by construction of the proposed railroad to the Gulf of California (the Arizona & Sonora Ry.) would save $300,000 a year on the transportation cost of the single item of fuel oil. It is planned to use lighterage for a while before constructing docks and wharves. Construction of the tidewater railroad, he said, is not wholly assured, but he considers the line essential in the interest of economical operation. He said that New Cornelia's plans include the possible construction of a refinery and copper rolling mill. About [illegible] men now are employed at Ajo of the normal force of about [illegible].

Wins Calumet & Arizona Prize for Suggesting Use for Copper

A prize of [illegible] offered by the Calumet & Arizona Mining Co. for the best suggestion for increasing the use of copper was won by [illegible], a Bisbee building contractor, who suggested that solid copper be used in buildings instead of the present "shoddy" imitations of [illegible] with a [illegible] solution, yet selling at a very high price. He has estimated that every dwelling should contain about [illegible] pounds of brass and that [illegible] would [illegible] by [illegible] a year. The Copper and Brass Research Association of New York, is sending to Arizona [illegible]

J. D. Wolf Appealing from Decision in Suit Over Flotation Patent

In the [illegible] of the case of J. D. Wolf [illegible] publish his full statement as follows:

"J. D. Wolf, the plaintiff, an inventor, and owner of what is claimed to be the basic patent for aerial frothing flotation processes, sued William M. Baldwin, a capitalist, for breach of a contract to exploit and finance the patent. No question of any infringement of the patent was involved and its validity was admitted at the trial. The judge refused, as a question of law, to admit any testimony offered by the plaintiff as to his damages and directed the jury to award the plaintiff the sum of $600 due to him for wages, about which there was no dispute, and, if they found there had been a breach of the contract, to award him a further sum of 6c. In accordance with this instruction of the judge, the jury found there had been a breach and awarded the plaintiff $600.06. Mr. Wolf is appealing from the judgment."

Industrial Conditions Improved in Northwest

Greater Optimism Prevalent—Radicalism Disappearing—Discoveries of New Ore More Frequent

By Hilliard W. Power

Spokane.—With the fourth quarter of 1921 well started, there is a much better tone prevalent in mining sections and districts of Oregon, Washington, Idaho, and British Columbia tributary to Spokane than was noticeable at the end of 1920. Though production and other activities have not materially increased as compared with a year ago, an undercurrent of optimism is appreciable; a realization among mining men and investors of the Northwest that the worst of the current depression has passed. It is felt, however, that recovery will be slow.

Compared with many other metal-mining areas, the Northwest has been rather fortunate, inasmuch as silver has been an item of considerable importance in helping to keep the industry on a more even keel during the time of stress than would otherwise have been possible. Had it not been for the Pittman Act, mining in the Northwest would certainly be in a much worse condition than it is. With its continued aid, and the prospect of lead being the first of the base metals to show a marked recovery from the depression caused by the post-war readjustment period, the outlook is decidedly better than earlier in the year.

A factor of no small importance in the improvement anticipated is the willingness of labor to give a fair day's work for a fair day's pay. A tendency to radicalism, which appeared to increase as wages went up to the peak of two years ago, has waned to nothing but a shadow. In the silver-lead districts of British Columbia, where the One Big Union movement had reached threatening proportions in the spring of 1920, the O. B. U. element has been so thoroughly discouraged as to remain nothing but a memory. South of the international boundary line the popular sport of the radical element among laboring men of making things unpleasant and unprofitable for capital by I. W. W. activities has been succeeded by a pathetic desire to hold the job. Consequently, where, a year or two ago, radicals would sometimes make an effort to set fire to mine property, because there was a reasonable assurance of another job just around the corner, the same men now feel inclined to get out and fight any element that promises destruction of their jobs. Though wages in mining sections generally have not been readjusted to the pre-war basis, as have the prices of copper, lead, and zinc, the improvement in quality and quantity of work delivered has been most marked. There is also a willingness on the part of common labor around mines to make an effort to become skilled, as it is noted that the competent man has much less trouble securing connection with a payroll than the laborer.

It has also been noted that new and important strikes have been more numerous lately. The majority of these are on prospects or partly developed mines. In a territory such as the Northwest, an epidemic of new finds almost inevitably follows or is contemporaneous with a period of acute business depression. The reason apparently is, that instead of sitting around waiting for something to turn up or for a capitalist to buy a group of claims, the owners are forced by necessity, like the hen, to go out and scratch for it. The majority, of course, find nothing; but there is always a certain proportion who do.

Reduction in freight rates on ores to the Bunker Hill smelter at Kellogg, secured only lately, is looked upon as a factor of no small importance in further improving mining conditions throughout this territory. There are indications of a brisk competition arising in the near future among large metallurgical interests for ore, particularly lead, and more especially lead ore or concentrates fairly free from zinc. All of this is to the advantage of the producer of silver-lead, which is the backbone of operating profits in the Northwest.

Mount Morgan Gold Miners Refuse Wage Reduction

By Reuters Agency

Brisbane, Oct. 31—The members of the Rockhampton branch of the Australian Workers' Union have declined to resume work at the Mount Morgan gold mines under the award of the industrial arbitration court which reduced their wages by 20 per cent.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

War Minerals Relief Bill Crippled

Measure Under Fire in House—Rhodes Forced To Propose as Committee Amendment That Funds To Meet Awards Must Be Reappropriated—Vote Blocked

An effort to kill the bill providing for the liberalization of the War Minerals Relief Act failed on Nov. 9, when the House voted down decisively an amendment by Representative Cramton, of Michigan, to strike out the enacting clause of the measure. Another amendment, however, provides that any funds to be used in meeting awards made under the bill must be reappropriated. This action all but thwarts the benefits expected to be derived from the legislation, as it is recognized that it will be difficult to secure the reappropriation of the funds necessary to meet new awards.

The House devoted practically its entire day to the discussion of the bill, which bears the number S. 843. The bill passed the Senate on June 17. It has been on the House calendar since Aug. 2.

Representative Rhodes, the chairman of the Committee on Mines and Mining, explained that the bill had the support of all members of the committee. The principal reason for passing the measure, he declared, is to permit an equitable application of the relief intended in the original war minerals act. He took issue with those who contended that the proposed changes in the law would give rise to abuses and enable spurious claimants to benefit by it. He presented a statistical statement showing that the total amount of awards to Oct. 15 was $3,355,008.37, and that the total amount of administrative expense to that date had been $301,227.92. When these amounts are deducted from the original appropriation of $8,500,000, there remains $4,843,763.71, the unexpended balance of the appropriation. The statement also shows that were the ratio of awards to continue in the consideration of claims which had been disallowed on the ground of no specific request or demand, the unexpended balance would be drawn on only for $2,795,289.68. It was also pointed out that a considerably higher ratio of award could be made without exceeding the limit of the original appropriation.

There was little opposition to the provisions of the liberalization bill which would admit claims which were mailed prior to June 2, 1919, or to the authorization that payments be made in claims where clerical miscalculations had crept in. The opposition was centered almost entirely on the provision allowing a published request to be regarded as a cause for stimulation.

It was argued by those opposing the bill that the Government had encouraged industries of all kinds to make provision for increased production. Labor was induced to undertake employment at points distant from home. When these plants were suddenly closed with the ending of the war no provision was made to compensate these men for the losses entailed by changes of habitation and the expense of return. The wheat grower took his losses. The cotton grower took his. No bill was introduced proposing to reimburse farmers and laborers. It was a discrimination in the interest of a small class of war contractors. Arguments to this effect were advanced by several members. A strong point was made of the contention that money could be found to compensate contractors, but could not be found for the compensation of ex-service men.

Representative Wingo, of Arkansas, the ranking Democrat on the committee, in addition to urging the passage of the bill, made a bitter attack on Philip N. Moore, a former member of the War Minerals Relief Commission, whom he held responsible for many of the troubles of the war minerals claimants.

Representative Cramton objected strenuously to any liberalizing of the existing law. He pointed out that the claims are not legal, but are simply claims in equity.

Representative Stevenson, of South Carolina, objected to the words "or published." He said that the Government could not be expected to back ventures which were undertaken without the exercise of good judgment, or those where there was not some specific knowledge of the possibilities of success.

Representative Husted, of New York, objected strenuously to the recognition of "a mere general request appearing in a newspaper." "Every industry in this country," he said, "was stimulated more or less by general requests. If you allow relief in such cases you will have no right to deny compensation to any industry in the country. Farmers have a much better right to claim compensation on this basis because they produced not only at the public request of the Government, but the prices they received were fixed by law. In the case of these producers of minerals, there was no price limitation fixed by law. If you pass this legislation you open the floodgates for all kinds of claims, and you are going to establish a precedent which will inundate us and which we cannot deny with any shadow of justice."

Representative Vaile, of Colorado, declared that various Government agencies so stated the situation as to create a general impression that those who knew of deposits of war minerals and who did not work them were in fact slackers. The more conscientious people of the mineralized sections, he pointed out, did not wait for a peremptory demand from the Government, but unquestioningly attempted to carry into effect the published appeals of such men as Franklin K. Lane, Van. H. Manning, and H. N. Hurley.

Representative Arentz, of Nevada, read the text of characteristic announcements by Government agencies put out for the sole reason of stimulating the development of deposits of war minerals. "Over 1,200 metal mine operators," he said, "abandoned the projects they were carrying on at the time, and responded to the Government's appeal for their services and for the use of their personal funds and diverted their energies, and in most cases their all, in seeking out these little developed or virgin deposits." He called attention to the fact that few of these properties had reached the point of actual shipment prior to the Armistice and that the national Government had forgotten its promises to these patriots of the desert and of the mountains.

Representative Black, of Texas, who led the opposition, asserted that it is a proper function of Government to stimulate production of all kinds, but that it is not a proper basis for claims against the United States. He declared that the passage of the bill would mean that all other claims against the War Department and other departments which had been [illegible] either in whole or in part would then have reason to demand the reopening of their cases.

The point of order which forced the amendment [illegible] the bill was made by Representative [illegible], of Wisconsin. He [illegible] the point that the bill was in effect providing an appropriation contrary to the [illegible] of the House. This led to a long discussion of the parliamentary point involved. The Chair, admitting that it was a very fine point involved, upheld the point of order, which forced Representative Rhodes to propose as a committee amendment a clause providing that the balance of the appropriation must be reappropriated before payments could be made on any additional awards which may be made if the liberalized bill becomes a law.

Representative Graham, of Illinois, contended that the passage of the bill means the incurring of an additional liability of $12,000.000. He condemned the liberalizing feature, but urged the adoption of the section which would give claimants the right of appeal.

Representative Sinnott, of Oregon, reviewed the history of the chrome development during the war. He said that chrome was developed with the express understanding that an embargo was to be placed on imports and that since it had been surreptitiously lifted by a Government agency, there could be no question of the equities of those who made the United States independent of foreign chrome supplies.

The bill reached the stage of a final vote, which was blocked by a point of no quorum by the opposition. It was expected that the final vote on the bill was to have been had on Nov. 16.

NEWS BY MINING DISTRICTS

London Letter

Zinc Concentrates Coming From Australia—City Deep Taxes—Another Anantapur Gold Company To Shut Down—Gold Discovery In West Africa Poor

BY W. A. DOMAN

London, Nov. 1.—For many months firms interested in the spelter industry have been "at" the government with the object of inducing it to release some of the large stock of zinc concentrates which it has on hand in Australia. There are eleven firms or companies in this country equipped for the smelting of zinc concentrates, and at the present time not a single one is working. The trouble seems to be that the authorities are averse to selling at a loss. This, however, they must do, for their contracts were entered into during the war, when prices were high, and now a very serious drop is [illegible].

The intention of the smelters is, of course, to find employment for large numbers of men. Whether this can be done profitably is not yet clear, for the price at which the government is willing to release the concentrates has not been divulged. Spelter cannot be produced here so cheaply as on the Continent, partly on account of the inexperience of the workmen, and partly because of the higher wage level. As concentrates are to be shipped from Australia it is thought that the government has in view a plan for assisting the unemployed, work being naturally preferable to a dole. There does not seem to be unanimity on the subject among the different firms, but the head of one of the most important has expressed the view that profits could not be derived with concentrates at 10 [illegible] to [illegible] a ton. If this be correct, there would appear to be little hope of building up a remunerative smelting industry in this country.

A comparison of the working results of the City Deep and the Crown Mines for the September quarter is rather interesting:

	City Deep	Crown Mines
Tons crushed	[illegible]	[illegible]
Working revenue	[illegible]	[illegible]
Revenue per ton	[illegible]	[illegible]
Working costs per ton	[illegible]	[illegible]
Working profit per ton	[illegible]	[illegible]
Total working profit	[illegible]	[illegible]
Taxes	[illegible]	[illegible]

Although the figures are only estimated, the City Deep appears to be taxed much more heavily than the bigger Crown Mines. In each case, of course, the revenue and the profit include the [illegible] obtained for the gold above the standard. As the number of [illegible] is not stated, working expenses cannot be properly compared. The fact that [illegible] of the revenue of the Crown Mines is [illegible] up in taxes, as against about [illegible] per cent in the City Deep, is explained by the lower grade of ore [illegible] at the former mine.

The Anantapur gold field has not [illegible] a great success. [illegible] have already gone under and now the North

Anantapur Gold Mines is about to shut down. During the twelve months ended June 30, 8,800 tons of quartz was crushed, and from the various processes 11,299 oz. of gold was obtained, realizing £61,823, of which £30,355 remained as profit. The total dividends for the twelve months were 5/6 per share on the preference and 1/6 on the ordinary. There are only 25,000 preference shares of £1 each, and 91,253 ordinary shares of £1. No further discoveries of value were made last year, and the ore reserves are virtually depleted. There are about 40,000 tons of sand on the old dump which is receiving attention. As the company has funds in hand, a copper concession contiguous to the Rakha Hills Mines is being tested.

NEW MILL OF BROKEN HILL SOUTH, LTD., BROKEN HILL, AUSTRALIA, BUILT TO REPLACE THAT DESTROYED BY FIRE. CONCRETE HAS BEEN LARGELY USED IN THIS PLANT

The Aporoma Goldfields of Peru is in need of working capital. This is not surprising, seeing that little work has been done since the outbreak of war. It is proposed to raise £22,000, mainly to improve the water supply. Part of the amount has been underwritten.

To keep the East Rand Proprietary Mines in operation as long as possible, the directors contemplate reducing the monthly tonnage from about 120,000 to 100,000.

There is a good real of talk about new gold discoveries in West Africa. At one place in particular, on a tributary of the Ancobra River, I learn that an alluvial area is being tested. Six pits have been sunk, and sixteen samples of 60 lb. each have been taken, and the average of the whole is said to be 17 dwt. Half a crown per cubic yard would be good, but 17 dwt! The syndicate interested is awaiting further information.

Johannesburg Letter

New World's Stoping Record Made, It Is Claimed—September Gold Output Announced

By John Watson

Johannesburg, Oct. 11.—It is claimed that the world's record for mine-stoping has been beaten. On the Van Ryn Deep a contractor broke a total of 248 fathoms between Sept. 2 and Oct. 1. There were twenty-six working shifts and seventy-eight machine shifts, with three machines. The fathoms broken per machine shift averaged 3.18. The stope width was 69 in. and the type of drill used was the Holman cradle hammer (C.H.2).

The rainy season here has barely started. The month of September recorded a little over one inch of rainfall. Councillor Lourens has given notice of the following motion for the week's meeting of the Johannesburg Town Council: "That the council is of opinion that the only satisfactory solution of the water question is an additional supply of at least 10,000,000 gal. per diem from the Vaal River.

The gold production for September was declared Oct. 10 by the Transvaal Chamber of Mines, the total output being 691,096 oz. of fine gold, having a value of £3,801,028. September having only thirty days, accounts for the decrease of 20,430 oz. as compared with the August output. The price of gold for September has averaged £5 10s. per fine ounce. The August figure was £5 11s. 6d. The native labor returns show 187,375 total natives employed on gold, coal and diamond mines, being an increase of nearly 3,000 over August.

AUSTRALIA

Deal in Zinc Concentrates Effected—Rimu Gold Tries New Dredge—Mount Boppy Gold Closes Down

Melbourne—The British Board of Trade has concluded arrangements with the Electrolytic Zinc Co. of Australasia for the sale of 750,000 tons of zinc concentrates to be treated at the new Risdon works, in Tasmania. It will be remembered that the British government, to establish the zinc industry, entered into a contract with the Broken Hill producers to purchase their surplus concentrates after making provision for Australian requirements. The British industry, however, has not developed up to anticipations, and recently it has been found that the Continental smelters can obtain supplies from other sources at a lower price than the British government was prepared to take. The fact that production at Broken Hill has recently been so much below normal has made it possible for the Electrolytic Zinc Co. to take over the large tonnage of concentrates which is still stocked at Broken Hill and Port Pirie. The terms of the purchase have not been disclosed, but they are officially stated to be satisfactory.

The Mount Boppy Gold Mine, the largest operating mine in the Cobar district, New South Wales, has closed down owing to the high cost of labor and supplies. The mine was controlled by a London company, and for many years was known as the premier gold producer of New South Wales. It was worked almost continuously for twenty-one years, and to the end of 1920 produced 420,965 oz. of gold, valued at £1,756,138.

The American controlled Rimu Gold Dredging Co. at Hokitika, New Zealand, has had a trial run of its new dredge, the South Hokitika, which is electrically operated, power being obtained from Lake Kaneira. The plant is said to be the most modern operating in New Zealand. The dredge master, Mr. Lewis, has had experience in similar plants in the United States.

CANADA

British Columbia

Carmi Mill To Be Completed Next Spring—Conditions in Slocan Improved.

Nelson—A contract has been let to Scrogie & Ewing, of Rossland, for driving 50 ft. of tunnel and 250 ft. of raise on the Granite, of the Granite-Poorman holdings.

Grand Forks—Owners of the Union mine may install a flotation mill to treat a large quantity of low-grade ores, running about 0.12 oz. gold and 11 oz. silver per ton.

Carmi—It is officially announced that the mill of the Carmi Mining Co. will be completed during the spring of 1922.

Sandon—A distinct improvement in mining activity is noted throughout the Slocan generally. Lessees at the Rambler-Cariboo have made their initial shipment, and the Rosebery-Surprise company, operating the Bosun mine, near New Denver, is again marketing concentrates. Marked activity prevails around the Utica mine, on Twelve-Mile Creek, with O. C. Thompson, lessee, preparing for active development this coming winter. Silversmith's mill construction program is nearing completion, and with the recent improvement in freight rates to American smelters and prospects of competition for the high-grade silver-lead ores of the Slocan by smelters, the mining situation has materially improved over what it was a year ago.

Trail—Ore shipments received at the Consolidated smelter the week ended Nov. 7 totaled 11,307 tons, the shippers being as follows: Horn Silver Mine, Similkameen, 43 tons; Grant, Woodberry, 2; Jesse Bluebird, Woodberry, 21; Josie, Rossland, 96; Molly Hughes, New Denver, 27; Ottawa, Slocan City, 26; Queen Bess, Alamo, 33; Rambler, [illegible] Woodberry, 1; and company mines, [illegible]

Stewart—All the towers in connection with the aerial tramway of the Premier Mining Co. have been completed, and most of the work at the upper end has been done. At present operations are being pressed forward on the bunkers at the dock. Additional and better storage and shipping facilities are to be provided at [illegible]. The construction of a trail up the [illegible] fork of the Marmot River has been of much assistance to prospectors and claim holders in that district. The owners of the Idaho Group expect to ship about twenty tons before the spring.

Ontario

Nipissing's October Production Good—Wright Hargraves Declares First Dividend—Gold Found in Gauthier Township

Cobalt—In October the Nipissing mined ore of an estimated net value of [illegible], but did not ship any bullion. This output is considerably in excess of the best month for this year and exceeds the corresponding month last year. It is no doubt due to the Sixty-four vein, which in one place showed 26 in. of 2,600 oz. ore. During the month the low-grade mill treated 6,756 tons and the high-grade mill 176 tons.

The fiscal year of the Coniagas ended Oct. 31, and it is understood that the output was approximately 1,200,000 oz. which is the best record for several years. No estimate is yet available of the costs or profit but costs per ounce were considerably less than for the previous year. Ore reserves will not be estimated but conditions remain about the same as at the end of last year. The average grade of the ore was under 10 ounces per ton.

Kirkland Lake—The Wright Hargraves which started milling only last May has already entered the lists of the dividend payers by the declaration of a 5 per cent dividend payable Jan. 1. The company has an issued capital of [illegible]

The shaft being sunk by the Associated Goldfields, of Larder Lake, on the recently acquired Costello claims will shortly reach 110 ft. when crosscutting will be started. Work has been stopped on other parts of the company's ground on which so much money has been raised and spent and it is understood that the management has practically abandoned all hope of finding anything of value on this portion. The company has been through a number of reorganizations, the last one being for a capitalization of $30,000,000.

The directors of the Bourkes mine have passed a by-law raising the capital from $2,500,000 to $5,000,000 and will offer $1,700,000 of the new stock to shareholders in proportion to their holdings. A shareholders' meeting will be called for Nov. 19 to consider and ratify the by-law.

A new gold discovery has been made near the Argonaut mine in Gauthier township. The vein has been stripped for a considerable distance and shows a width of 3 ft., and carries considerable iron and copper sulphides in addition to [illegible]

Porcupine—The new shaft planned by the Hollinger Consolidated Gold Mines will probably be sunk near the south side of the property and comparatively close to the boundary of the Vipond North Thompson. The fact that the [illegible] at which the greatest of the Hollinger orebodies [illegible] dipping steeply toward the south, is considered highly important as affecting the position of the V. N. T.

MEXICO

Chihuahua

Ahumada Stockholders To Meet at Juarez

Chihuahua—The Ahumada Mining Co., with headquarters in Ciudad Juarez and mines in various parts of the state, has issued a call for a general meeting of stockholders to take place at the offices of the company in Juarez on [illegible]. The meeting has been called by the secretary, [illegible], for the purpose of hearing the annual report of the directors for the last year and discussing plans for future operations. [illegible] the board of directors.

The Cia. Minera [illegible] and [illegible] mining companies will hold a joint stockholders' meeting in Chihuahua City on Nov. [illegible] for the purpose of electing new officers and transacting business. R. E. White is president of both of these companies.

Sinaloa and Durango

Rise in Silver Causes Increase in Activity in Culiacan

Culiacan—In the Badiraguato district the old Guajolote mine is being worked by Messrs. Cochran and Coffee. The deposit is a free milling gold ore running about 0.7 oz. in gold and well in silver. A mill has been built and recent development work has opened up large ore reserves.

The Los Cuates mine in the same district, belonging to the Piero family, of Pericos, and under lease and bond to J. Q. Kiler and associates, is being opened up, and it is reported that they have struck good ore.

The San [illegible] mine, being worked by F. E. Avery and associates, from Columbus, Ohio, is being developed as fast as is possible with hand drills. The operators have an abundance of water power developed and will soon install a compressor with air drills.

The Rosendeñia mine, belonging to J. Q. Kiler, is under option to Arizona capitalists, who will soon begin unwatering, with the purpose of installing a concentrator.

In the Sinaloa district, the Bacubarito Placer Mining Co. has shipped in twelve carloads of dredge machinery, which is being hauled from the station of Casal to Bacubarito, where the company possesses placer deposits. This is a Mexican company composed of prominent capitalists in Mexico City.

In the Mocorito district, the property being worked by Gaston Schwod and Zerapio Lopez and Ernesto Espinosa is said to be giving good results. They have installed a small stamp mill and are treating a free-milling gold ore with amalgamation.

The Potero, also in the Mocorito district, is again working to full capacity after a short shutdown due to an accident to some of the machinery.

At the mine of the Palmarito Company in the Mocorito district, the development work is progressing in the three-compartment shaft. Good ore is said to have been encountered on the 100 level.

In the [illegible] district, the [illegible] plant being operated by J. R. Rogers is making [illegible]. Old dumps left by the old West Coast Mining Co. are being treated.

In the [illegible] district of [illegible], Durango, the [illegible] mine, being worked by [illegible], [illegible] old workings are being cleaned out and [illegible].

The [illegible] property, [illegible], has been purchased by a [illegible] syndicate, which will install a [illegible] plant to treat the gold ores of the mine.

In the [illegible] district, Messrs. [illegible] are developing [illegible] gold property on the [illegible]. A mill to treat these ores will soon be installed.

The rise in the price of silver has caused considerable activity in mining circles, as, with silver around [illegible], there are a number of properties which can work at a profit. [illegible] in the mining industry, and mining properties are changing hands which have been abandoned since the beginning of the revolution in 1910. The country is absolutely peaceful and at present it is perfectly safe to go anywhere without fear of molestation.

ARIZONA

Smith-Hovland Case Before U. S. District Court—Magma Chief Investigation Dropped—Jerome Verde Property Formally Transferred—Dundee-Arizona To Sell Stock

By James H. McClintock

Phoenix—The long-continued case in chancery of Hoval A. Smith, against Henry B. Hovland has at last reached the United States Court for the District of Arizona, following the report of Edwin F. Jones of Tucson, who has acted as master in chancery. Briefly, the report is that the two litigants entered into a verbal agreement of partnership, of date of Jan. 1, 1905; that the partnership has been dissolved; that the debts of the partnership, with a single exception, have been paid from a sale of partnership assets, and that no accounting between the partners has been made. On this foundation and upon the basis of evidence that came mainly from the parties at interest, the master has decided that Hovland owes the partnership more than $1,000,000 and that Smith is entitled to credits aggregating $187,460.76.

The men were close friends when they joined in investments in mines, work for which they had been prepared in the same school, and they deemed the signing of a partnership agreement unnecessary. They had dealings involving the handling of millions of dollars, in connection with the purchase and sale of large properties in the Bisbee and Miami districts. Following a disagreement, this in the language of the master's report, "they met as enemies. They both sat here (in Tucson) during the whole of this trial, for more than a year, without in any manner acknowledging the presence of the other. Their testimony is colored by their animosity and hatred of each other." The trial began in February, 1920, and has occupied most of the intervening time, with massing of infinite detail concerning the joint and separate operations of the principals.

The Arizona Corporation Commission has dropped its investigation into the affairs of the Magma Chief Copper Co., a corporation which started operations in the Superior district and which later purchased the Sombrero Butte property, near Mammoth, Pinal County. Statement was made by the commission that the evidence submitted did not substantiate the charges of mismanagement.

At Miami, much work is to be done on the reverberatory furnaces of the International smelter before one of them can begin handling the 40,000 tons of concentrates now crowding the bins of the Miami Copper Co. Masons must be secured for repairing the furnace brickwork and for completing the connections with the new stack and converter flues. L. O. Howard, superintendent, says that all will be in readiness by Nov. 20. Work is to be started in the Sulphide tunnel, to secure silicious ores for fluxing the concentrates and for feeding the Inspiration experimental leaching plant, in which work is also to be resumed at an early date.

The property of the Jerome Verde Copper Co. at Jerome, inclusive of 27 full claims and several fractions, has been formally transferred to the Jerome Verde Development Co., for an announced consideration of $420,000, subject to a mortgage lien held by the Registrar & Transfer Co., of New York. The transaction is one in which the United Verde Extension Co. practically takes over the Jerome Verde, thus materially increasing its available acreage. The property acquired is one of the largest in the Verde district, with central and advantageous position, adjoining both United Verde and Extension, available for development from either. Despite its situation, only one lens of really good copper ore ever has been developed in Jerome Verde, though the formation at several points is declared to be favorable.

Dundee-Arizona Copper Co. has secured permission from the Arizona Corporation Commission to sell 61,120 shares of stock at $1 a share. Though Dundee is active on the curb, very little of its stock is in other than a few hands. The new money is needed for deep exploration. The mine is one of the smallest in the Jerome section, having only two full claims, centrally located, next to the U. V. Extension ground and a short distance from the Extension service tunnel. It has a large deposit of surface carbonates and is said to have good indications of worth-while sulphides in the lower levels.

Globe—Superior & Boston is doing extensive development work in silver-bearing ground, north of the main shaft, drifting east and west from a new shaft at 55-ft. depth. Concentrates shipped have returned about $200 a ton.

Oatman—Tom Reed has dropped about 100 men during the last month, which is said to be due to the cost of handling ore that might be profitable under better conditions. It is reported that only the higher grade will be handled. Much of the ore being milled is coming from the Aztec section of the mine.

NEW MEXICO

Question of Reduction in Freight Rates Receiving Attention of Traffic Men

By James P. Porteus

Lordsburg—The most encouraging event for mining in this section is the effort now being made by railroad traffic men in the direction of a reduction in freight rates on mine necessities, timber, fuel, and steel. The new rates will be effective as soon as the formalities can be completed. These rates cover shipments into the mining centers and are intended directly to assist the industry. A reduction on coal rates from Gallup, Dawson, and southern Colorado points has already gone into effect in southwestern New Mexico. The saving over the old rate will be from 50c. to $1.04 per ton.

Railroad freight men have not hesitated to admit that the present local ore rates were practically prohibitive. One of the executives remarked soon after the last blanket raise in rates, which so effectively stopped ore shipments, "It is evident that freight rates on ores are too high. There are millions of tons of low-grade ore in this territory [Arizona and New Mexico] that could be moved at lower rates. It would seem to be better to reduce the rates and move the tonnage at a small profit than to let the cars lie idle."

COLORADO

Commerce Commission Asked To Reconsider Gold Hunter Freight Rate Decision

Denver—Colorado ore shippers are advised that the Interstate Commerce Commission has been requested to reconsider its decision in the case of the Gold Hunter Mining & Smelting Co., in which the commission found that freight rates on ore or concentrates based upon gross values were unreasonable.

To this decision Commissioner Daniels and Hall both dissent, in that they believe that for general application the gross-value method for rate making is preferable to a net value.

This decision was discussed at some length in *Engineering and Mining Journal* of Sept. 24, 1921, p. 508

The Colorado mining organization has asked the American Mining Congress at Washington to oppose vigorously any action by the Interstate Commerce Commission that would revoke decision or have a tendency to sustain rates based upon gross valuation.

UTAH

Chief Consolidated Gets Control of Eureka Lily

Salt Lake City—Mine operators and railroad traffic officials of Utah, Nevada, and California have been invited to attend a conference to be held under the direction of the Public Service Commission in Nevada at Carson City. The meeting has been called for the purpose of discussing the possibility of reducing freight rates to the smelters from mining districts in the three states.

Eureka—Ore shipments from the Tintic district for the week ended Nov. 5 amounted to 168 cars, as compared with 191 cars the week preceding. Shippers were: Tintic Standard, 81 cars; Chief Consolidated, 39; Eagle & Blue Bell, 12; Iron Blossom, 11; Colorado, 6; Swansea, 7; Empire Mines, 3; Gemini, 1; and Sunbeam, 1.

The Chief Consolidated has gained control of the Eureka Lily, which adjoins the Tintic Standard. The Water Lily shaft in the Chief's most easterly holdings, which was sunk by Walter Fitch, Jr. Co. under contract, has been deepened 1,106.8 ft. in the three months ended Oct. 18. This makes an average of 368.9 ft. per month, maintained in spite of the fact that during the last ten days of the record the presence of gas in the bottom of the shaft made it possible to work only one shift a day. This record includes the present world's record for shaft sinking of 427.5 ft. in thirty-one days. The shaft is now down 1,250 ft.

The Chief Consolidated is opening up its newly acquired limestone quarry, and has so far proved a deposit of limestone of good grade over 125 ft. thick, 200 ft. along the strike of the beds, with an average depth of 70 ft. This block of ground is estimated to contain about 175,000 tons of marketable limestone.

Ore running well in silver has been struck by lessees in the Butcher Boy mine, formerly the Showers Consolidated, in South Tintic. The ore is in a winze 50 ft. below the tunnel level.

Park City—Shipments for the week ended Nov. 5 were 1,979 tons. Shippers were: Judge allied companies, 923 tons; Silver King Coalition, 568 tons; Ontario, 128 tons; and New Quincy, 50 tons.

At the Silver King Consolidated pyrite is increasing in the breast of the Spiro tunnel, which is being driven under the Empire canyon section, and quartz and other vein material is beginning to appear. The D. & M. fissure is expected to be cut soon. The ground is somewhat fractured and there is a large flow of water. The contact raise has reached black limestone, and drifting is to be started. On the 275 level a flat vein of galena is reported to be getting stronger and improving with every round. There is a heavy flow of water in the Iron drift.

Salt Lake City—The Alta Tunnel & Transportation Co. has received a settlement for the fourth lot of ore shipped since Oct. 1. This ore averages 46 oz. in silver. Difficulty is being experienced in securing enough teams to move the ore from the bins to the main canyon, where the ore is transferred to trucks. The ore is making out on the limestone bedding from the fissure, and on the south side of the stope bedded ore is 6 ft. thick, and it is stated will run 50 oz. This face is 30 ft. from the mineralizing fissure. Good progress is being made in advancing the east drift on the tunnel level.

The Big Cottonwood Coalition Mines Co. has completed arrangements for continuing development during the winter. The property consists of seventy-two claims in the Big Cottonwood mining district, a quarter of a mile from the Brighton road. An electrically driven compressor, transformers and other equipment have been purchased. The tunnel, which is in 3,388 ft., is being driven under contract.

Milford—A tunnel is being driven on the Galena Mining Co.'s property in the Beaver Lake mining district. This tunnel is following a fissure toward an old shaft from which ore was mined in the early days.

IDAHO

Cyanide Gold Mining Co. Buys Equipment—United Metals Lets Drifting Contract.

Seafoam—A contract has been let by the United Metals Co. for 150 to 500 ft. of drifting, with a view to placing the property on a producing basis by spring. Directors of the company have also provided funds for building a stamp mill early next season.

Lakeview—Development of the Moonlight group, adjoining the Weber property, has opened up a 2-ft. vein of high-grade silver ore carrying gold.

Bonners Ferry—A three-drill compressor and complete equipment has been purchased by the Cyanide Gold Mining Co., operating the old Buckhorn mine, in the northeastern corner of Boundary County.

WASHINGTON

Old Dominion Exploring Recent High-Grade Discovery

Colville—Following the completion of installation of ventilating equipment and some necessary timbering, drifting on the showing of extremely high-grade dry silver ore found in the Old Dominion mine in September is being continued, and with encouraging results.

Kettle Falls—The long tunnel of the Silver Queen Mining Co. has cut the vein at a distance of 1,100 ft. from the portal.

OREGON

Good Ore Being Taken from Bay Horse Mine.

Huntington—The Bay Horse mine, which resumed developments early this season, following several years of inactivity, continues to improve to such an extent as to lead to the belief that it may rank among the important mineral producing properties of the state. The general average of the ore is high through the mineralized zone that traverses the company's property for the length of three claims. The value is in silver. About five tons of high-grade ore is stoped per day.

MONTANA

Black Rock and Emma Mines May Resume Production Soon—Tarbox Levies Assessment

By A. B. Keith

Butte—It would occasion no surprise were the development force increased at the Black Rock mine of the Butte & Superior Mining Co. In fact, there has been much talk that production might be resumed soon. The ores of the Black Rock mine run well in silver, in addition to their zinc content. Development of the body of copper ore discovered some time ago is proceeding satisfactorily. The drift on the 2,200 level continues in copper ore averaging 4 per cent or over, and this has served to encourage the belief that the 2,600 level will show not only as good ore but also a larger tonnage of it, in view of the history of other "northwest" veins.

The management of the Anaconda Copper Mining Co. is said to be thinking of resuming production at the Emma mine, the silver ores of which are sufficiently rich to warrant their extraction with the smelters of the company in operation. The Emma mine, which is owned by the Butte Copper & Zinc Co., has been kept clear of water during the suspension of operations.

The Anaconda company in a crosscut from the main drift on the 1,600 level of the Main Range mine cut through a number of streaks of gray copper ore running well in silver. Though the showing disclosed no particular tonnage, it appeared to indicate a more mineralized area in the vein, in which section further development work will be done. This is in a portion of the vein to the west of the crosscut through which the vein was first opened. Drifting westerly has been resumed.

The Elm Orlu Mining Co.'s operations on its upper levels have disclosed indications of a considerable tonnage of silver ores, upon which the Timber Butte mill is operating to advantage. It has been necessary to work out milling problems in effecting a proper saving of the silver, as gray copper appears. Satisfactory results are said to have been obtained. Milling operations for some time have been planned to be a model for efficiency, both as to the recovery of zinc as well as that of silver and copper.

North Butte's development work on the [illegible] level of the Edith May vein is reported to be progressing satisfactorily. Opening of the hanging at this depth is expected to put into sight a considerable tonnage of high-grade copper ore.

Saltese—The Tarbox Mining Co. has levied an assessment of [illegible] mills per share, payable Nov. 11 and delinquent Dec. [illegible].

NEVADA

Rochester Silver Corporation May Finance New Candelaria Mill—New Camp at Royston Active

Rochester—The Rochester Silver Corporation shipped bullion valued at $40,407 early in November. This represents the clean-up for the last half of October and is larger than for any equal operating period during the last two years. It is rumored that the company is prepared to finance the building of a mill at Candelaria for the Candelaria Mines Co. This latter company has developed over [illegible] worth of ore in its property at Candelaria and considers the property ready for a mill, but construction has been delayed for financial reasons.

Eureka—In the Eureka Croesus the Catlin shaft has reached a depth of 650 ft. and will be continued to the [illegible] level. In the Bullwhacker favorable developments are reported in a drift on the 430 level. The Eureka Holly is crosscutting on the 500 level and the crosscut has about reached the projected position of an important orebody.

Hornsilver—The south crosscut from the shaft on the 700 level of the Orleans Hornsilver entered ore at 35 ft. The grade is not reported to be very high as yet, but there is still time for improvement, as no hanging wall has been reached. The shaft is to be sunk to the 800 level.

Tonopah—Bullion shipments since Nov. 1, and representing clean-up of operations for the last fifteen days of October, are as follows: Tonopah Extension, [illegible]; Tonopah Mining, [illegible]600, and West End, $62,600. The Belmont and MacNamara shipments have not been reported. The West End is mining from 6,500 to 7,000 tons of ore per month, which is the largest tonnage in its history. The best ore is being mined from the Ohio vein, but the West End vein continues to produce nearly half the total tonnage, and some ore of milling grade is being mined from the Fraction and Footwall veins. In the Mizpah, operations of leasers in the old workings are proving profitable. From the new shaft, on the 1,530 level, the north and south crosscuts are now out about 700 ft. from the shaft.

Royston—In this new camp, which has been reopened, and which is situated about [illegible] miles north of Tonopah, in the San Antone mining district, considerable surface work is being done, and several shafts have been started. Thus far most of the operators are leasers, although new companies are being organized and preparing to begin work. On the Betty or original lease the deepest hole is down about [illegible] ft. The vein was [illegible] in. wide at surface and has widened to [illegible] ft., and is rich, assaying several hundred ounces of silver per ton. It is claimed that the vein outcrop has been traced for over [illegible] ft., but the meager work done to date, in addition to the fact that rock is narrow and extremely hard to follow, leaves some doubt as to its proven continuity.

Ely—The Nevada Consolidated Copper Co. is still engaged in the development of the Ruth mine, and the high-grade orebody [illegible] discovered about ten months ago has been proved to persist to depth, with an average value of [illegible] per cent copper. This is direct smelting ore.

MICHIGAN

The Copper Country

Copper Range Increasing Force Slowly —Quincy Starts Logging—C. & H. To Continue To Explore Kearsarge Amygdaloid Vein

By M. W. Youngs

Houghton—The Copper Range mines continued to show a small increase in man-power in October, and refined copper production increased about 10 per cent. Both Champion and Trimountain increased their rock shipments somewhat, and Baltic maintained its September average. Champion sent 44,000 tons of rock to the mill, Baltic 19,000, and Trimountain, 12,000. Champion's yield per ton of rock was a little better than usual, and Trimountain's recovery also was above average. Baltic's yield fell off slightly, owing to a run of ground not quite up to the usual standard for the mine. An extensive program of drifting is under way in Champion and Trimountain, particularly in the latter mine. Emphasis is being placed on opening work rather than on production.

Logging operations have been started by the Quincy Mining Co. near Hancock, in a tract of timber land which it has held in reserve for many years. Labor conditions are now such that they warrant the building of roads and the cutting of this timber, which will be used entirely for underground purposes. It is in a sense a relief measure, inasmuch as it will give employment to a crew of men for several months.

A great deal of timber is still used in the mines, although some companies have been able to effect economies by the use of waste rock in abandoned stopes. This saves timber and the expense of hoisting the poor rock to surface as well. Although all round or stull timber remains in place in old workings, flat or sawed timber is recovered and used again in newer portions of the mine.

Though Calumet & Hecla has reduced its metal surplus considerably, there is still an abundance of copper in the Lake district, which accounts largely for the fact there will be no resumption of operations by the Calumet & Hecla mines this winter. The estimated production of Copper Range, Quincy, Mohawk and Wolverine, and the Calumet & Hecla refinery during the seven-months' period from April 1, the date of the Calumet & Hecla shutdown, to Nov. 1, was 45,000,000 lb. This is small in comparison with the normal output for the district, which, had all the mines been operating, would have reached 157,000,000 lb. Sales during the period, including both Lake and rail shipments, were 51,000,000 lb. Copper has been moving more freely out of the district for the last two months, and it is believed the surplus will have been reduced sufficiently by spring to warrant the resumption of mining by the Calumet & Hecla and subsidiaries at that time.

Calumet & Hecla will give attention to a continuation of exploratory work in the Kearsarge amygdaloid vein, which was cut at depth by a crosscut from the 81st level of the Red Jacket shaft, soon after general mining operations are resumed, probably in the spring. Though results of the drifting already done in this lode are only mediocre, the showing warrants further investigation. The work was stopped only because it can be prosecuted with greater facility and at less cost while mining operations are under way in the shaft. The drifts will be extended both north and south a reasonable distance to determine whether or not the vein will become better defined and more uniformly mineralized.

Not more than 1,000 ft. of drifting remains to be done before the 81st level haulageway, which will serve Calumet & Hecla's conglomerate shafts, will be completed. No. 12 shaft, its southern terminal, will be used as a supply shaft and for the use of the miners, and the Red Jacket shaft, the northern terminal, will become exclusively a hoisting shaft. The intervening shafts will be abandoned, eliminating the cost of maintaining expensive surface plants, and the mining of the lode will be done from the haulageway. This drift will, in large part, solve the problem of deep mining costs.

H. F. Fay, president of the Mayflower-Old Colony, has arrived in the district. Work will be resumed soon at the 1,400 level of the Mayflower, where drifts will be run both north and south. Exploratory work on the 1,700 level will continue. The main drift south will be pushed. A fault recently was encountered in this opening, after passing through 300 ft. of well-mineralized ground, and a crosscut east has been started to pick up the vein again.

Extensive repairs are under way in No. 2 shaft, Ahmeek, where the concrete skipway, which has crumbled in places, will be replaced with timber. This work will keep a force of timbermen busy for several months.

JOPLIN-MIAMI DISTRICT

Southern Lead & Zinc Co.'s Property Sold—3,000 Miners Working Steadily in Picher District—Producers More Optimistic.

By P. R. Coldren

Joplin—F. W. Evans, president and manager of the Keltner Mining Co., which has a mine and mill at Picher, Okla., has purchased the mill and mine of the Southern Lead & Zinc Co., situated in Kansas, two miles north and one mile west of Picher, and has started it in operation.

The Southern mine was developed about four years ago, Fred C. Clark, former playing manager of the Pittsburgh National League baseball team, having been one of the principal owners. For many months it was a steady and large producer, having one of the good concentrators of the field. For some months it has been idle, owing to the low price of ore. The Keltner mine, which Evans has been managing and of which he is one of the principal owners, has been a steady producer and is still being operated. The consideration in the deal is said to have been on the basis of $150,000.

The Euterpe Mining Co. is changing from electrical to oil engine power at its mine, in Kansas, just north of Hockerville, Okla. It has so far installed one 185- and one 125-hp. engine, and two more of similar size are to be installed and in operation by Dec. 15. The sinking of a third shaft at the mine is to be started at once. The company is operating two shifts in the ground and one with the mill.

Ed. Boyle, chief mining inspector for the State of Oklahoma, has visited the Oklahoma section of the field and reports increased activity, with prospects for further increase. Last week the Mahutska and White mines, at Picher, resumed operation, and it is stated the Piokee and the Victory Metal will be started up in the immediate future. The Blue Ribbon mine, at Hockerville, is also operating again, after a shutdown of several months, and the Haines mine, at Commerce, has also resumed. Mr. Boyle states that about 3,000 miners are now being given steady employment in and around Picher.

At the meeting of the Tri-State branch of the American Zinc Institute at Picher on Nov. 9, several members of the Ottawa County Medical Society reported that there is little unemployment in the district and very few cases of poverty-stricken people unable to feed and cloth themselves. They expressed the opinion that the mines now operating in the field will be able to give work to all reliable miners wanting work this winter, provided no more miners are encouraged to return to the field. Many who left early last spring or in midsummer have not returned.

There is a general feeling of optimism throughout this field that seems to be growing despite the slow rise in ore prices. Producers are talking and believing that zinc ore will be selling for at least $30 before spring. If it is, renewed activity at probably twenty-five mines that are now idle may confidently be predicted.

WISCONSIN

State Industrial Commission Holds Hearing on Proposed Safety Regulations—Vinegar Hill Opens New Ore at North Unity

By J. E. Kennedy

Platteville—The Wisconsin State Industrial Commission held a public hearing in Platteville on Nov. 4 on proposed general safety orders for mines, recommended for adoption by an advisory committee appointed last winter by the commission to draft more comprehensive and better safety orders for all mining operations in the state. The state commission has had general safety orders on lead and zinc mines since February, 1916, but they are recognized to be too general to be satisfactory. There have been no orders heretofore relating to safety in iron mining. The committee at a later date will conduct a hearing at Hurley or Rhinelander upon the proposed orders for iron mines.

The advisory committee is composed of the following members: E. R. Shorey, University of Wisconsin, Madison; H. B. Morrow, School of Mines, Platteville; J. J. Handley, Wisconsin Federation of Labor, Milwaukee; James Billinglsey, Frontier Mining Co., Galena, Ill.; John J. MacCullough, Vinegar Hill Zinc Co., Platteville; T. H. Garnett, Mineral Point Zinc Co., Galena, Ill.; A. M. Plumb, Wisconsin Zinz Co., Platteville; A. A. Bawdon, Odanah Mining Co., Hurley; Dr. J. J. Rutledge, U. S. Bureau of Mines, St. Louis; and A. D. Findeisen and R. McA. Keown, Industrial Commission, Madison.

The Vinegar Hill Zinc Co. has opened up a new run at the North Unity mine, making forty tons of lead concentrates per week, in addition to an increased output of blende. This company is now operating the Dale, a new property at Livingston.

Local prospectors have struck a good deposit of lead in a shaft on the Cook ground, east of the old Dall mine. The Blockhouse company has its No. 2 mill inclosed.

THE MARKET REPORT

Daily Prices of Metals

Nov.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
10	12.875@13.00	28.125	28.375	4.65@4.70	4.35	4.70@4.75
11	......	......	....	......	....	......
12	12.875@13.00	28.125	28.[illegible]	4.65@4.70	4.35	4.70
14	13.00	28.375	28.625	4.65@4.70	4.35	4.70
15	13.00	28.375	28.625	4.65@4.70	4.35	4.70
16	13.00	28.625	[illegible]	4.65@4.70	4.35	4.70

*These prices correspond to the following quotations for copper delivered: Nov. 10 and 12, 13.125@13.25c.; 14, 15, and 16, 13.25c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
10	66¾	67	74	156⅝	158⅜	24	23⅞	25⅞	26⅜
11	66⅝	67¼	74	158	160	24⅛	23¾	25⅝	26⅝
12	...	...	...	....		.	...	..	...
14	67	67¾	75	157⅜	159⅜	24⅛	23¾	25¾	26⅜
15	66¾	67½	75	157⅞	159⅜	24⅛	23⅞	25⅞	26⅜
16	66⅝	67½	75	157¼	159¾	24⅛	23⅞	25⅞	26⅜

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver			Nov.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
10	394	99¾	68⅛	39	14	393[illegible]	99¾	67	38⅞
11	....	...	..	38⅞	15	[illegible]	99¾	67¼	38⅞
12	393¾	99¾	66⅞	38¾	16	39[illegible]	99¾	67½	38⅞

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Metal Markets

New York, Nov. 16, 1921

Copper has been in good demand during the last week at increasing prices; the remaining non-ferrous metals have been quiet and steady, with no unusual demand expected during the rest of the year. Inventories are customarily made during December, and consumers do not care to carry unduly large stocks at that time. The marked progress made at Washington toward the limitation of armaments is unlikely to have any effect on the metal industry, with the possible exception of decreasing the normal demand for nickel, for the amount of use of the other metals used in armament is an insignificant proportion of the average peace-time demand.

Nov. 11 was Armistice Day, a holiday throughout the country. The next holiday will be Thanksgiving Day, Nov. 24.

Copper

On Thursday and Saturday a few producers were still quoting 13⅛c. delivered for small amounts of spot metal, with 13.25c. being generally asked for November-December. The demand exhausted the supply, and by Monday 13¼c. was the best that could be done for any near-by delivery, with 13⅜c. asked for January. Sales were in fairly large volume on Monday and Tuesday at these prices. Today some producers are entirely sold out of copper available for November shipment and are quoting 13⅜@13½c. for December-January, delivered. So far we have heard of no sales made for near-by deliveries at 13⅜c., but it seems likely that this price may be established in the next two or three days.

Export demand from Germany, France, and England has been satisfactory and Japan also has again participated in the market. The price of electrolytic copper in London is now higher than Continental parity, though this condition is no doubt a temporary one. The Copper Export Association has raised the Hamburg price to 13.50c., coincident with the increased firmness in the domestic market.

Lead

The official contract price of the American Smelting & Refining Co. continues at 4.70c. Several producers have done a quiet business during the week at this level. At least one outside interest, however, is offering ordinary lead at 4.65c., and corroding lead, which ordinarily commands a premium, is obtainable at 4.70c. The St. Louis market continues weak, with free offerings at 4.35c., a price which has been shaded in some instances. Desilverized could probably not be obtained in St. Louis for less than 4.40c., however. Desilverized lead in Chicago has sold for 4.50@4.55c. during the week.

Zinc

The week has been quiet, and only small sales are reported. The slowing down of business has had a slight effect upon prices, zinc being obtainable practically the entire week for 4.70c. No sales are reported below this level, though there are rumors that 4.675c. might have been done yesterday. Zinc is gradually but surely improving in statistical position. Stocks of zinc were reduced over 10,000 tons during October, according to figures of the American Zinc Institute. On Oct. 1 they were 81,135 tons; on Oct. 31, 70,824. Zinc production during the month was 14,538 tons; whereas shipments totaled 24,849 tons, which accounts for the decrease. The average number of retorts in operation was 26,859. At the end of the month 27,949 were being used. Total retort capacity of the country is [illegible]. The figures explain why the zinc market improved during the last few weeks. The base price of sheet zinc has been reduced from $10 to $9 per 100 lb., f.o.b. works, with discounts allowed up to 8 per cent.

Tin

Tin continued to exhibit a stronger tendency, and the feeling that the advance was to be only a temporary spurt has been largely dissipated. The statistical position of the metal is none too good, as large stocks are still available. However, production has been somewhat curtailed, and in fact it is doubtful if American producers can continue to keep their plants in operation much after the end of the year, as South American producers are not sufficiently well pleased with present prices to be willing to ship and concentrates.

The tinplate business is also improving, both here and in England. The recent reduction in the price of tinplate to 4.75c. has stimulated sales, and also the chief interest has allowed customers to book orders and specifications for delivery early in the new year, the finished material being held in stock until the consumer is ready for it. This is expected to result in tin-platers operating at 75 to 85 per cent capacity during the remainder of the year, instead of 50 to 60 per cent, as has been the case recently.

Tin for February delivery: Nov. 10th, 28.625c.; 12th, 28.75c.; 14th, 29c.; 15th, 28.875c.; 16th, 29.375c.

Arrivals of tin, in long tons: Nov. 7, London, 25; 12th, Liverpool, 25; Straits, 75; 14th, Straits, 775; Australia, 100.

Gold

Gold in London: Nov. 10th, 104s. 2d.; 11th, 104s. 6d.; 14th, 104s. 5d.; 15th, 103s. 9d.; 16th, 103s. 6d.

General stock of money in the United States Nov. 1, 1921: Gold coin, $3,504,677,154; standard silver dollars, $341,923,378; subsidiary silver, $272,861,577; United States notes, $346,681,016; Federal Reserve notes, $2,713,214,310; Federal Reserve Bank notes, $124,763,400; National Bank notes, $743,288,847; total, $8,047,409,682. Circulation per capita, $52.71.

Foreign Exchange

Today sterling sold at the highest figure since last May. The rise is in part attributed to short covering. Other exchanges have been generally quiet. On Tuesday, Nov. 15, francs were 7.255c., lire, 4.1625c.; and marks, 0.385c. New York funds in Montreal, 9 13/16 per cent premium.

Silver

China exchanges have improved again, with the result that China has bought considerable silver during the last week. The Indian bazaars, on the other hand, continue to keep out of the market. The market closes quiet, with tendency uncertain.

Mexican Dollars—Nov. 10th, 52½; 12th, 51; 14th, 51½; 15th, 51½; 16th, 51⅞.

Other Metals

Quotations cover wholesale lots unless otherwise specified.

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 17.50@18c., with practically no sales.

Antimony—Chinese and Japanese brands, 4.70c.; W. C. C. brand, 5.25@5.75c. per lb. Cookson's "C" grade, spot, 9c. per lb. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $3@$3.25 per lb.; black oxide, $2@$2.10 per lb. in bbls.

Iridium—Nominal, $150@$170 per oz.

Molybdenum Metal—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominal, $55@$60 per oz.

Platinum—$85 per oz. The market is weaker. Practically no sales have been made.

Quicksilver—$39@$41 per flask. San Francisco wires $41. Market dull.

The prices of the following metals remain unchanged from the figures published in these columns on Nov. 5: Rhodium, Selenium, Thallium, and Tungsten.

Metallic Ores

Manganese Ore—$23@$24 per unit, seaport; chemical ore, $55@$60 per gross ton, lump; $75 per net ton, powdered. Nominal.

The market is generally exceedingly quiet, and prices on the following ores remain unchanged from the figures published in the Market Report in the Nov. 5 issue: Chrome, Iron, Magnetite, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, Zircon, and Zirkite ores.

Zinc and Lead Ore Markets

Joplin, Mo., Nov. 12.—Zinc blende, per ton, high, $27.75; basis 60 per cent zinc, premium and Prime Western, $25; fines and slimes, $23@$22; average settling price, all grades of zinc, $24.09.

Lead, high, $63.90; basis 80 per cent lead, $55; average settling price, all grades of lead, $55.57 per ton.

Shipments for the week: Blende, 8,774; lead, 911 tons. Value, all ores the week, $262,050.

Purchases of blende were 4,400 tons this week, against 12,850 last week. Buyers were willing to take more ore on a $25 basis, but sellers of reserve stock firmly asked $26 to $27.50, and consequently purchases were little more than the week's production. Shipments were almost 4,000 tons in excess of purchases, and mark a further decrease of reserve stock of over 3,200 tons.

Production, which was on a high level all summer, has dwindled to less than 5,500 tons per week, according to recent surveys made by purchasing agents. Each week's shipment is now making inroads on the reserve stock, much of which is held for $30 basis, with some holding for $40 basis.

Platteville, Wis., Nov. 12—Blende, basis 60 per cent zinc, $30. Lead ore, basis 80 per cent lead, $60 per ton. Shipments for the week: Blende, 512; lead ore, 78 tons. Shipments for the year: Blende, 10,184; lead ore, 1,683 tons. Shipped during the week to separating plants, 602 tons blende.

Non-Metallic Minerals

Asbestos—Crude No. 1, $1,000@$1,500; No. 2, $600@$850; spinning fibres, $225@$400; magnesia and compressed sheet fibres, $150@$250; shingle stock, $80@$150; paper stock, $45@$65; cement stock, $15@$25; floats, $7@$10, all per short ton, f.o.b. Thetford, Broughton and Black Lake mines, Quebec, Canada.

Generally dull markets also exist for the non-metallic minerals, and there is no quotable change in the following from the prices published in our Nov. 5 issue: Barytes, Bauxite, Borax, Chalk, China Clay, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Kaolin, Limestone, Magnesite, Mica, Monazite, Phosphate Rock, Pumice Stone, Pyrites, Silica, Sulphur, Feldspar, and Talc.

Mineral Products

Arsenic—6½c. per lb., f.o.b. New York. Price has become firmer.

Potassium Sulphate—Powder, domestic, $1@$1.10 per unit, basis 90 per cent, f.o.b. New York.

The prices of Sodium Nitrate and Sodium Sulphate are unchanged from the quotations published in these columns Nov. 5.

Ferro-Alloys

No quotable changes have taken place in the following ferro-alloys from the prices quoted in the Nov. 5 issue: Ferrotitanium, Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotungsten, Ferro-Uranium, and Ferrovanadium.

Metal Products

Zinc Sheets—$9 per 100 lb., less 8 per cent on carload lots, f.o.b. works.

Copper Sheets and Wire, Lead Sheets, Nickel Silver and Yellow Metal are unchanged from the quotations given in the Nov. 5 issue.

Refractories

Prices on the following are unchanged from the figures published in the Nov. 5 issue: Bauxite Brick, Chrome Cement, Chrome Brick, Fire Brick, Magnesite Brick, and Silica Brick.

The Iron Trade

Pittsburgh, Nov. 15, 1921

The dullness in the steel market has become more pronounced, and affects all lines more or less, with the exception of tinplate, which, since the establishment of a $4.75 price a fortnight ago for the first half of 1922, has shown activity in mills obtaining specifications for immediate rolling, shipments to be made after Jan. 1.

In production, sheets and wire products show the most activity, production being at 60 to 70 per cent of capacity. Tubular goods come next, bar production is fair, and plate, shape, and rail production is light.

There are hints that the railroads are now more actively engaged in buying rolling stock and rails than is generally assumed. Few contracts have thus far been announced.

Fundamental conditions affecting the steel trade are as good as formerly, but the usual year-end dullness is appearing somewhat ahead of time. Resumption of the forward movement is to be expected by about Feb. 1. Meanwhile, steel production may taper off a trifle. October showed a rate in ingot output of 44 per cent of capacity, the best rate since February, and comparing with a 21 per cent rate last July.

Steel prices generally exhibit a slight softening tendency from week to week, but there are no clear-cut declines. With a full operation present prices would, in the main, be found profitable.

Pig Iron—The market is absolutely stagnant. Prices are unchanged at $20 for bessemer, $19 for basic, and $21 for foundry, f.o.b. Valley furnaces, but there is little doubt there would be some yielding if competitive business of importance were offered.

Coke

Connellsville—Furnace, $3.35@$3.50; foundry, $4.25@$4.75 per ton.

Risks and Security in Mining Investments

By Pope Yeatman and E. S. Berry*

BEFORE CONSIDERING in detail the question of risk and security in mining investments, it might be well to give in brief a typical financial history of a successful mining proposition:

The first step is the financing of the prospector who makes the discovery by those who "grubstake" him. The number of mines which pay from the beginning are few indeed, so that, after discovery, funds beyond the means of the prospector and of his partners must be supplied, usually by disposing of an interest in the property. Later, as development continues, still larger sums are necessary in order to install machinery and perhaps a treatment plant. If the sum required is large, the aid of bankers may sometimes, after consolidating several other properties, be called in, a stock company formed, and securities issued. Before this, in most instances, the original discoverer has dropped out, and unless the partners themselves arrange for the financing, the promoter or middleman comes into the venture, and plays his often very important part.

After successful operation for a number of years, with perhaps consolidation with other properties, profits begin to ease off and production lessen. It is at this period that, especially in the case of precious-metal mines in which the ore has been erratic or pockety, the "tributor" or leaser appears, who searches for and mines ore in the old workings, paying the company a royalty on the ore he extracts. When the mine no longer attracts the leaser, the end has come and operations cease.

Small investors are not justified in going to the expense of having exhaustive examinations made and are forced in the main to rely, first, on their own studies of the problem; second, the reliability and reputation of the engineer reporting on the property; third, the standing of the banking house that issues the stocks or bonds; fourth, on the board of directors of the company or controlling organization; and fifth, on the management.

The investor's own study or diagnosis of the problem may be based on too incomplete data, on lack of technical knowledge on his own part, and on too little published information due to (a) youth; this latter may be due to the fact that the company has not been in existence long enough to publish annual reports; (b) that it is desirous of picking up adjoining properties and is therefore unwilling to spread broadcast its reports in detail.

The reliability and reputation of the engineer on whose report the advisability of making the venture is based are, naturally, a matter of first consideration, for on his experience, technical and commercial knowledge, and honesty everything depends. The experience and past record of the engineer should count for much with the investor in determining the reliance to be placed on the report.

The reputation of the bond or brokerage house of issue is of the highest importance. Some excellent firms have made a specialty of bringing out mining securities, and have carefully guarded the interests of their clients in making sure that the venture was a worthy one and an attractive one for the investor. Their main purpose has been to do well for their clients and by so doing place themselves in a position of high honor and make it possible for the firm to build up a large and stable business.

The importance of a good directorate goes without saying, and in its appointment the small investor may have something to say later, but in the beginning the bankers and the mining group bringing out the securities will control.

During the constructive period of the enterprise, it is most important to have in charge of the design, planning and carrying out of the work men of the highest caliber. The business, when well established, systematized, and reduced to a routine, can be conducted by an [illegible] whose qualities are mainly honesty and plain common sense. The gold mines of the Rand have experienced these conditions, at first employing men of great experience and ability as advisers and managers, and later, when operations were more or less standardized, men of a routine type of mind were put in charge, and so with many other gold mines. The low-grade porphyry coppers in this country, however, are still in the first-named class.

Questions which a careful investor should go into are:

1. What is nominal capital?
2. What proportion issued?
3. What proportion of working capital is already expended and what remaining on hand?
4. What further amount may be needed?
5. Financial condition of company as to debts and similar information?
6. Annual income?
7. Dividends?
8. Application of profits?
9. Yield of ore?
10. Working costs?
11. Nature of equipment?
12. Tonnage mined and treated monthly?
13. Ore reserves?
14. Life of mine?
15. Validity of title?
16. Location of property; whether in foreign country or United States?
17. Safety of investment under law of and difficulties of operating in a foreign country?
18. Does chemical combination of ore present any extraordinary difficulties?

As in all business ventures, there are risks of all degrees in mining. As the risks are great, so should the returns be proportionately high. The following gives some idea of the relative chances in investment:

It has been stated that 95 per cent of the commercial and industrial enterprises which are started every year ultimately prove impracticable or unsuccessful. In mining the proportion of failure is also high. Such failures include those of ventures poorly conceived, organized and financed, as for example, small retail stores, concerns organized to introduce impracticable patents or processes; or in the case of mining, they include companies which were poorly managed or financed, which should never have been undertaken and whose securities should not have been placed on stock exchanges without careful investigation.

The reduction in the proportion of failures is considerable in the case of mining companies whose securities have been floated by financial houses of high repute. After favorable reports by engineers of experience and standing, the failures are reduced to a minimum.

Other ventures, more or less of a gambling nature, are the formation of exploration companies, without real [illegible] in hand, whose aim is to seek out mines and prospects, purchase and develop already existing mines which need funds for further development or for the building of treatment plants, but which at the time of the formation of the development company are not contemplated. Such enterprises are presented with no fraudulent [illegible], it being recognized by the investors that the business is more or less of a gamble.

As showing the large amount of work which such exploration companies often have to do in their search for properties, the following table [illegible] of properties have to be looked into, and the proportion of propositions rejected as unattractive:

	Number of Properties		
	[illegible]	[illegible]	[illegible]
Presented for consideration	[illegible]	[illegible]	[illegible]
Rejected after office examination	[illegible]	[illegible]	[illegible]
Examined in preliminary field examination	[illegible]	[illegible]	[illegible]
Accepted, complete examination	[illegible]	[illegible]	[illegible]
Properties accepted	[illegible]	[illegible]	[illegible]
Properties taken under option	[illegible]	[illegible]	[illegible]

A speculative venture of another class would be the reopening and reworking of mining properties which had not been operated for years, and the records of which had either been incomplete or lost [illegible] trustworthy. It may be that reports [illegible] of production and [illegible] that the only inducement to go into the proposition was hearsay evidence, and [illegible] as shown by shafts, tunnels, and dumps. Many old mines in Mexico and even in the United States were purchased, opened up, and operated on knowledge based on little more than hearsay evidence. Such mines [illegible] supposed to contain great speculative features, but they are real gambles.

---

*Excerpt from a booklet "Mining Securities," issued and copyrighted by the American Institute of Finance, Boston, 1921.

Again, metallurgical conditions may have changed since the mines were originally abandoned, and to such a degree as to make it seem possible to operate mines that had ceased to work on account of not having been able to make a profit formerly.

Other ventures of a speculative nature, but with greater chances of success, are represented by certain vein mines only partly prospected, but with evidences very greatly in favor of the continuance of the ore shoots in length and depth, it not having been feasible previously to thoroughly prove the ground by thorough development. Past records of production, costs, and other data have much weight in determining the desirability of such investments, but care should be taken to discover if possible whether the orebodies were reaching their limit, or whether the ore was becoming impoverished in depth to such an extent as to be unprofitable.

A true investment proposition would be one in which the orebody was thoroughly determined as to tonnage, length of life, with treatment plant employed or promised; assurance of favorable costs of production and reasonable prices for the product, and grounds for belief in the honest and efficient conduct of its operations by the directors and management. Many iron, coal, and low-grade copper properties, and to some extent lead mines, may be included in the true investment type.

The most desirable type of all, however, is that giving a combination of the investment and the speculative features as illustrated in the early days, and at the present time by the low-grade copper mines of Utah, Nevada, Arizona, New Mexico, and Chile. When many of these properties were first put on the market, they were what might be considered truly speculative, because, though the officials and engineers believed that there was a large tonnage of ore and that it could be treated at a very handsome profit, the operations had not been carried out on a sufficiently large scale to prove this.

However, after success began to be assured and the proposition became worthy of being placed in the investment class, there was still a considerable speculative value on account of all profitable ore not yet having been fully developed throughout the company's property, and until after this feature has been thoroughly proved it is not possible to leave out the speculative element and look on the proposition as one truly in the investment class alone.

Of course, with most raw metals, as is the case also with manufactured products, there are always the questions of price, cost, and demand and supply, and these should be recognized when the investment is under consideration.

Thirty or forty years ago, practically all mining propositions, with the possible exception of some of coal and iron, were considered as absolute gambles, and anyone investing in them was thought to be a speculator of the wildest type. It was not considered right for anyone to go into such propositions unless he could stand the loss of what he invested; in other words, he should be ready to "kiss his money good-bye" when he made his purchase.

Today, however, because of the greater knowledge of ore deposits, more men skilled in the business of mining, and a greater trust in those engaged in such pursuits, mining has come to be considered a legitimate business in which investments can be made with safety and with as much certainty as in many manufacturing or commercial enterprises; but the investor should go into the business, not in the old-fashioned, happy-go-lucky spirit, but after thoroughly considering the value of the property and the ability and integrity of the officials who are to be responsible for the conduct of the business.

On account of risk inherent in mining, the dividend rate should be higher than is usual for railway or high-class utilities and industrials. Some companies have accumulated amortization funds, and diverted these funds for the purchase of other mining properties, thus continuing the functions of the organization beyond the life contemplated for the original orebodies, but the investor of the mining type prefers to do his own investing of funds.

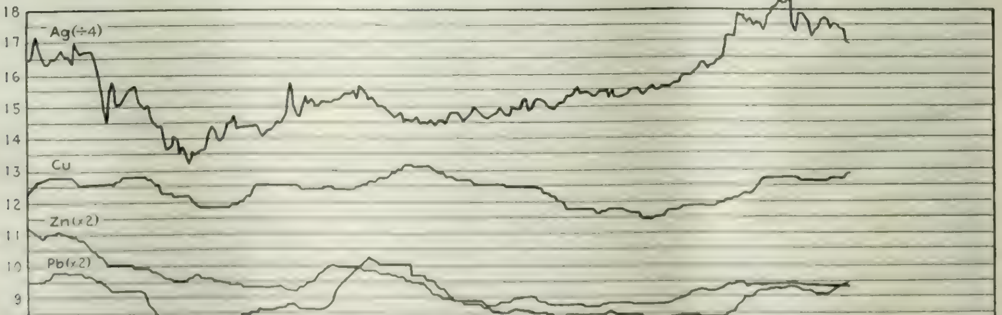
Other things being equal, of securities of two properties with equal amounts of ore and of the same grade, the one having speculative chances of still further ore being developed should sell for a higher price than the other, the orebodies of which were completely developed.

It must be realized that, unlike railway, manufacturing, or agricultural enterprises, the assets of a mining company are what are known as "wasting assets." As the ore is extracted, the reserves are depleted and there is nothing to replace such loss. In other words, the capital is drawn upon, and the dividends should be great enough not only to pay a good rate of interest, but also to provide for the return of the principal.

There are a few companies, however, whose prospective life is so great that for all practical purposes depletion need not be considered. Illustrative of this point may be mentioned Chile Copper, and Braden Copper, whose ore reserves, on the basis of the capacity of the treatment plants contemplated, have very long lives.

The old-time fable that mining ventures are inherently gambles, and therefore dangerous, still holds in the minds of many, but our increased knowledge of orebodies, improved methods of mining and metallurgical treatment, good and honest management, has of late years placed mining in the list of safe and attractive business enterprises, which, of course, require proper care and study of the proposition before entering into the venture, such as any business should demand.

1921 Prices of New York Copper, Silver, Lead and St. Louis Zinc



Gold Imports Make Record Stocks

Maximum Accumulation Is Registered—Gold Backing of Federal Reserve Notes Greatly Increased—Nations Are Still Maintaining Embargoes on Gold Shipments, but Are Trying To Reach Sound Currency Basis

EDITORIAL MARKET STUDY

THAT THE MERE POSSESSION of gold does not bring prosperity to the holder is well illustrated by the present position of the United States. More gold lies in the vaults of the Federal Reserve Banks of the United States and the Treasury than has ever been accumulated in one country—over 40 per cent, it has been estimated, of the total stocks in the world. The annual domestic production of gold, which at the present time lies between $40,000,000 and $50,000,000, is only about one seventieth of the gold coin and bullion in the Republic, $3,504,677,154 on Nov. 1. Economists and bankers are puzzled over the benefit to be derived from the possession of so much precious metal, and it is held to be a foregone conclusion that a good measure of this accumulation ultimately will be and can be released without harm to the country's financial structure.

RECORD STOCKS OF GOLD IN UNITED STATES

The stock of gold in the United States is at a record high, although not much higher than in June, 1919, the month in which the embargo on the export of gold was lifted. Stocks then stood at $3,092,038,000, dropped to $2,646,616,000 in May, 1920, and on Nov. 1, 1921, were $3,504,677,154, a new record. The imports of gold which have been responsible for this swelling of stocks and which average $70,400,000 monthly, have practically all found their way into the vaults of the Federal Reserve Banks—the natural reservoirs for the gold of the country. Gold does not remain long in the possession of the individual members of the Federal Reserve system, as they are required by law to keep all their reserve with the Federal Reserve Bank of their district. Hence any importation of gold under the auspices of a member bank will find its way to a central reservoir, where it can perform the important function of acting as a gold reserve behind paper currency.

The Federal Reserve system is admirably adapted to provide the necessary elasticity to prevent undue fluctuations of currency and credit whenever a large amount of gold enters or leaves the country. The medium through which this elasticity is obtained is the issuance of Federal Reserve notes, which are backed by gold and redeemable in it. During the war and for a time thereafter the amount of gold behind the Federal Reserve notes was considerably below 100 per cent, and the ratio varied greatly. Now, however, the gold backing to the Federal Reserve notes is above 100 per cent, an unusual situation. The change is well illustrated by figures taken from the circulation statement of the Treasury Department as of Nov. 1, 1921, which among other tabular matter gives the following comparative statistics:

	Nov. 1, 1921	Nov. 1, 1920
Gold coin including bullion in Treasury	$3,504,677,154	$2,7[illegible]
Federal Reserve notes	2,713,114,150	[illegible]
Ratio gold to notes	129.2	77.4

In the short space of one year the net improvement in the ratio is 51.8 per cent; it is even greater in the first ten months of 1921, as on Jan. 7, 1921, the ratio was 63.6 per cent. The 100 per cent line was crossed early in August, veritably a milestone in the position of the Federal Reserve system, and further gains have been made. The notable transformation in the relation of gold to notes is due to heavy importations of gold from foreign countries, coupled with a sharp contraction in note circulation—deflation of the currency as it has been called. Before the introduction of the Federal Reserve system an influx or efflux of gold greatly affected the credit structure of the country, credit curtailing on an outflow and increasing on an inflow. The Federal Reserve system has minimized this effect.

NATIONS STILL HAVE GOLD EMBARGOES

The gold entering this country is being sent to reduce foreign indebtedness to the United States. Its source is largely private and newly mined metal, as the gold holdings of the large central banks of Europe such as the Bank of England and the Bank of France hold more gold than they did before the war. Even the German Reichsbank shows but a small loss of gold. Owing to the great inflation of European paper currencies, the magnitude of the gold reserves has been largely overshadowed.

It will be recalled that practically the entire world insists on maintaining an embargo upon gold for fear of undermining the slim reserves beneath mountains of paper. The United States is the outstanding exception. Many nations, particularly in South America, are in an excellent position as regards gold reserves, but, due to the fact that the export of gold has been forbidden for a long time, the governments of these countries are reluctant to lift the bars and fear a general rush on the part of the populace to procure gold regardless of the strong position of the banks. A bill has recently been introduced into the Argentine Congress to permit the export of gold to within 50 per cent of circulation, as Argentina now has a reserve of 81 per cent. Permitting a freer movement of gold would improve foreign exchange rates, which would in turn aid our exporters in disposing of products that are now tied up in South American ports because of adversely fluctuating exchange rates.

Although many commissions, international conferences, and individuals have investigated the world's currency problems, and many practical recommendations have been made and offered as solutions, these recommendations have not been translated into action and have not had the backing necessary to enforce their introduction. The apostles of the printing press, Russia, Poland, Germany, Austria, and other countries, are pursuing their way unchecked, and utterly disorganizing their financial systems.

EFFORTS TO RETURN TO GOLD STANDARD

The states set up by the peace settlement are having difficulties in organizing and developing a satisfactory currency. They all seem to realize the necessity of backing their systems to gold, but are finding it a hard task to carry out such a program. The advantage of being a gold standard is clearly established and requires no further evidence in its support than the sorry examples of the present state of disorganized European finance.

The Czecho Slovakian republic has created a reserve fund of gold, silver, and jewels, raised through voluntary subscriptions, which it intends to use in its currency arrangements. One of the great impediments to the introduction in the Central European states of sound currency is the unbalanced condition of exports and imports. Until some balance is established in foreign trade, the gold reserve will be threatened. The chaotic state of the world's business is attributed largely to distorted foreign exchange. The effort of any nation to return to a gold standard is worthy of encouragement, as it will hasten the day when conditions return to normal.

MINING STOCKS

Week Ended November 12, 1921

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Ahmeek	Boston	54	52¼	53½	Sept. '20, Q	$0.50
Alaska-Br. Col.	N. Y. Curb	*46	*42	*44		
Allouez	Boston	24	23	23	Mar. '19	1.00
Anaconda	New York	43¼	42½	43¼	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2½	2¼	2½		
Ariz. Com'l	Boston	8¾	8¼	8¼	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*35	*31	*34		
Bingham Mines	Boston	13¾	13½	13½	Sept. '19, Q	.25
Calumet & Arizona	Boston	....	....	52½	Sept. '21, Q	.50
Calumet & Hecla	Boston	245	240	240	June '20, Q	5.00
Canada Copper	N. Y. Curb	*30	*28	*30		
Centennial	Boston	†9	†8½	8½	Dec. '18, SA	1.00
Cerro de Pasco	New York	31¾	30¼	31	Mar. '21, Q	.50
Chile Copper	New York	12⅞	12⅛	12⅜		
Chino	New York	26½	25¾	26½	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*14½	*14	*14½		
Con. Arizona	N. Y. Curb	*1	*1	*1	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1 1/16	*92	1		
Copper Range	Boston	35½	34¾	35	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*37	*35	*36		
Davis-Daly	Boston	7	6⅝	6¾	Mar. '20, Q	.25
East Butte	Boston	10	9¾	9⅞	Dec. '19, A	.50
First National	Boston Curb	*80	*75	*75	Feb. '19, SA	.15
Franklin	Boston	2¼	2¼	2¼		
Gadsden Copper	Boston Curb	†*50	†*40	*40		
Granby Consol.	New York	24	21½	24	May '19, Q	1.25
Greene-Cananea	New York	23	23	23	Nov. '20, Q	.50
Hancock	Boston	†2¾	†2	2¾		
Howe Sound	N. Y. Curb	2⅝	2⅝	2⅝	Jan. '21, Q	.05
Inspiration Consol.	New York	36¾	35¼	36½	Oct. '20, Q	1.00
Iron Cap	Boston Curb	7	6¼	6½	Sept. '20, K	.25
Isle Royale	Boston	22	21	21	Sept. '19, SA	.50
Kennecott	New York	24¼	23¼	24	Dec. '20, Q	.50
Keweenaw	Boston	1⅛	1⅛	1⅛		
Lake Copper	Boston	2¾	2¾	2¾		
La Salle	Boston	2	2	2		
Magma Chief	N. Y. Curb	....	....	*8		
Magma Copper	N. Y. Curb	22	21½	21½	Jan. '19, Q	.50
Majestic	Boston Curb	†*7	†*6	*12		
Mason Valley	Boston	†1½	†1¼	1⅜		
Mass Consolidated	Boston	2⅛	2⅛	2⅛	Nov. '17, Q	1.00
Miami Copper	New York	23¼	22¾	23¼	Aug. '21, Q	.50
Michigan	Boston	2	2	2		
Mohawk	Boston	53½	52	52	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	5⅝	5⅛	5⅛		
Nevada Consol.	New York	13¼	12⅞	13¼	Sept. '21, Q	.25
New Cornelia	Boston	15⅛	14⅞	14⅞	Aug. '20, K	.25
North Butte	Boston	10⅞	10½	10½	Oct. '18, Q	.25
North Lake	Boston	†*25	†*15	*20		
Ohio Copper	N. Y. Curb	....	....	*7		
Old Dominion	Boston	23½	23	23½	Dec. '18, Q	1.00
Osceola	Boston	32	31	31	June '20, Q	.50
Phelps Dodge	Open Mar.	†185	†170	....	Oct. '21, Q	1.00
Quincy	Boston	40	40	40	Mar. '20, Q	1.00
Ray Consolidated	New York	14⅛	13½	14⅛	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*24	*20	*22		
St. Mary's Min. Ld.	Boston	40	38	38	June '20, K	2.00
Seneca Copper	Boston	..	..	20½		
Shannon	Boston	1 1/16	1	1 1/16	Nov. '17, Q	.25
Shattuck Arizona	New York	6¼	6	6	Jan. '20, Q	.25
South Lake	Boston	†1¼	†*50	*75		
Superior & Boston	Boston	1⅞	1½	1½		
Tenn. C. & C. cfs.	New York	9⅞	8	9¾	May '18, I	1.00
Tuolumne	Boston	*43	*40	*43	May '13	.10
United Verde Ex.	Boston Curb	27	26	27	Nov. 21, Q	.25
Utah Consol.	Boston	3¼	3⅛	3⅛	Sept. '18,	.25
Utah Copper	New York	57	55⅛	56½	June '21 Q	.50
Utah Metal & T.	Boston	1¼	1¼	1⅛	Dec. '17,	.30
Victoria	Boston	1⅛	1¼	1¼		
Winona	Boston	*50	*50	*50		
Wolverine	Boston	12½	12	12		
NICKEL-COPPER						
Internat. Nickel	New York	13¾	13	13½	Mar. '19,	.50
Internat. Nickel, pf.	New York	74	71¼	74	Nov. '21, Q	1.50
LEAD						
National Lead	New York	77½	77	77½	Sept. '21, Q	1.50
National Lead, pfd.	New York	105¾	105¾	105¾	Sept. '21, Q	1.75
St. Joseph Lead	New York	13¼	13	13¼	Sept. '21, Q	.25
QUICKSILVER						
New Idria	Boston	*60		*50		
ZINC						
Am. Z. L. & S.	New York	9½		9½	May '20,	1.00
Am. Z. L. & S. pfd.	New York	32	32	32	Nov. '20, Q	1.50
Butte C. & Z.	New York	5½	4¾	5	June '18,	.50
Butte & Superior	New York	14½	14¼	14½	Sept. '20,	1.25
Callahan Zn-Ld	New York	4⅛	3⅞	4⅛	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	125	124	124½	Aug. '21 Q	2.00
Success	N. Y. Curb			2	July '16,	.03
Yellow Pine	Los Angeles			*35	Sept. '20, Q	.03

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills, Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange, Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	New York	⅜	⅜	⅜		
Alaska Juneau	New York	¾	½	¾		
Carson Hill	Boston	13⅞	12	13		
Cresson Consol. G.	N. Y. Curb	2	1 11/16	1 11/16	June '20, Q	$0.10
Dome Extension	Toronto	*68	*68	*68		
Dome Mines	New York	19¼	18⅞	19	Oct. '21, Q	.25
Florence Goldfield	N.Y. Curb	*38	*35	*37		
Golden Cycle	Colo. Springs	*68	*67½	*68	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*5	*4	*5	Dec. '19,	.05
Hollinger Consol.	Toronto	7.50	7.45	7.49	Nov. '21, 4 wks.	.05
Homestake Mining	New York	55½	55	55	Nov. '21, M	.25
Kirkland Lake	Toronto	*29	*25	28		
Lake Shore	Toronto	1.23	1.18	1.20	Aug. '21, K	.02
McIntyre-Porcupine	Toronto	1.95	1.87	1.94	Sept. '21, K	.05
Porcupine Crown	Toronto	*17	*12	*15	July '17,	.03
Porcupine V. N. T.	Toronto	*17	*15	*17		
Portland	Colo. Springs	†*38½	†*34	*35	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	.	...	*4	May '19,	.05
Schumacher	Toronto	*25	*22	*23		
Silver Pick	N. Y. Curb	*8	*8	*8		
Teck Hughes	Toronto	*16	*14¾	*15		
Tom Reed	Los Angeles	*40	*33	*37	Dec. '19,	.02
United Eastern	N. Y. Curb	2 7/16	2 5/16	2⅜	Oct. '21, Q	.15
Vindicator Consol.	Colo. Springs	*23	*23	*23	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*5	*4	*5		
Yukon Gold	N. Y. Curb	1⅛	1 1/16	1⅛	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	*18	*18	*18	Apr. '20, M	.03
Batopilas Mining	New York	....	....	⅜	Dec. '07, I	.12½
Beaver Consol.	Toronto	*22	*20	*20½	May '20, K	.03
Coniagas	Toronto	1.20	1.20	1.20	May '21, Q	.12½
Crown Reserve	Toronto	*13	*10	*12	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3½	3⅜	3½	Oct. '21, Q	.12½
La Rose	Toronto	*33½	*33	*33	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*19	*17½	*19	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.20	1.10	1.10	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	5½	5¼	5⅜	Oct. '21, Q	.03
Ontario Silver	New York	4¾	4½	4¾	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	.	....	*12	Jan. '12,	.10
Temiskaming	Toronto	*29	*25	*26	Jan. '20, K	.04
Trethewey	Toronto	*13	*11	*13	Jan. '19,	.05
GOLD AND SILVER						
Boston & Montana	N. Y. Curb	*98	*91	*93		
Cash Boy	N. Y. Curb	*5	*5	*5		
Consol. Virginia	San Francisco	...	....	*36		
Dolores Esperanza	N. Y. Curb	1⅜	1⅛	1⅜		
El Salvador	N. Y. Curb	*16	*14	*15		
Jim Butler	N. Y. Curb	....	....	*7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	....	....	*4	June '16,	.05
Louisiana Con.	N. Y. Curb	...	.	⅛		
MacNamara M. & M.	N. Y. Curb	*14	*12	*12	May '10,	.02½
Tonopah-Belmont	N. Y. Curb	1 1/16	1⅛	1⅛	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*71	*68	*70		
Tonopah-Extension	N. Y. Curb	1 1/16	1½	1½	Oct. '21, Q	.05
Tonopah Mining	N. Y. Curb	1⅜	1⅜	1⅜	Oct. '21, SA	.05
West End Consol.	N. Y. Curb	*94	*87	*93	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*9	*6	*9	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	*95	*95	*95	Dec. '20,	.15
Chief Consol.	Boston Curb	3½	3¼	3¼	Aug. '21, Q	.05
Consol. M. & S.	Montreal	18¾	18¾	18¾	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†3.00	†1.00	....	July '20, Q	.10
Daly-West	Boston	†2¼	†1½	2	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†3	†2½	2	Apr. '21, K	.05
Electric Point	Spokane	*4½	*4½	*4½	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*47	*42	*44		
Federal M. & S.	New York	8	8	8	Jan. '09,	1.50
Federal M. & S., pfd	New York	26¾	26¾	26¾	Sept. '21, Q	1.00
Florence Silver	Spokane	*8½	*7½	*8½	Apr. '19,	.01½
Grand Central	Salt Lake	†*25	†*10	....	June '20, K	.03
Hecla Mining	N. Y. Curb	4 1/16	4	4 1/16	Sept. '21, Q	.10
Iron Blossom Con.	N. Y. Curb			*17	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake		†2.00	...	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb			*3	June '21, I	.02
Prince Consol.	Salt Lake	*7	*7	*7	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*2½	*2	*2	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*10	*9	*10		
South Hecla	Salt Lake	†*50	†*20	..	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*10	*10	*10	Oct. '17,	.05
Stewart Mining	N. Y. Curb			*4	Dec. '15	.05
Tamarack-Custer	Spokane	1.95	1.85	1.90	Jan. '21, K	.04
Tintic Standard	Salt Lake	2.00	1.90	2.00	July '21, Q	.05
Utah Apex	Boston	2½	2⅜	2⅜	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	*2	*2	*2	Nov. '17,	.01
VANADIUM						
Vanadium Corp.	New York	33⅛	31⅞	32⅞	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	59½	59½	59½	Oct. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	†80		80	Oct. '21, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	40¾	38⅞	40⅝	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	85¼	82¾	84	Sept '21, Q	1.75
Am. Sm. pf. A	New York	84¼	82¾	84	Oct. '21, Q	1.50
U. S. Sm. R. & M.	New York	33⅛	32	33½	Jan. '21, Q	.50
U.S.Sm.R.& M. pf.	New York	41⅛	41	41	Oct. '21, Q	.87½

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, November 26, 1921 *Number* 22

The Reception of the Mine Law Revision

A BIRD'S-EYE VIEW of the various impressions reported from different parts of the country, as to the proposed revision of the mining law, indicates a general reaction against its enactment as it stands, a general drawing back from this and that provision, and in consequence a disinclination to accept the whole. Unmistakably, there is a feeling here and there that someone is trying to "put something over" on somebody else. That this is an absurd feeling is plain from a history of how and by whom and under what sponsorship the revision of the mining law came to be made; but bare facts avail little against a general impression. Certainly, the mining people will get nothing which they do not want: all who have the job of making or even suggesting laws are too wide-awake to their welfare and wishes.

The Specific Objections

ONE OF THE THINGS which has aroused much specific objection is the point which we ourselves have already objected to editorially—namely, the provision that makes it imperative for the locator to have the lines of his claim coincide with the ordinary areal subdivisions of existing land surveys, where these have been made. The objection to this provision is widespread. But we have it reliably that the committee which drew up the revised code, the Bureau of Mines, and the elements of Congress interested in mining-law reform are quite ready to drop this provision from the bill, or, indeed, to drop any other feature which shall not be desired, if by so doing something may be left of the proposed law which will mean a benefit and an improvement over the old law.

There will be found, upon examination and straw voting, some other features of the bill which are debatable. One such is the provision that a claim must go to patent in five years, or, if the prospector is unable or unwilling to pay $50 per acre per year, it must be relinquished to the Government again. One competent observer has stated to us that in his opinion this injures the present rights and privileges of the prospector more than anything else in the bill. Under the existing law the prospector may hold an unpatented claim indefinitely so long as he performs his annual assessment work upon it; and there would appear to be really no valid objection to continuing this situation. It takes longer than five years sometimes to find enough on a claim to warrant patenting; and if the prospector is working away in the meantime on a hundred-to-one chance, it certainly is good business for the public to let him do it, and he should be given the privilege if he wants the gamble.

We Must Stand for Progress

THERE ARE A LOT of other objections, some valid, and some, in our opinion, not at all valid, which have been urged against various details of the bill. In the original form, the indications are that the bill will not pass. Shall it be killed, and shall the work and progress it represents be scrapped? That would be a thousand pities. Let us see what advance is represented in it which we can all agree upon, and at least gain some one forward step by the present moment. The distinguished engineers who have drafted the bill would certainly welcome any solution which means any good advance whatever; and the great mining societies—the American Institute of Mining and Metallurgical Engineers, the American Mining Congress, the Mining and Metallurgical Society of America—which have long ago committed themselves to a revision of the mining law, would certainly support any restricted and generally beneficial program.

Abolish Extralateral Rights

ONE THING AT A TIME may be the necessary program under the existing circumstances. The principal feature of the proposed bill is one to which a great majority of mining men, whether they be prospectors or operators, will agree—*the abolition of extralateral rights for claims located after the passage of the proposed law.*

It is worth while that this point, and, if necessary, this point alone, be considered, and made into a law, or rejected, at the present moment. We have our opportunity to rectify, although very late, a stupid and ignorant piece of legislation—that which gave so-called extralateral rights to a claim.

The Origin of Apex Litigation

AS TO THE ORIGIN of this monster of legal provision, which makes havoc with the natural law, we quote from an article written by Horace V. Winchell in the scholarly Professor Peele's "Mining Engineers' Handbook":

> "The right given by the mining laws of the United States to follow the vein beneath the surface of land owned by another was aptly termed the 'extralateral right' in an early discussion by Dr. R. W. Raymond (Trans. A.I.M.E., Vol. 12, p. 387), and passed into current use as legal phraseology. This provision of the law has given rise to interminable litigation; and in its interpretation volumes of opinions have been furnished by the courts and writers of law books. The manner of its introduction into our system of laws does not seem to be exactly understood. It is at variance with the ordinary Spanish and Mexican codes, and is not to be found in the mining laws of any country but the United States. It was tried for a long period by the Germans in the sixteenth and seventeenth centuries, when a sort of inclined location was allowed, the miner having the right not only to follow the vein beneath the surface, but having also 7 lachter (about [illegible] ft.) on each side of the vein, parallel to its walls, within which to work (R. W. Raymond, 'Mineral Resources,' [illegible], p. 181); but it was there abandoned because it gave rise to so much litigation. It was later tried for a short time in British Columbia, but promptly given up, for the same reason. (J. M. Clark, Trans. A.I.M.E., Vol. 43, p. [illegible].) [illegible] have arisen from the fact that our laws adopted from the local rules of the

> miners, and that these rules were a product of the evolution and development of the western mines, starting with surface rights only, and at first solely with reference to placers, and being later extended to lodes. Each man located his vein and desired to work it regardless of its dip or inequalities and without interference with or from his neighbors. In many districts, moreover, there was a general theory, at least in early days, that the veins were all parallel to each other in dip and strike; and such complexities of structure and uncertainty in mining as afterward developed could not have been foreseen."

There you have it. You are properly called upon now to discard—after long trial—a fool law that the Germans tried and discarded in the sixteenth and seventeenth centuries A.D. And in Germany, and in British Columbia, as Horace V. Winchell writes, the valid reason why it was abandoned was that it gave rise to so much litigation. And it is causing, and has caused, too much litigation in this country; wherefore, then, should we be behind the efficient Germans—more than three centuries behind, we mean—in chucking it?

The Lawyers and the Geologists

THE LAWYERS will not advise putting an end to litigation. It is too much to expect of them. Would you put it to a farmer to abolish farming? Besides being their livelihood, litigation is the natural atmosphere they breathe; they regard it as natural and necessary in the scheme of life, and the more the better. But when they claim that the kinks of the law have all been worked out for extralateral rights, it is to laugh, to use a German idiom rendered perhaps admissible since we are discussing an old German-abandoned law. If we look over the records of the last apex case—any old case—we are forced to the conclusion that either they are very obtuse or they assume that the rest of us are. These apex cases are handled by lawyers and geologists, in cahoots; and it is very interesting to glean the general impression that the geologists are for the abolition of the extralateral rights which alone make these silly battles permissible, while the lawyers are not for it. Make a note on the advantage of scientific and engineering training, as against that of the law, in engendering clarity and equity of mental attitude, and vote for an engineer or geologist or technologist of any kind, for any position, and any time. The engineers, we have heard, stood highest in average psychological tests of all groups in the A. E. F.

Vertical Boundaries in British And Latin America

IF YOU DO NOT WANT to accept the German experience and conclusion—and perhaps we should not expect this in view of the developments since 1914—then we will put it this way: That most of the rest of the world were too wise ever to try this plan at all, based, as it is, entirely on a kindergarten idea of ore occurring only in straight fissure veins, like sheets of paper, going on forever laterally and in depth—only growing richer in depth—which is what they thought when they passed this law. This fairy-story idea of orebodies, and the resultant apex law, are equally matched as to practicable inapplicability. Not only did this legend never take root in Europe, except as stated, but nowhere in the New World than in this country. South of the Rio Grande, and north of the Great Lakes, they have flourished peaceably under a sensible law—vertical boundaries and square claims. This applies to all Mexico and the countries as far as Cape Horn, and to all Canada as far as the North Pole.

Existing Vertical Boundary Regulations On American Soil

MOREOVER, the United States has provided similar vertical boundaries and square claims in mining laws framed for and enacted by Porto Rico and the Philippines. It is an old story that we do better by our dependent wards than we do by ourselves.

Furthermore, the vertical boundary and the abolition of extralateral rights has been enacted by private agreement, in many mining camps, such as Leadville, Tonopah in part, and many of the great camps of Arizona. Some of these, like Leadville, tasted or drunk deep of litigation before they found that the Federal law had nothing in particular to do with ore deposits. We are going to publish an article by D. A. Richardson, an authority on Mexican Mining Law, from which we quote in advance regarding the Spanish law:

> "Under the early ordinances, as well as under the present law, there was an absolute right to work all veins or portions of veins within the located claim, regardless of the apex, and regardless of the dip or pitch. There was and is absolutely no right to follow a vein either on the strike or dip outside of the lines of the claim, unless the vein passes into vacant ground in which the locator must acquire rights prior to other locators, in order to protect himself in the possession of the extended vein. The contrast between this feature and the extralateral right accorded the locator under the laws of the United States is probably the more important of the entire mining system, and the superiority of the Mexican law, particularly in those cases where there are many adjacent locations in districts containing numerous cross lodes, broken veins, and covered apexes, is recognized in the United States in many such districts by the execution of agreements between the principal mine owners restricting the rights of locators and mine workers to the ore found within the space formed by extending their surface lines vertically downward."

Finally, the mining law of the State of Texas, covering the location of mining claims on state lands, provides for vertical boundary lines, although not for square claims. This excellent law is worthy of study on many points which we have not space to touch on here. But, concerning extralateral rights, it provides (Sec. 2) that "claims may be of unlimited depth, but shall be bounded by four vertical planes from the side and end lines." This law was enacted in July, 1919; it was originated, drafted, and sponsored by the Mining Circle of the El Paso University Club. A correspondent writes us that "this law has the approval and commendation of the mining fraternity in this region."

Criticism of Mining Schools

AS ENGINEERS, we look critically at the product of the various engineering schools. We see the different stages from the embryonic engineer to the consultant and operating engineer. Then we get busy and throw back various suggestions to the colleges and universities. We are not efficient diagnosticians nor are we good physicians, for we collect no fee for our gratuitous advice. We throw a bolt into the educator's camp and then go about getting our living without thought as to the possible damage we have done. We are perhaps conscious of having done "our best," but on the whole we feel our own shortcomings.

Let us see if it is possible to get a logical basis upon which to start. First, there is the "raw material," the entering students. This is not a standardized product.

You can't take each individual and put him through tension, compression, and torsion tests, and segregate the group into classes. We must not overlook the fact that students are human beings, and as a group represent a wide range in abilities, aspirations, and individual power. The intelligence tests are of some value, but are at best suggestive only, as we must not overlook the fact that they imperfectly reveal the moment position of a living, developing, and maturing individual. Thus the educator must receive a group of individuals representing a relatively wide range in individual capacity and earnestness. He can reject the most unlikely material on the basis of preparation, but he is powerless to discriminate further as the individual elects and would object to any other basis of discrimination.

Second, there is the objective of the educator. In respect to mining education, there are at least three objectives, which in the terms current are the vocational, the service, and the engineering courses. The vocational supplies the need of the working miner and foreman. The service course provides minor executives, assistants, and men of greater intelligence and a higher order of training. The engineering course represents a still higher level in ability and knowledge. Quantitatively, the mining industries require more workers, fewer service men, and of engineers, the least number.

It seems to us that this division would lead to greater clarity of thought and more intelligent attainment of objectives. Many schools do not discriminate between the service and the engineering objectives, but endeavor to make a given course serve both. Here is where considerable confusion has arisen. Engineers criticise the service course from the point of view of the engineering course and vice versa.

In the development of the five- and six-year courses, educators have endeavored to meet the needs of an engineering course, but we question whether some of them have not failed to discriminate closely between the objectives of the two courses. It looks to us as if the longer course represents the service course, with the addition of cultural and other courses. In our opinion, the engineering course should be an entity, consistently planned to meet the objective. If this were done, perhaps the time element, our third and last point, might be modified.

How much time should be given to mining education? Should it be one year for the miner, two years for the foreman, four years for the service man, and five or six years for the engineer? We do not attempt to say, for this question is one for educators in conference with mature engineers to decide. The variable nature of the raw product, the average rate of assimilation and the economic utilization of the time are the important factors. The time should be as short as possible, consistent with the objectives.

It is the function of the educator to plan his courses with as definite an objective as possible and to segregate his raw student material to correspond to the several courses. To the engineer who criticises it is essential for him first to study the practical limitations and then supply quite complete specifications covering the end product of the particular kind of school. Two recent reports of committees of the Mining and Metallurgical Society, one on vocational and one of mining engineering education, represent a decided advance in thought upon the subject and should be followed up by further systematic attempts to resolve the problem on the part of engineers.

The Passing of the Burro

THERE WAS A PERSON of our acquaintance who had never been able to see the point of but one joke. That was when the automobile began to make itself prominent. "It's wonderful," said one citizen to another, "how the automobile is replacing the horse." "Indeed it is," was the reply, "I even found a bit of rubber tire in my sausage this morning."

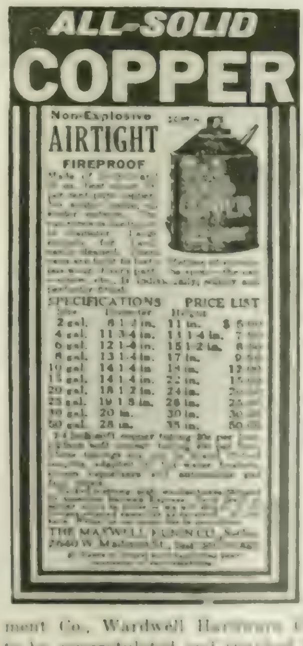
The burro has been the chief reliance for the discovery of new mines. What with the burro that slips off the trail, the burro that wanders and must be found, and the burro that kicks the top off the outcrop, statistics of mining tradition will undoubtedly find that but for the burro new finds of ore would have been few and far between. Contributed popular evidence from time to time all accumulates in favor of the burro and weighs against the "expert." Wherefore, as we all love the old days, we grieve at the following dispatch:

> "Yuba City, Cal., Nov. 5—Ted O'Connor, of San Francisco, is haled here as the only autoist in the world who has found genuine pleasure in a blow-out. While on a motoring trip with his wife through the Yuba County hills a tire blew out and he dismounted to fix it, using appropriate language. While kicking and storming around the wheel he picked up a gold nugget that weighed in at $18 value."

The horse and the burro have lost one of their last traditional offices in uncovering ore. The tire blow-out takes the place of the burro's kick. Romance is gone, and a new race of liars is scheduled to arise.

The Way of the Transgressor Is Hard

WE REPRODUCE HEREWITH an advertisement sent us by an Arizona subscriber with the comment "If you are a millionaire you can afford to buy something made of copper." Apparently, those who make it at home do not necessarily escape from bootleg prices. On the other hand, we were much cheered by an advertisement which was recently sent us by the Rome Brass & Copper Co., which told of a "No-Profit Sale" by the hardware dealers of Rome, N.Y., in which nickel-plated copper dippers were sold at [illegible], two-quart copper coffee pots at [illegible]; No. 8 nickel-plated copper tea kettles at $1.15, and heavy sheet-copper wash boilers at [illegible]. The Rome Manufacturing Co., [illegible] Co., C. E. Tyler, E. F. [illegible] Co., Rome Hardware & Implement Co., Wardwell Hardware Co., and I. Weiss are to be congratulated and thanked by the industry. We hope the idea will spread.



ALL-SOLID
COPPER

Non-Explosive
AIRTIGHT
FIREPROOF

SPECIFICATIONS PRICE LIST

Size	Diameter	Height	
2 gal.	8 1/2 in.	11 in.	$ 6.00
4 gal.	11 3/4 in.	11 1/4 in.	7.[illegible]
6 gal.	12 1/4 in.	15 1/2 in.	8.[illegible]
8 gal.	13 1/4 in.	17 in.	9.[illegible]
10 gal.	14 1/4 in.	19 in.	12.00
15 gal.	14 1/4 in.	22 in.	15.[illegible]
20 gal.	18 1/2 in.	24 in.	[illegible]
25 gal.	19 1/8 in.	26 in.	25.[illegible]
30 gal.	20 in.	30 in.	30.[illegible]
50 gal.	28 in.	35 in.	50.[illegible]

THE MAXWELL [illegible]

WHAT OTHERS THINK

"The Education of the Mining Engineer"

In the discussion following the report of the Committee on Technical Education, a summary of which appeared in your issue of Nov. 5, Mr. Graton regrets that only one side, that of the "producer" or educator, had been presented. However, Mr. Guess refers to the "product," presenting his ideal of the young engineer. The subject is one well worthy of discussion without, as well as within, the technical societies.

Mr. Guess expects rather too much in his "ideal *young* engineer," whether the deficiency lies with the technical educator who produced the engineer or with the individual engineer. A "self-starter with four cylinders; character, horse sense, energy, and technical knowledge," the average graduate starts—or is started—off with one cylinder functioning: the last, 'technical education."

Naturally, he possesses inherent elements of "character," but individual character is built up with the upbuilding of the man, as his experience is gained. College training can do much toward the development of this cylinder and toward its ultimate efficiency, laying the foundation on which the permanent structure is erected in subsequent years.

Looking back over the years of varied associations, one is prone to view "horse sense," like art, music, or genius along other lines, as being inborn. A certain amount, as with the accomplishments mentioned, may be acquired, but real "horse sense" seems to be inherent. Perhaps this cylinder should "hit" now and then along with the fourth, from the beginning.

Technical training can and should have a great influence in the development of "energy," the third cylinder, in guiding its direction. But in this experience alone will, finally, develop and direct that energy to a degree of efficiency. I have noted a maximum of energy in the operation of the individual, but, unfortunately, with a minimum of result.

Analysis of the subject indicated lack of foundation and inability to co-ordinate effort to apply technical knowledge systematically to the problems in hand. The subject had had a more or less haphazard technical training which illustrates in the superlative degree the influence of technical training in the guidance of traits to be acquired and perfected under experience.

"Leadership," native in some and acquired by others, is largely latent in the college life; in the individual it develops mainly from the necessities of his surroundings. Much can be acquired by study of those with whom he is associated and those over whom he may have supervision. Thriving on opportunity it cannot develop in an isolated occupation.

"Culture," largely a matter of early training and environment, largely relative, in all more or less acquired, will be further influenced by the environment of the occupation under which experience is being won. The college atmosphere may set a standard; the young engineer "roughing it" must keep an ideal before him, an ideal set by college and social surroundings, for inspiration. But, we must not forget that culture is a matter of environment; that it is relative; that its quality may be as sterling in the mountain wilds, of its kind, as in the social center.

The engineering college can but lay the foundation on which to erect the structure of experience. With "technical knowledge" acquired, a habit formed of thinking, of acting and of deciding along precise lines and with thoroughness (a habit which must be formed and founded in the college work), the graduate is, as far as is at present practical, prepared to acquire experience. He can build up his "character," bolster up any inherent lack of "horse sense," develop well-directed "energy," and supplement his "technical knowledge" by continued study, reading, travel, research, through any and all available channels.

The seven-cylinder motor may be a novelty, but, to carry on Mr. Guess' analogy, I should add another cylinder, "initiative." The college can do much toward creating and developing this qualification, so essential to his success, in the young engineer.

Too many young engineers have been seriously handicapped by being started off with but one cylinder, or, at best, two cylinders indifferently operative. They are started out along a line of work, lacking experience in the practical, operating side of that to which their duties are leading.

They lack, also, the details of practice which they should have acquired by experience under operating association. They have not learned "to think." Professor Wendell believes they do not "have time to think." But, "thinking" is a big part of the engineer's job; he must learn to think as well as *take* time to think. The result is that the young engineer so catapulted into the activities of operation of field examinations or other of the many spheres of activity to which he may be assigned, on his own resources, pursues a restricted course establishing an immature individuality and precedents which it may take years for him to overcome.

Another result lies in ineffective return to his employer, and, perchance, loss of faith by his employer in technical training. One cannot blame the young engineer, nor do I feel that he is open to criticism. He lacks experience and the development of the qualifications; the lack to which Mr. Guess objects. He is unfortunate, as well as his employer, in being thus sent, prematurely, to duties for which he has as yet not qualified.

I sometimes feel that the very general methods of imparting knowledge, in technical as well as public schools, particularly in the latter, tend to minimize the effort of thinking. Thinking is not a natural accomplishment but the development of certain mental faculties. Knowledge can be pumped into a student, developing the "memory" faculty, but to develop the "thinking faculty" the student must be so reached as to take in a considerable proportion of "knowledge" by "suction."

We meet a good many young engineers in the field who have jumped from college to experts. That they should be so thrown on their own resources is unfortunate alike for them and their employer. Immature theories and views then formed shadow them all through their professional careers. They are untrained to think, have no precedent of their own experience to guide them, and fall back upon an effort to apply the memory of the lecture course.

Professor Warren's stressing "the need of securing men on the teaching staffs who have had actual and adequate experience in the field" cannot be too strongly emphasized. A "technical course as a 'short-cut to experience'" is hardly conceivable. Experience can be acquired only by actual work in the chosen field of endeavor, and this with the maturity of the mind that comes only in the years, after the average man has been graduated. Those of us who look back on our earliest efforts will fully appreciate this.

Helena, Mont. L. S. ROPES.

Drilling Results and Dredging Returns

In the issues of *Engineering and Mining Journal* of Oct. 22 and 29, you publish a paper by Charles W. Gardner on "Drilling Results and Dredging Returns." The publication of this article is most timely, and you have opened up a fertile and interesting field for discussion. Mr. Gardner has given us a large amount of information that he has gathered during his many years of experience in this industry.

In your editorial of Oct. 22, you set forth the fact that Mr. Gardner has not analyzed the individual cases nor given any explanation of the underlying causes for all of the uncertainties and discrepancies that he enumerates. It is of little use for us to learn that our results are wrong if we cannot be told the why and wherefore or if we cannot be shown how to correct the errors of our ways. Mr. Gardner has cast a cloud of doubt over all placer prospecting work that may cause an investor to hesitate before putting much money into a gold-dredging project.

A dredging enterprise requires quite an investment today. One property that I now have in mind, having been recently equipped with a 10-ft. dredge, wherein the whole equipment included the power plant and necessary buildings, required nearly $1,000,000 cash. The large equipment is more necessary today than heretofore, because most of the richer placer ground where a small dredge could be made to pay has already been equipped and exploited, and today we only find ground available containing comparatively low values and on which we must install large dredges or units, to obtain sufficiently low working costs to earn a profit. Not only must the capital investment be large, but it must all be risked or spent before it can be definitely known that the enterprise will prove a money maker. One cannot put up a small unit to handle fifty tons per day as can be done in a lode mine and then further extensions be made to this plant after it has been proved that one has a profitable operating business. The dredge must be completely installed, and in many instances together with its power plant, before a yard of gravel can be dug and the soundness of the enterprise be proved.

When one is called upon to consider an investment of say $1,000,000 in a dredging project, probably one of the first questions that will arise in his mind is, "Are the drilling results reliable?" And if the investor should chance to read Mr. Gardner's article, he might be fully justified in concluding that all drilling results are unreliable and that no one knows much about the drilling business.

In your editorial you state that "The method of depending on bore holes is not universally applicable to such deposits, and with this conclusion most engineers will agree. Just where to draw the line is a hard question. What deposits can be safely drilled? What deposits must be examined by other methods?"

Your conclusions are theoretically correct, but in actual experience the engineer usually has little choice in the matter, as it is generally necessary to resort to drilling because of the presence of water, the amount of time required for shaft sinking, the great difficulty, and the large expense of this work. I hold that shaft work is preferable where possible, but many an engineer will put down only a few shafts on a certain area, on account of the time, expense, and difficulties, whereas many more drill holes would be put down by him within this same area in little time and at small cost. Local conditions beyond the control of the engineer generally decide this matter for him and compel him to resort to drilling.

As to R. H. Smith's suggestion that the gold dredge was not doing its work, I think that there is very little room for any blame for poor gold recovery on a dredge of modern design, as ample screening capacity, large water supply, extensive table area, effective dump chutes, save-alls and clean dumping buckets all make for high efficiency today. Many shortcomings were found in one or all of these elements in the dredges built in the earlier days, but this is not true of the dredge of modern design.

In reading Mr. Gardner's article, one is almost forced to conclude that the larger part of the trouble as set forth by him lies in the personal element, and much benefit will be derived if we can hear from others giving their experiences in this field of operation.

New York. A. C. LUDLUM.

Labor Turnover at Mines

In *Engineering and Mining Journal* of Oct. 15, on page 603, you refer to a short report of mine in the Bureau of Mines *Reports of Investigations* on a six-year accident record of the Anaconda Copper Mining Co., and you apparently would like to be informed as to the labor turnover in the Butte district. I am herewith forwarding *Technical Paper 229*, by myself, entitled "Accident Prevention in the Mines of Butte, Montana," and on page 49 you will find some data as to the labor turnover for the North Butte mine for the years 1916-1917. This tabulation was furnished to me by the officials of the North Butte mine, and though I have no definite figures as to the labor turnover for that period in the mines of the Anaconda Copper Mining Co., I am very much inclined to believe that the labor turnover for the Anaconda mines was even greater than that of the North Butte mine.

In the matter of labor turnover for Butte, however, it is not to be inferred that every time a new man is hired at a mine he is necessarily a new man to the district, inasmuch as a man may work at one mine today, another mine next week, and still another one for a number of weeks in succession, and in fact there are specific records showing that men have worked at as many as fifteen to twenty different mines in a year.

Denver, Col. D. HARRINGTON.

The Mineral Resources of Syria*

Country Now Opened for Development—Geology and Mining Laws—Coal, Lignite, Petroleum, and Asphalt Found—Salt and Other Non-Metals—Iron Widely Distributed—Chrome, Copper, Lead, Gold-Silver, Nickel, and Tin

BY I. M. TOLL
Written for *Engineering and Mining Journal*

SINCE THE FIFTEENTH CENTURY Syria has been under the rule of the Ottoman Porte, although the Turkish burden lay very lightly upon the country until in the 80's the Asiatic policy of Abdul Hamid was initiated, stressing the importance of Mesopotamia, Arabia, Syria, and Egypt. In pursuance of this policy the construction of the Bagdad railway was pushed, and a modern railroad was built from Aleppo to Beersheba, connected by branch roads to five reconstructed Syrian ports. Damascus and Aleppo once more became great trade centers, and tramways and electric lighting were instituted.

The position of Syria as the keystone of this part of Asiatic Turkey necessitated jealous guarding and strict administration. Nowhere else in his dominions did Abdul Hamid so keenly resent foreign influence and the growth of Christian and Jewish institutions; yet these persisted, and the culture of Syria was the culture of France. Nationalistic sentiment flourished, and the Young Turk revolution in 1908 was followed by rebellious intrigue on the part of the Syrians that was exposed in 1914, in the early part of the war. Executions and massacres were the principal features of the reign of terror that followed, uniting Syria as she never before had been united.

After the Turkish army had been driven from the country by the united British and Syrian forces, relative quiet obtained until the British army was replaced by the French under General Gouraud, whose evident intention it was to occupy Syria as a French province rather than as the ally and advisor of a self-governing Syrian nation. The opposition of the natives was overcome by overwhelming superiority of arms and numbers, and the complete pacification of Syria is now claimed. On Dec. 23, 1920, an Anglo-French agreement determined the boundaries of the British and French Asiatic mandatories. The accompanying map shows those of French Syria.

REGION AWAITS DEVELOPMENT

This land, the resources of which have so long been withheld from the foreign investor, is now opened for development. Except for the railroads built by Abdul Hamid, the attempts to develop the country made by the Turks have been desultory and incomplete.

Syria's agricultural resources are her greatest asset, and much is expected of the northern part (Aleppo to the Beka'a) in cotton and cereals. At present, however, only one-fifth of the utilizable land is under cultivation, and only the most primitive methods are applied.

The information upon which this article is based has been derived entirely from the works cited in the appended bibliography. Because Blanckenhorn has done the most copious as well as the most recent work, his reports have been accepted as authoritative at points of dissension. His volume on Syria, Arabia, and Mesopotamia, in the *Handbuch der regionalen Geologie* series, contains by far the most complete treatment of the geology of those countries and has been largely drawn upon in the preparation of this article. Accurate locations of mineral deposits are difficult to find in Syria, and statements as to the kind, quality, and quantity of the ores are surprisingly rare in the literature.

The mineral resources of Syria have been the subject of many wildcat speculations in France, and the expectations of the public regarding them have been elevated far beyond their real value. So far as is known today, Syria's mineral deposits are but mediocre; yet much of the region is virtually unknown, and those parts which appear to be most rich in this respect, the vilayets (provinces) of Aleppo and Adana, have been the least prospected.

Of the mineral resources of Syria, the non-metals have in the past been of far greater importance than the metals. The latter have not, however, been adequately prospected, and their potential value cannot be estimated definitely until a thorough geological survey of the country has been made.

GEOLOGY

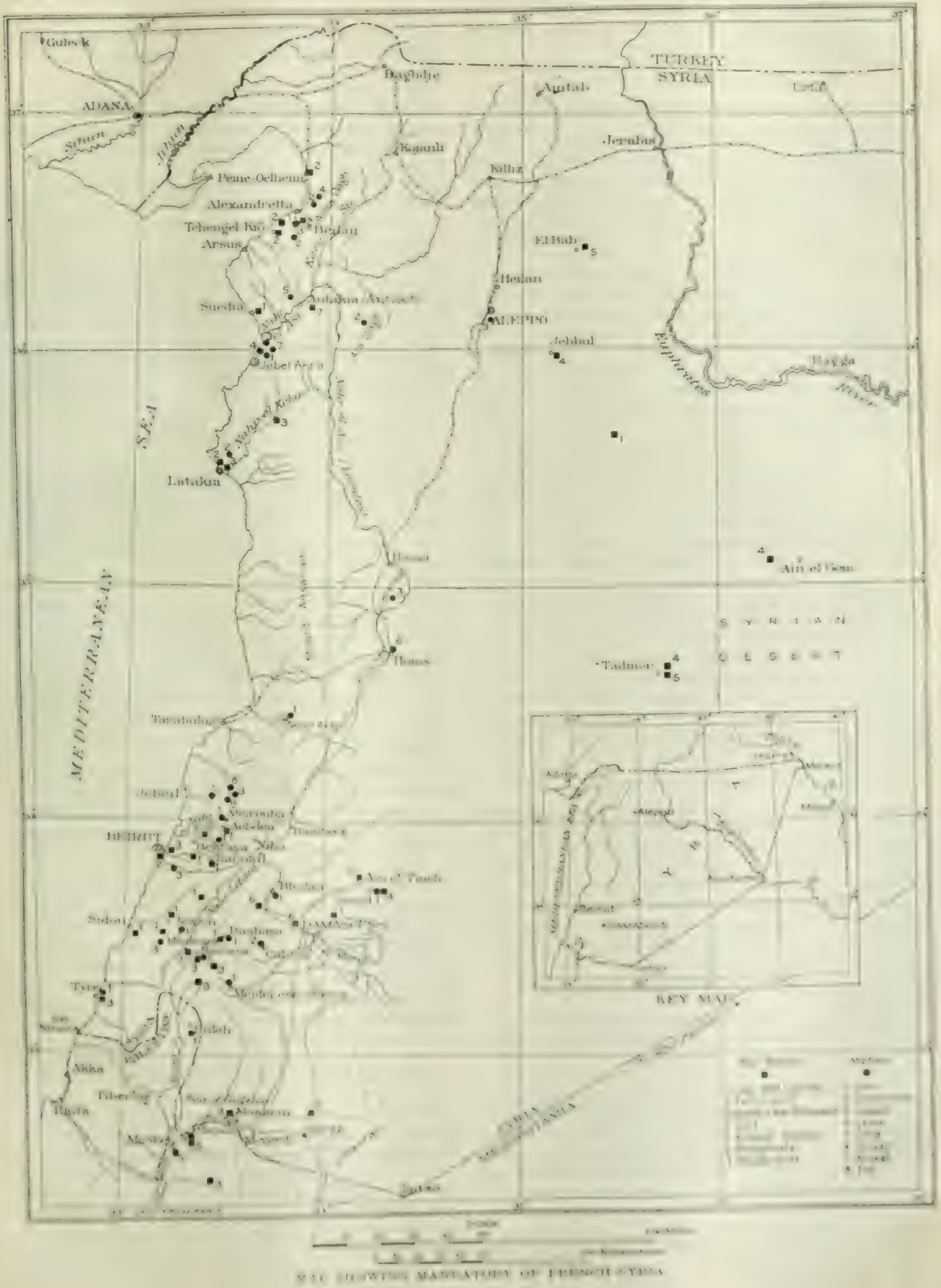
Structurally Syria is divided between two distinct provinces. North of a line along the Afrin River to Aintab the country has the folded structure of southern Europe and Asia. The flexures trend northeast-southwest and are approximately parallel to those of the Taurus. The Amanus and Kurd mountains may be said to belong to that system. South of the line the country is of the Indo-African type, only slightly folded and highly faulted. The faulting is subsequent to the folding, and is post-Cretaceous, probably late Tertiary.

The oldest rocks in Syria are Jurassic in age and very limited in extent, being exposed from the Sea of Galilee to Tarabulus. Cretaceous limestones, including the oil-bearing Senonian, cover the greater part of Palestine and occupy large areas northward to the Taurus and eastward into the Syrian Desert. Nummulitic limestones of the Eocene overlie the Cretaceous, and north of the Lebanon Eocene and Miocene formations cover most of the country. The Miocene of Syria west of the Euphrates is marine and predominantly calcareous. The upper Miocene oil-bearing salt and gypsum formation of Persia extends across Mesopotamia into Syria, and at the Euphrates includes intercalated fresh-water deposits. The Pliocene is not widely distributed, coarse marine deposits being found locally along the coast and in the valleys of the largest rivers and in fresh-water marls in the beds of old lakes in parts of middle and southern Syria.

Basalt flows are of widespread occurrence in Syria, the largest being that which caps the Hauran Mountains and forms the great lava plateaus north and east of the Sea of Galilee. In the far north these lavas are

---

*Published by permission of the Director of U. S. Geological Survey.



MAP SHOWING MANDATORY OF FRENCH SYRIA

interbedded with Miocene deposits and must be contemporaneous with them, but for the most part the lavas appear to be Pliocene in age.

THE TURKISH MINING LAW OF 1906

Not until the European powers brought pressure to bear upon the Turkish government did the imperial irade of March 26, 1906, clear up the question of mining concessions in Turkey and put an end to the chaotic conditions that prevailed previously. Prospecting under this law became subject to the securing of a license (*permis de récherche*) from the Administrative Council of the vilayet, and concessions were to be obtained by imperial irade.

In accordance with the law, an application for a prospecting license should contain the name, domicile, nationality, and profession of the applicant; the situation and boundaries of the lands to be prospected, with the name of the district; the minerals to be prospected for; the category of the land and an engagement to indemnify owners; two sketches showing the situation of the mines; and papers showing the legality of the applicant company.

The petition is submitted to the governor general of the vilayet, who has it registered. A certificate of registration is delivered to the applicant, securing the first right to the license and hence to the concession. A committee is then delegated by the Administrative Council to ascertain whether there is any reason why the license should not be granted. Reasons sufficient for refusal are enumerated in Article 13: the fact that the area includes public buildings, places, gardens, and similar features, or extends to public domains; when the prospecting works will cause trouble or prejudice the needs of the natives; when the works are to be constructed in a city or village or in the neighborhood of forts or other military works. If none of these reasons exists, the license is delivered upon the payment of the government fee—five, ten, or fifteen pounds Turkish.

PERSISTENCE IN MAINTAINING RIGHTS ESSENTIAL

The permit is for one year and is renewable once for another year. It is transferable, but the formalities should be completed before the expiration of the license. An additional eight months is gained by a transfer. The applicant is expected to push the formalities of his petition continually, and if he neglects his petition for six months it is dropped altogether. If negligence on the part of the applicant is evident after the formalities have been consummated, the right of the petitioner will be abrogated two months after due notification.

The holder of the license will be permitted to execute all prospecting works and to export 2,000 tons of minerals before taking the concession. Government fees will be due, however.

A concession will be granted upon the application of the license holder. It may be secured by a foreigner provided that he agrees to submit to the law of the land and is not an official or an employee of a foreign government. The application must contain the information required for a prospecting license and in addition a report of the prospecting engineer, accompanied by samples.

If after inquiry the government is satisfied that the mine is exploitable and that its development will not injure any neighboring mine, the application will be accepted and registered and notice thereof posted and printed in the public press. After two months no opposition will be heard to the granting of the concession.

If no acceptable opposition is made, a *cahier de charge* is prepared by the Ministry of Mines and referred to the Council of Ministers, who render a favorable decision. The concession is then granted by a firman.

The owner is required to begin work on his mine within two years, and if he neglects to do so within two and one-half years the concession will be withdrawn.

Taxes are of two kinds, fixed and proportional. The first amounts to 10 *piasters* per *djerib* (10,000 M) and the second amounts to 1 to 5 per cent of the product if the mining is done by galleries and 10 to 20 per cent if the minerals are found in masses.

Concessions are transferable by sale and transmissible by inheritance, and they are usually granted for a period of ninety-nine years.

FRENCH REGULATIONS RESTRICT OTTOMAN LAW SOMEWHAT

On Jan. 26, 1921, the Acting French High Commissioner issued a circular note (No. 119) regarding prospecting permits and mineral concessions under the new French régime. Although the Ottoman law still governs mineral affairs, certain restrictions are made as to the application of this law.

All concessions granted since Oct. 29, 1914, are cancelled. No new concessions can be granted without special authorization from the High Commissioner of the French Republic, which authorization will be given only exceptionally and in case of urgent necessity.

The control formerly held by the administrative council of the vilayet over the granting of prospecting permits (*permis de récherche*) is now vested in the High Commissioner, and all questions must be submitted to him.

Deposits already known will soon be listed and published and cannot be the subject of new licenses.

As the 1906 law grants to the holders of a *permis de récherche* a right of priority to the corresponding concession and a right to an indemnity in case the concession is refused him, the High Commissioner will grant one of these only to parties who will produce sufficient guarantee for assuring a reasonable exploitation of the properties.

Prospecting permits are valid for only one year; and if they are not renewed or the corresponding concessions are not granted, they are cancelled *ipso facto* at the expiration of this period. Therefore all permits granted by Ottoman authority have expired, and the holders must make application for renewal.

COAL AND LIGNITE DEPOSITS NUMEROUS BUT NOT OF HIGH QUALITY

Coal and lignite are found throughout Syria, but are nowhere of high quality. In Vilayet Aleppo, about 80 km. southeast of Aleppo, coal outcrops have been noticed by various explorers, but accounts relative to their importance are conflicting. Other outcrops have been reported at Suedia, north of Jebel Akra, on the Mediterranean coast. East of Sidon and extending along the western slope of Jebel Niha occurs a lignite bed 0.5 to 1.6 m. thick which is exposed for 1,200 m. and which certainly extends for a distance of at least

2,000 m. On the other side of Jebel Niha, between Niha and Mashrara, is a lignite exposure 500 m. long. At Haitoura, near Jezzin, is a lignite deposit whose extent is not definitely known, but which produces 500 tons annually. The Ainamade mine, near the village of Karnail, yields 1,000 tons a year. Both deposits are capable of larger outputs. Outcrops of coal have also been traced in the valley of the Nahr el Kelb; in Jebel Kalamun, a range of hills northeast of Damascus; in the village of Rashaya, at the foot of Mount Hermon; in Huleh, Province of Damascus; in Jerud; and in Birteh.

In the Nahr-Beirut region of Lebanon coal and lignite mines were formerly worked, and deposits also have been found at Falooga, near Hamana; Pambre; Aebdin, near Bekfaya; Mreyjaet, and Jezzin. Aebden is the seat of native exploitation undertaken on a small scale to supply silk factories of the district with fuel. The Lebanon coal measures are poor, however, and the seams are thin, being in places only a few centimeters thick, locally increasing to a meter and a half. It is pitch coal with numerous transitions to paper coal and bituminous coal, and pyrite is disseminated throughout. In spite of the wide distribution of coal in central and southern Lebanon, the presence of the pyrite and the high cost of transportation over difficult mountain ways make its development impracticable.

PETROLEUM AND ASPHALT OCCUR

The Syrian oil region is continuous with that of Palestine, where the petroleum appears to originate in either the Campanien or the Senonien group of the Upper Cretaceous. In northern Syria several oil springs of the Alexandretta region have been described, one 18 km. north of Alexandretta on the coast, another at Tchengel-Köi, between Arsus and Alexandretta. Oily films show on the surface of several streams flowing from Alma Dagh, where gas has been escaping for many years, toward Alexandretta; and Blanckenhorn mentions a spring southwest of these streams and close by the shore, called by the natives Kasod Jaghü. Asphalt is found also in the Alexandretta region. In Jebel Keferie, a hill 300 m. high in the region of the bend of the Nahr el Kebir, about 40 km. from the sea on the road from Latakia to Aleppo, is an important deposit of compact asphalt occurring over an area measuring about 1,500 x 1,400 m. Near by the asphalt oozes from vertical joints and impregnates the surrounding limestones and marls. There are oil springs on Jebel Musa, near Antakia, and on the coast. Three other localities in the neighborhood of Latakia are mentioned: Harbeh Vesolas, Kefrie, and Ghismum.

Near the city of Beirut both petroleum and asphalt are found. Blanckenhorn reports bituminous limestone at the springs of the Jordan. Asphalt is mined at Hasbaya and in the upper Jordan valley on the western slope of Mount Hermon. The pure asphalt occurs in beds up to 4 m. in thickness at the principal mine, that of Suk el Chan, or Bir el Hummar, located on the east slope of Jebel ed Dahr, a mountain separating the valley of the Hasbani from that of the Litani. Along the Damascus-Haifa railroad, in the valley of the Yarmuk, there are numerous exposures of bituminous limestone, as at Marani, and Schumacher discovered a petroleum spring between El Ekser and Makarin. At this spring, Tell el Dehamid, drilling was attempted in 1912, but was abandoned at the beginning of the war. Asphalt occurs at El Hamm and at Muskes. In the Hauran Mountains, near Ain et Tineh, and at Sunuhre, in the Beka'a district, bituminous limestones are exposed, but their quality is not sufficiently high to make exploitation profitable.

ATTEMPTS TO EXPLOIT PETROLEUM FAIL

Several attempts have been made to exploit petroleum in Syria, but as yet none have been successful.

In the latter part of the 80's a company capitalized at 500,000 fr. was organized at Basel for the purpose of developing the Jebel Musa springs. In 1889, a concession of 8,000 hectares was given to Ahmed Nedschabi Effendi for seventy years at an annual rental of 10,000 fr. and 10 per cent royalty; but this lapsed after three years of unsuccessful prospecting.

During the years 1892-95 the Vereinigtes Deutschen Petroleumwerke A. G. drilled at Alexandretta without success. Director Bösche reported that expenses were so high that even with favorable drilling results it was extremely questionable if a profitable development of the undertaking could be obtained. For current expenses the sum of 150,000 marks was set, and when production should actually begin a further royalty of 8 per cent would have to be paid.

In 1913, Prince Jusuf Pascha Kemal undertook the development of petroleum and asphalt in Beirut Province, with the agreement (as reported) that in the event of a sale of the concession the Ottoman government was to retain 20 per cent of the price for itself and the owner of the property.

The Petroleum Gesellschaft Latakia was formed by Abdul Wahhab Effendi Harun, and by the purchase of older concessions obtained the privilege of exploiting asphalt and petroleum at Latakia.

A ninety-nine years' concession was secured in 1909 by the Société Minière Syrienne Haiffa, composed of a number of local capitalists, for the exploitation of petroleum and asphalt in Vilayet Damascus. This included five prospecting and drilling permits on the east slope of the Jordan valley and in the Yarmuk valley about 88-152 km. from the Hejaz railway. The capitalization proved insufficient, and the aid of British capital was sought. After favorable examination by a petroleum expert, large investments were made, resulting in the formation of the Syrian Exploration Co., Ltd., capitalized at £100,000. This company is the same as that known as the Syrian Mining & Agricultural Syndicate, in Haifa as the Syndicate Agricole et Minière de Syrie. The concession is for 8,000 hectares of oil lands about 150 km. from Haifa, in the Yarmuk valley.

OPERATIONS NEAR MAKARIN ABANDONED

In 1912 two wells were sunk into a well-developed anticline near Makarin. In 1914 they had reached a depth of 500 ft. and found showings of oil, but no pay sands were reached. The rotary as well as the cable system was used, but the latter was more efficient, because of the hardness of the rocks. According to Dominian, limestone was first penetrated, then sandstone at 100 m., and finally hard shales. Hoberg gives the sequence as 10 m. of basalt conglomerate and lava, then soft bituminous limestone, followed by 55 m. of Nubian sandstone. When the drilling machinery broke, the attempt was abandoned.

The large concessions obtained by the Standard Oil Co. of New York are supposedly limited to the Dead Sea region.

Of the mineral resources of Syria, asphalt and bituminous limestone have been considered by far the most important, and up to the present these alone have been profitably exploited.

ADVERSE CONDITIONS DETER DEVELOPMENT

Attempts have been made several times to work extensively the asphalt deposit at Latakia, estimated to contain over 2,000,000 tons. The primitive methods used gave 79 tons in 1906, valued at 17,790 *piasters*, and in the following year 20 tons, valued at 4,500 *piasters*. The concession passed from hand to hand until it was finally held by a Greek capitalist resident in Egypt who paid £50,000 for the rights on 1,590 sq.m. The difficulties of transportation to the coast and of shipping were great, and the construction of a narrow-gage railway and extensive harbor works was planned. This, however, would necessitate the aid of foreign capital, and the project was dropped. At Dahana and Sullas, near Latakia, deposits were being worked in 1904 by an Englishman, Gavin A. Gilchrist. During that year an initial shipment of 300 tons of asphalt was sent to England, but the mines do not appear in later reports.

The Alexandretta asphalts have their origin in partial evaporation of the petroleum. An analysis by Jacunski showed that this asphalt has the following composition: Carbon, 77.18 per cent; hydrogen, 9.07; sulphur, 9.40; nitrogen, 2.10, and ash, 0.50; total, 98.25.

In 1902, a total of 350 tons of asphalt was exported from Beirut. Most of the asphalt came from deposits near the port, and the larger part of the shipment was consigned to Trieste, where it brought 360 marks per ton. In Beirut the price varied between 50 and 57 fr. per ton.

The Hasbaya mines are very rich, and have been worked since the country was held by the Egyptians, in the sixteenth century B.C., with wells as deep as 60 m. They were taken over by the Ministry of the Civil List of the Sultan, in lieu of taxes, from the Schebab family, who had only worked the deposits at rare intervals. In 1856, a group of Damascus merchants received permission to mine bitumen, asphalt, and stone in Damascus, and the permit was renewed every three or four years on the payment of a rental, until in 1895 the Ministry decided to place the mines on the open market in order to draw from them a greater income. Brief leases were taken at 19½ per cent and even 65½ per cent, but after five years no lessee appeared. From 1890 to 1900 66,000 tons of asphalt was extracted.

HASBAYA ASPHALT HIGH IN BITUMEN

Hasbaya asphalt is of great purity. Hitchcock states that it contains 72.6 per cent of bitumen and volatile constituents, 14 per cent of carbon, and 13.4 per cent of earthy constituents. It is very slightly soluble in alcohol, more soluble in ether, and almost completely so in turpentine; softens in water at 24 deg. C., and melts at 121 deg. C.; burns with a yellow flame, leaving a gray residue.

The bituminous limestone of Hasbaya contains 77.36 per cent calcium carbonate and 10 per cent bitumen, according to an analysis by Dr. Anderson. Where the bitumen content is not present, the carbonate decreases and the silica increases to 78.60 per cent.

During the war the scarcity of lubricating oils in Syria became so serious that the directors of the Hejaz railway decided to attempt distillation of the abundant bituminous limestone. The Makarin deposits in the Yarmuk valley seemed most promising because of the high bitumen percentage and because the six exposures extending over 10 km. could be easily worked from the surface. The limestone here contains 18 to 20 per cent bituminous material and has a heating power of 1,500 to 1,800 calories. The site chosen was that of the Syrian Exploration Co.'s abandoned plant, and the work was begun in the end of 1914. The first method used was extraction by gas ovens; but the method proved to be too complicated and expensive. The experiment was continued for ten months, however, and resulted in a daily production of 10 kg. a day at a cost of 70 *piasters* per kg.

In the second experiment, use was made of the materials left from the drilling outfit. The oven had a capacity of 15 cu.m., burning ten or twelve tons of rock in twenty-four hours. The stone, soft and of shaly nature, was broken by hand. The output was 500 to 600 kg. of crude oil, specific gravity 0.85 to 0.95, and about 1,000 kg. of ammoniacal water. The oil was sent to Damascus for distillation. In this way 20 to 25 per cent of the bitumen content of the rock was extracted at the following costs per ton: Extraction and transport, 25 *piasters;* breaking, 40; loading and unloading, 16; and general expenses and upkeep, 20; total, 101 *piasters*.

The yield was 45 kg. per ton and the cost per kg. 2.45 *piasters*. Taking into account the cost of the oven, the cost of building, general expenses and interest on capital (1,000,000 *piasters*), the cost price rises to 3.45 *piasters* per kg. With modern machinery the deposits could doubtless be exploited with less cost.

SALT INDUSTRY LITTLE DEVELOPED—MINERAL SPRINGS NUMEROUS—OTHER NON-METALS

The salt industry in Syria is old, but the maximum production has nowhere been reached. At Jebbul, on a salt lake 35 km. southeast of Aleppo, is one of the principal Turkish salt works. In winter the lake is 35 km. long and 20 km. wide, but in summer it becomes entirely desiccated, resulting in the formation of a pale rose-colored deposit of salt 1 to 5 cm. in thickness. The annual production, less than 10,000 tons, could be increased to 100,000 tons. Beyond the southern border of this lake are the unexploited salt lakes of Al Hamra, Haraidsche Ajta, Serka, Ramle, Derehim, and Maragha.

Southeast of Palmyra, at Tadmor, is a small lake yielding salt of high quality. A bitter salt is obtained from the salt marshes of Jerud, northeast of Damascus, where the deposits are as thick as 10 cm. The total lack of fresh water and the location on the trail of Arab thieves make mining and transportation difficult. Nevertheless, a small quantity is produced each year. The natives also prepare salt at Ain el Gom (Kum), 90 km. south of Ragga, in the desert.

Mineral and thermal springs, for the most part sulphurous, are numerous in Syria, particularly in Aleppo. At Bab, 45 km. east of Aleppo, ruins of ancient Roman baths are found around sulphurous thermal springs. Similar sulphurous waters are present at Tadmor (Palmyra) and at Sabkha, in Zor Province. But the best-known springs are those at Hammi (ancient Gedara), in Damascus, where large streams gush forth from the ground. That the Romans recognized their therapeutic value is shown by the ruins surrounding them; and today Arabs come to these springs even from Persia and Armenia. Dr. de Brun, of the Faculté de Médecine, at Beirut, testifies to the medicinal qualities of the water.

There is much fine marble in Syria and beautiful alabaster. In Aleppo both marble and gypsum are quarried; in Damascus, marble and porphyry; and in Beirut, gypsum and sandstone. Important deposits of red and yellow ocher are also worked in Beirut province.

Rock with a limited phosphate content is widely distributed throughout Syria and can easily be quarried. The best deposits are in the Barada valley.

A deposit of pandermite, a hydrous calcium borate, near Antioch, has never been worked, but is of potential value.

IRON WIDELY DISTRIBUTED

Iron occurs widespread throughout Syria. Deposits have been found in Jebel Akkar above Tarabulus; Mejdel esh Shems, 50 km. from Damascus; Bludan, 5 km. from the Beirut-Damascus railroad; Beirut; the slopes of Jebel Akra and of Mount Ansarieh, rich in various other metals; and Kufeir, 50 km. from Beirut. In Vilayet Damascus, the iron mines at Hasbaya have been abandoned, but those at Mashrara, in the Beka'a, and at Rashaya, north of Mount Hermon, are being operated. At the last-named locality coal from the same area is used.

The Lebanon possesses iron oxide ores in abundance, especially near Meirouba, at 1,200 m. altitude, in the valley of the Nah el Kelb. This deposit, like many others, is undeveloped, because of lack of means of communication. The ancient Phoenicians mined iron ore in the Lebanon, and central Syrian iron deposits have been worked intermittently ever since. The best known of these deposits is located in Wadi Sannin, the southern arm of the Nahr el Kelb, in Jurassic limestone. The ore occurs in a series of lenses extending parallel to the strike from northwest to southeast, and is mainly limonite and hematite, with some siderite. It is easily mined and yields a high-grade product, but the mining methods are very primitive. This may be the same locality as that described by D. A. Murr, of the American University at Beirut, as situated about ten miles distant from the coast near the mouth of the Dog River.

The deposits are in the neighborhood of Btaghrin village, and are known under the names of Biara Merjaba and Ein el Mur lands. Samples upon analysis gave from 42 to 60 per cent of iron, averaging 47 per cent for Biara and 50 per cent for Ein el Mur. The ore was worked by the natives and smelted in a primitive fashion until about fifty years ago, when the scarcity of wood for fuel and the low price of imported iron made it unprofitable to continue. The quality of the ore compares favorably with the average class of English ores. The gangue is chiefly lime.

Iron ore is found in the neighborhood of the village of Almat, about nine miles up the valley of the Fidar River from the coast near Jebeil. The rocks are limestone, with a few beds of shale and sandstone. Samples of the ore gave 51 per cent iron.

A license of research on iron deposits in the Yarmuk valley was issued to a group of men from Damascus and Haifa and was later transferred to a British firm. The license was not worked out, owing to the breaking out of the war.

The chrome-bearing area of southwestern Asia Minor extends down into Syria, where it includes deposits in Aleppo, in the Ala Dah, the Beilan area, and the Amanus region of the Giaur Dagh, northeast of Alexandretta. Chromium occurs at Catana, near Damascus, and in Beirut are deposits yielding 40 to 50 per cent chromium. These deposits were worked only for five years, but yielded during that time a minimum of 25,000 tons of ore. The concession was held by a Turk.

Copper deposits have not yet been developed in Syria, although they are found in every vilayet. Copper deposits occur in Vilayet Aleppo, 3 km. from Aleppo; in Beirut at Jebel Akra and in Beirut Sandjak; in Damascus at Djebel el Arbain, and in the Lebanon near Sidon and in the Kesserwan district.

The presence of lead ores in the Amanus massif has been confirmed, and silver-lead ores have several times been reported from Jebel Akra.

Auriferous sands are found in stream beds near Antakia. Silver occurs near Homs (ancient Emesa) and in the Kesserwan district of the Lebanon. A deposit is also mined at Toufail.

There is a nickel-bearing deposit at Jebel Akra, the minerals analyzed containing 72 per cent nickel.

Tin deposits in the Kesserwan district were examined and approved by Australian engineers, and licenses for the right of mining tin, copper, and silver were applied for by Murr in behalf of the Australian company which they represented. The work was discontinued, however, upon the outbreak of war.

BIBLIOGRAPHY

Anon., "Les Anales Franco-Helleniques." April 13, 1919.

Anon., "La Mission Paul Huvelin en Syrie." *Chronique Gèographique*, No. 157, XXIX Année, pp. 70-72, 1920.

Anon., "La Question Syrien Exposée par les Syriens." *Comité Central Syrien*, 8vo., pp. 56, Paris, 1919.

Anon., "Richesses minérales de la Syrie." *Echo des Mines et de la Métallurgie*, June 29, 1919.

Anon., "The Mineral Wealth of Turkey." *The Mining Journal*, Vol. 124, pp. 55, 56, Jan. 25, 1919.

Beret, G., "La France et la Syrie." *Colonies et Marines*, pp. 532-548, Aug. 1, 1919.

Bernex, Jues, "La Petrole en l'Asie Mineure." *La Presse Coloniale*, No. 1682, 1917.

Blanckenhorn, Max, "Grundzüge der Geologie und der physikalischen Geographie von Nord-Syrien." Berlin, 1891.

"Syrien, Arabien und Mesopotamien." *Handbuch der regionalen Geologie*, Bd. 5, Heft 4, 1914.

"Syrien und die deutsche Arbeit." Weimar, 1916 (*Deutsche Orientbücherei*, No. 18.)

"Die nutzbaren Minerallagerstätten der asiatischen Türkei." *Weltwirtschaft*, No. 5, 1916.

Cuinet, Vital, "La Turquie d'Asie." *Géographie administrative, statistique et descriptive de chaque province de l'Asie Mineure.* Paris, 4 vols., [illegible]

Cumberbatch, H. A., "Bitumen and Asphalt Deposits in Syria and Palestine." *Board of Trade Journal*, Vol. 61, pp. 38-39, 1908.

Danby, Arthur, "Natural Rock Asphalts and Bitumens. Their Geology, History, Properties and Industrial Application." London, 1913.

Diener, C., Libanon. "Grundlinien der physischen Geographie und Geologie von Mittel-Syrien." [illegible]

De Launay, L., "La géologie et les richesses minérales de l'Asie." Pp. 635-636, [illegible]

Diller, J. S., "Chromite in [illegible]." *Mineral Resources of the United States*, Part 1, [illegible]

Doelter, C., "Die Mineralschätze der Balkanländer und Kleinasiens, Anhang." *Die Mineralschätze der Asiatischen Türkei*, pp. 114-[illegible], Stuttgart, [illegible]

Dominian, Leon, "The Coal Resources of the Turkish Empire," "The Coal Resources of the World." 12th International Geological Congress, Vol. [illegible], p. [illegible], [illegible]

"Fuel in Turkey." "The Oil Fields of Mesopotamia." Pp. [illegible] New York, [illegible]

Engler, C., and Höfer, H., "Das Erdöl, seine Physik, Chemie, Geologie, Technologie, und sein Wirtschaftsbetrieb." II Band, pp. 445-449. Leipzig, 1909.

Fester, Gustav, "Die turkische Bergbaustatistik, 1318 bis 1327" (14 März, 1902 bis 13 März 1912). "Flugschriften der Zentralgeschäftstelle für deutsch-türkische Wirtscraftsfragen." Viertes Heft. Weimar, 1918.

Finckh, Ludwig, "Beiträge zur Kenntniss der Gabbro und Serpentinegesteine von Nord-Syrien." *Zeitschrift der deutschen geologischen Gesellschaft*, pp. 79-146, 1898.

Fitzner, Rudolf, "Aus Kleinasien und Syrien." I. Rostock, 1904.

Froidevaux, Henri, "Les études de la mission francaise en Syrie." *La Geographie*, Tome XXXIII, pp. 424-427, 1920.

Hoberg, Otto, "Erdölbohrung in Syrien." *Levante Zeitung*, No. 21. 1. 11. 13.

Honoré, M. M., "La Syrie et l'ingénieur." *Bulletin de la Société Ingénieurs Civils de France*, pp. 600-648, November-December, 1918.

Huevlin, Paul, "Report of the Syrian Mission to the Lyons Chamber of Commerce," Nov. 6, 1919.

Imhoff, "Das Eisenbahnnetz der asiatischen Turkei vor Kreigsausbruch, P. M." 1915, 264 pages.

"Konsulatsberichte, Das Minenwasen in der Turkei." *B. H. J.*, Bd. VII, Heft 4, 1904.

Kruger, Karl, "Vorkommen, gewinnung und Absatz des Kochsalzes im türkischarabischen Vorderasien." *Mitteleilungen der geographischen Gesellschaft in Hamburg*, Band XXXIII; S. 69-103, 1921. With 11 figures.

Kuntzer, Karl, "Abdul Hamid II und die Reformen in der Turkei." Dresden, 1897.

Luckerts, "Les richesses minières de la Turquie d'Asie." *Le Movement économique*, Bucharest, 1905.

May, W., "Die bergbaulichen Verhaltnisse in der Turkei." *Zitschr. für Berg und Hüttenwesen*, Bd. 44, 1896.

Mohr, P., "Was könnte die Turkei an Rohstoffen uns liefern? Eine Skizze über die Möglichkeit der Forderung des Bergbaus." *Wirtschafts-Ztg. der Zentralmachte*, 1916.
"Bergbau und Mineralvorkommen in der Türkei." *Mag. f. Technik und Industriepolitik*, July, 1916.

Moutran, N. de, "La Syrie de demain." *France et Syrie*, 2e èd, Paris, 1916.

Schmeiszer, C., "Bodenschätze und Bergbau Kleinasiens." *Zeitschrift für practische Geologie*, Bd. 14, pp. 186-196, 1906.

Schweer, Dr. Walther, "Die türkisch-persischen Erdölvorkommen." Hamburg, 1919.

Siméon, Charles, "Une campagne coloniale sur le chemin de Baghdad." *Revue des deux Mondes*, p. 148, 1916.

Simmersbach, Bruno, "Die nützbaren mineralischen Bodenschätze in der kleinasiatischen Turkei." *Zeitschrift fur Berg-, Hutten-, und Salienenwesen*, Bd. 52, pp. 515-557, 1904.
"Die wirtschraftliche Entwicklung einiger Berg-baubetriebe in der Turkei." *Verhandlungen des Vereins zur Beforderung des Gewerbfleisses*, pp. 487-501, 1905.

Tumoffen, Le P., "Notes sur la géologie du Liban." (*Calcaires du Jurassique, des gres a lignite du Cretacé, des etages Urgo-Aptien, Albien, Cenomanien, Turonien et Senonien, ainsi que la Tertiaire.*) *Congrés Francaise de la Syrie. Séances et Traveaux, Paris, Champion.* Marseilles, Chambro du Commerce, 4to., 1919.

Weakly, Sir Ernest, "Report Upon the Conditions and Prospects of British Trade in Syria." Cd. 5707, London, 1911. With map.

Tabling Sludges and Tailings

Investigative work on the mill sludges of the Wisconsin zinc-mining district is being directed by the Mississippi Valley station of the U. S. Bureau of Mines at Rolla, Mo. Work has been done on the tabling of sludges and fine tailings. The system of floating the sludge table concentrates has been simplified. The system of flotation has been changed so that the "oil rock" impurity can be more effectively removed than heretofore.

Controlling Rock Strata Gases In East Tintic District

The development of certain mines in the East Tintic mining district, Utah, has been hindered considerably by the presence in the rock strata of heavy irrespirable gases which at times flood the lowest working places, as well as by abnormally high rock temperatures in the lower horizons, according to Serial 2275 *Reports of Investigations*, by G. E. McElroy, mining engineer, U. S. Bureau of Mines. Local weather conditions are intimately associated with the gas inflows. The atmospheric low-pressure areas, or storm-centers, that affect the district, almost invariably pass to the north of the district and from west to east, and the local topography is such that winds are diverted to a southwest course that would otherwise assume the direction of a line joining the district and the center of the low-pressure area.

The following theory has been deduced to explain the mode of occurrence of gas inflows: A decrease in barometric pressure causes an increase in volume, according to the laws of gases, of a large body of gas contained in the quartzite and resting on water at an unknown depth. As the gas body is confined on the sides and bottom, the increase in volume tends to raise the level of the gas. However, as field observations show heavy inflows only from shattered and fissured zones, it is concluded that the rate of penetration of gas into the porous quartzite is so much slower than the rate of increase in volume that the excess is pushed up through the shattered more or less open zones that occur in the quartzite. Under certain conditions of rate and amount of decrease of barometric pressure, the gas rises to the levels of mine openings, and an inflow of gas results. The upward travel of the gas is limited by the practically impervious shale overlying the quartzite, except where local fissures in the shale provide access to connected fissure zones in the overlying limestones. As the barometric pressure rises, the increase in pressure causes a contraction of the gas body and the level of the gas in the shattered zones recedes.

Rock temperatures of 80 to 110 deg. in gas-producing horizons 900 to 1,600 ft. below the surface were obtained, and air temperatures in several dead ends indicated possible rock temperatures as high as 120 deg. Rock temperatures appear to be dependent mainly on locality, to a less extent on geologic formation, and practically independent of depth, which in other districts is usually the governing feature. Unfortunately, the highest rock temperatures are accompanied, as a rule, by the lowest relative humidities, but efficient mechanical ventilation of all working places is necessary to provide moderately comfortable and in some cases even bearable working conditions.

The necessity for good air motion at working places and the relatively slow rate of gas inflow indicate that the best remedy is dilution of the gas inflow with large volumes of air by mechanical ventilation. To make the remedy effective under all circumstances, both for efficiency and safety, two independent sources of power for ventilating apparatus should be used.

To Promote Use of American Graphite

A co-operative agreement between the U. S. Bureau of Mines and the Graphite Producers' Association for an investigation as to the possibilities of a more extended use of American graphite is being considered.

Mule Haulage in Metal Mines

Under Favorable Conditions the Use of Mules for Underground Tramming Has Proved Economical—Limitations Include Short Tramming Distances, Reasonable Grades, and Limited Life of the Mine—Treatment of Animals—Maintenance and Operating Costs

BY W. F. BOERICKE

Written for Engineering and Mining Journal

IN CONSIDERING the adoption of any underground tramming system, the following factors must be taken into account: Tonnage to be hoisted daily; distance from stopes or hoppers to shaft; grades and curves to be overcome, and life of the mine.

A system of haulage that may be suited for any one of these conditions may be totally unsuited for the others, and the system decided upon should be that which will show the least cost per ton of operation, taking into account the complete amortization of the capital expense involved when the mine is worked out. For instance, the stopes may be over 2,000 ft. from the shaft, the tonnage desired over 600 tons per day, the grades not heavy, and the track in fair order. These conditions call for mechanical haulage. If the life of the mine is limited, it will probably be better to operate under the higher cost that the use of mules entails, rather than to expend a large amount of money in an expensive locomotive, heavier rails, and an improved roadbed, with attendant disorganization of the mine while the changes are being made, all of which capital expenditure must be amortized before the ore is exhausted.

Hand tramming is suitable only for mines of small output, with tramming distances comparatively short—not over 400 ft. Small cars, of ½- or ¾-ton capacity, are required, as a ton load is too heavy for one man to push unless favored by a grade. The advantage of hand tramming over any other system is the complete absence of any capital expense. With any attempt to increase tonnage, or an increase in tramming distance, the cost of hand tramming becomes prohibitive. Such methods may be used to advantage in cleaning up a small bunch of rich ore, or robbing pillars, where the handling expense is only a small percentage of the total value.

SOME DISADVANTAGES OF MECHANICAL HAULAGE

Mechanical haulage, where conditions are favorable, will show the minimum operating cost. But the tonnage handled must be a maximum and the distance from shaft to stopes must be long enough to show economy in time of hauling, after making all allowance for delay in making up the long trains at shaft and side tracks. Grades, wherever practicable, must be eliminated, or at least eased off as much as possible; curves must be cut out or widened. Unless the track and roadbed are in good condition, the locomotive will promptly search out every weak place and "jump" the track, necessitating vexatious delays in getting it back again, while the work of the mine is held up, and the millman enters on his report "No Dirt." Though it is true that a number of men can be eliminated from underground or put to other work when the change is made to mechanical haulage, the replacement of the engine driver, who may be incapacitated any time from accident or sickness, becomes a serious problem. It is usually an easy matter to put on an extra mule driver or trammer, but a good motor man cannot be picked up on an hour's notice. It is not just a question of operating the engine, although that in itself requires the work of a skilled man. Because of his daily experience over the run, he knows where to put on speed for a grade, where to ease up for a curve, and a knowledge of these matters is most important in the operation of a long train. Furthermore, unless an extra engine is on hand, a breakdown in a vital part of the engine usually entails a shutdown in the mill, so that with a mine running on a close margin of profit, the loss of a day's time with all overhead expenses going on as usual will often completely eliminate the expected economy of the new haulage system for a considerable period.

LIMITATIONS OF MULE HAULAGE

Mule haulage is particularly adapted for mines having the following conditions to meet: Open stopes with mining conducted all on one level; tramming distance over 400 ft. and less than 2,000 ft.; many grades, neither very long nor very steep; many curves, some of very sharp radius, and limited life of orebody, but assured for a reasonable period. These conditions are common to many mines, particularly in the zinc mines of Wisconsin and Missouri.

Good mules can be purchased for from $100 to $150 per head. If the roof is high, and there is an incline down which the mules can be taken underground, large mules should be given preference, for the working capacity of a mule weighing 1,100 lb. or 1,200 lb. is far more than that of one weighing 800 lb. It may often happen, however, that there is no incline and the hoisting shaft is small and without means for installing a special mule cage, or that the tramming must be done in low drifts. Small mules can be taken down the shaft without much trouble by suspending them in a special harness and hooking them under the cage or directly to the cable in bucket hoisting. With a careful hoistman, there is not much danger of accident.

CHARACTERISTICS OF MAUD

The mule is a much maligned animal. It will do an extraordinary amount of work during a shift's time patiently and willingly, if given decent treatment and care. It quickly learns the tracks underground, and knows its route in the dark. Reins can be dispensed with after a few days, and no guidance is necessary. A mule will feel its way along a shaky track with uncanny accuracy, and the only light needed is the cap light of the driver. Electric lights along the track are of course an excellent investment in every way, and by their aid a much better speed can be maintained and the track and roadbed kept in better condition. A mule is in no sense a stupid animal, despite frenzied testimony of the skinners to the contrary. Unlike a horse, it is not nervous, and frequent blasting and boulder shooting do not disturb it in the least.

The number of mules required underground will depend on the tonnage and the distance from the shaft. Cars must be taken away from the shovelers as fast as loaded, whether they work on contract or day's pay. If cars are trammed by hand from the stopes to the central gathering station and there made up in trains for the shaft, there must be a sufficient number of mules to get the loads to the shaft and the cars returned without anyone waiting for empties.

The time required by the average shoveler to fill a 16-cu.ft. car (¾ ton) where there is plenty of dirt and not much time needed for breaking up boulders is from six to ten minutes. Tramming to the siding or layby and returning with the empty will take five minutes more. This is at the rate of from four to six cars per hour. Better records will be made by experienced shovelers.

If the shoveling time is fifteen minutes per car, this establishes a maximum for the tramming time. When the haul to the shaft is short, one mule can serve several shovelers without doubling up on the cars. As the distance increases more cars must be provided and two or more cars will be pulled at one time. With trams exceeding 1,500 ft. it is generally necessary to put in a relay station and an extra set of mules to pull to the shaft. The gathering mules will bring the cars singly or in pairs to the station, where they are made up into the longest trains possible and are then taken by heavier animals to the shaft. This means buying about one-third more cars for the mine.

Fifteen miles is the maximum distance that should be expected of a mule working every shift underground. As this is the total distance of the round trips, the mule will pull loads 7.5 miles. Considering a 1,000-ft. haul to the shaft, the number of trips will be about forty. As the distance increases the number of possible trips decreases unless the animal is run to exhaustion. It is therefore better to get the track into such condition that a number of cars can be taken per trip, and the mileage thus decreased.

GOOD TRACK CONDITIONS DESIRABLE

Mules should not travel faster than five miles per hour for good results, and if long trains of seven or eight cars are used a speed of three miles per hour is enough. Aside from the danger of accidents and derailments that may occur if greater speed is attained, a faster rate than this will wear out the animal quickly and cut down its vitality and tractive effort. It is better to get the track in good condition, improve the oiling of the cars, make an effort to cut down grades and curves, and then put one or two extra cars on the train and cut down the speed, than to make more trips with fewer cars. Mule drivers, especially the younger men, delight in taking chances by racing mules, and a kind Providence apparently protects them from low roof, weak track, and derailments; but it is poor practice and should be discouraged.

A mule needs a 6-ft. clearance between track and roof to work comfortably, and this should be exceeded if possible for large animals. Smaller mules can get along in lower headings, and in some mines, where the clearance was less, spaces have been hollowed out between the ties for them to walk in.

Wherever there is an incline to the mine it is usually advantageous to bring the mules out at the end of each shift. They quickly learn the routine, require little urging to go underground, and still less to come out. Where this is impossible or impracticable, underground stables must be built. These in all cases must be dry. If possible they should be on an upper level or stope, with plenty of ventilation, but not exposed to draft. A sloping floor will aid drainage with individual stalls. The stable should be electrically lighted and kept as clean as possible. A mule tender, whose sole job is to look after the mules, curry, shoe, and feed them, watch their hoofs, and, in case of injury, do a little veterinary work, is worth his pay aside from any humanitarian reasons. If the job is left to the individual mule skinners the animals are likely to be neglected.

Mules should be well fed. Careful figures were kept at a large mine working fourteen mules, to determine the amount and cost of feed for the animals. These mules were all in constant service and averaged about eleven miles per shift, pulling two 16-cu.ft. cars for an average tram of 1,000 ft. The feed needed per month averaged as follows:

Feed	Amount	Per Mule
Hay, tons	3.1	0.22
Oats, bushels	69.0	5.00
Corn, bushels	28.5	2.00

The above figures are rather low in comparison with another mine where twenty-two mules were used on an average tram of 1,450 ft. with layby stations and numerous grades and curves. These were as follows:

Feed	Amount for Year	Per Mule per Month
Hay, tons	83.76	0.31
Oats, bushels	2,424	9.10
Corn, bushels	752	3.00

The cost of feeding will vary with the market price of produce. With hay at $15 per ton, oats at 35c. per bushel, and corn at 60c. per bushel, the cost per mule per day will be about 26c. To this must be added the wages of the mule tender, or a fair allowance of time paid for the attendance, regardless of whether there is an extra man or not. Twenty-five cents per day per mule is not unreasonable for four or five mules, where each driver takes care of his own animal, but when more than eight mules are employed it is better to have one man take care of the entire stable. If the right man is selected he can take care of a large number of animals and the cost of feeding can then be cut to 10c. or 15c.

Rats cause considerable waste around a stable. No more feed should ever be taken underground than is necessary, as the dampness affects it and the rats raise havoc with the grain.

Not the least value of a mule is his ability to exceed his ordinary tractive effort greatly over a short distance. For a short pull, the mule can make some astonishingly steep grades. Regardless of his usefulness on a long haul, therefore, the mule has an undisputed place in gathering cars for the trains and in clean-up work where tracks are rough and only intended for temporary use, the curves sharp, and the grades steep. The following figures, from actual practice, show what can be done. The cars used were 16.5 cu.ft.

Length of Grade, Ft	Per Cent of Grade	Number of Cars Pulled by One Mule
55	6.6	2
35	15.0	1
88	8.7	2
34	12.8	1
31	14.3	1
130	7.0	1 or 2

The ideal grade for haulage is usually taken as between 0.5 and 1 per cent, the gradient of equal traction, where the power needed to pull back the empties is just equal to that required to overcome the friction of the loads coming down hill. In actual mine work, unless on long drifts that are carefully surveyed and driven on line, such an ideal condition is rarely encountered. Tracks will run up and down with variations in the floor of the orebody. Care in selecting the trackway and sometimes changing the line or cutting out a high spot will be amply repaid in added efficiency of the mules.

MULE HAULAGE EXPENSE

The cost of mule haulage is made up of the following items: Cost of feeding; cost of attendance, wages of mule drivers, and depreciation.

The cost of feeding has already been given as 25c. per day, but it varies somewhat with the market price of supplies, although it is nearly a constant charge, whether the mules are worked or not. The cost of attendance can be covered by 25c. per day, and this will also pay for such supplies as are needed, shoes, nails, harness, and other requirements. Wages of mule drivers are about $3 per day on the present scale. They are generally employed on straight time, not contract.

A mule with good care and feed will thrive underground. Barring accidents, there is no reason why mules should not remain below six years or longer, and then, if in good health, they have a considerable value for farm work on the surface. If a mule costs $150 and is worth $50 when taken out, over a six-year period a depreciation figure of $16 per year, or 5c. per day, is enough. The total expense of mule and driver per day is, therefore, $3.55.

The ton mileage obtained will vary with the conditions in the mine, and I am quoting some typical instances. In all cases a 16.5-cu.ft. mine car, weighing 800 lb. empty, with solid body, loose wheels, plain bearings, lubricated with grease through slot holes bored in the hubs, was used. Track gage was 22 in., with 16-lb. rail.

At mine No. 1, the average tram was 1,450 ft. Two cars were hauled per mule. The grades were against the load, the worst pull being 300 ft. of 3 per cent grade. The curves were sharp. No brakes were used on empties; the drivers held back the cars by placing their hand on the mule's rump. The mules were worked hard on account of the long tram, and obliged to travel at a run on the return trip. Data were as follows:

Average tons trammed per shift	[illegible]
Average tram distance, feet	[illegible]
Number of mules	4
Mineral tons per mule	[illegible]
Miles traveled per mule	[illegible]
Ton miles per mule	[illegible]
Cost per ton, cents	[illegible]
Cost per ton-mile, cents	[illegible]

At mine No. 2 the average tram was 2,613 ft. This was covered by using a relay of big mules that picked up the loads at the layby station 1,000 ft. from the shaft and pulled them there in eight-car trains. The gathering mules pulled two cars over fair tracks with less than 1 per cent grade against the loads. On account of the long tram they were worked hard and were worn out soon. This mine was soon afterward changed over to gasoline haulage. The comparative figures are:

Average tons trammed per shift	288
Average tram distance, feet	[illegible]
Number of mules	[illegible]
Mineral tons per mule	[illegible]
Miles traveled per mule	[illegible]
Ton miles per mule	[illegible]
Cost per ton, cents	[illegible]
Cost per ton-mile, cents	[illegible]

At mine No. 3 conditions were better. The average tram was 2,000 ft. over a level grade with curves well proportioned. Large mules were used, taking trains of six cars to the shaft. These traveled at slow speed, about 3½ miles per hour. The figures follow:

Average tons trammed per shift	[illegible]
Average tram distance, feet	[illegible]
Number of mules	[illegible]
Miles traveled per mule	[illegible]
Ton miles per mule	[illegible]
Mineral tons per mule	[illegible]
Cost per ton, cents	[illegible]
Cost per ton-mile, cents	[illegible]

At mine No. 4 conditions were excellent for mule haulage. Cars were taken from the gathering point, 1,483 ft. from the shaft, by two mules per shift, in trains of four cars. The track from the layby station to the shaft dropped uniformly 1½ per cent in favor of the loads on a straightaway run. The track was in good condition and was electric lighted. The cars ran down the grade by their own weight after being started, and the mules went at an easy trot, about five miles per hour, which did not exhaust them. They could easily have taken down a much longer train, but four empties were their limit on the return trip. Brakes were not needed except at the end of the run, when a wheel of the last car was spragged. Comparative data follow:

Average tons trammed per shift	[illegible]
Tram distance, feet	[illegible]
Number of mules	[illegible]
Mineral tons per mule	[illegible]
Miles traveled per mule	[illegible]
Ton miles per mule	[illegible]
Cost per ton, cents	[illegible]
Cost per ton-mile, cents	10.1

The noteworthy mileage made by these mules was no doubt due to the down grade with the loads, which eliminated all hard pulling.

Practical points then seem to be as follows: Use the largest-size mule that can be worked in the drifts; keep track and roadbed in the best possible condition, with the grade, if any, in favor of the loads; load the mule to his capacity (if the grade is about 1 per cent this will be determined by the number of empties he can pull back), and maintain a constant, steady speed—frequent spurts may satisfy the sporting proclivities of the driver but they detract from the mule's efficiency.

It is frequently the case, as in mines No. 1 and No. 2, that the cost per ton may go up while the cost per ton-mile goes down. The same number of mules may take a less number of cars but cover a much longer distance, thus decreasing the latter but increasing the cost per ton, and, until both figures are known, criticism cannot be intelligently made. Knowing the time required for a round trip to the shaft from the stopes, plus delays in coupling and uncoupling cars at the stations, a close guess is possible at the number of mules needed to take care of any tonnage from any distance. For instance, in considering a tramming distance of 1,000 ft., with a tonnage of 300 required, four-car trains are possible, and the estimated time for a round trip, including delays, is seventeen minutes. Twenty-eight trips per eight-hour shift are then possible, mineral tons per mule will be 112 and three mules will be required. The cost per ton will be [illegible], and the cost per ton-mile, [illegible]

It is rare that the tramming problem can be handled by so simple a calculation as this. Conditions are constantly changing, and in an effort to speed up production, a demand for more cars is made, or more speed by the trammers, and the ground boss has a new problem on his hands. A double track is always desirable, and an extra mule will earn his keep many times over in helping out in a pinch.

History of Side-Charging of Reverberatory Furnaces

Recent Patent Litigation in San Francisco Brings Up Interesting Points — Practice Now Used in All Large American Copper Smelters Was Developed in Operating Plants by Smeltermen

EDITORIAL STUDY

RECENTLY LITIGATION has arisen over the method now commonly used for fettling and side-feeding reverberatory copper-smelting furnaces. We have made a more or less extended study of the art of reverberatory smelting of copper ores, and from various sources have summarized the following:

Fettling of the reverberatory smelting furnace is a necessity and has been accomplished in the smaller furnaces by claying the corrosion groove which forms at the matte and slag lines. This was formerly done by driving balls made from clay and siliceous material into the groove with a plugging iron. Peters, in his 1899 edition of "Modern Copper Smelting," on p. 453, gives, among other reasons for waste of time in reverberatory practice, the following: Slow charging through the side doors instead of hoppers—too frequent fettling. In his further comment, he states that the groove in the side lining should be rammed full of a mixture of 80 per cent quartz (hazel-nut size) and 20 per cent raw fireclay. "This should be thoroughly pugged together and made into large balls for use before the furnace doors are taken down. Two sets of men clay the furnace simultaneously from the two opposite sides—after this groove is once thoroughly filled, it can be kept from too rapid cutting by frequently throwing a heavy ridge of siliceous ore against it and all around the edges of the hearth."

In his "Principles of Copper Smelting" (1907), Peters said, "Modern practice has so amended this [frequent fettling] that the fettling is done only once a month or thereabouts. The practice of running the furnace with a more siliceous slag, 42 to 47 per cent silica . . . has little tendency to cut into the lining of the hearth and walls."

PETERS' RULE OF PRACTICE

In "Practice of Copper Smelting" (1911), Peters states (p. 323): "The chief agent in their elimination [undercutting of the side walls and hearth near their junction with the sand hearth] has been the practice of keeping the hearth full of matte so that it is completely protected from contact with the bases of the charge; further, the constructing and maintaining of a broad, heavy border of siliceous material, usually siliceous ores, which protects the contact-horizon completely from any attack of the slag." Peters shows a cross-section of the Cananea reverberatory, with side hoppers and openings in the arch contiguous to the side walls. He states that the feeding of fettling material through these openings intermittently was successful at Cananea, but that the same process tried experimentally at Garfield was not found advantageous, owing to the formation of extensive siliceous "floaters," which caused delay and the use of extra limestone to dissolve them.

In October, 1912, E. P. Mathewson presented a paper on the "Development of the Reverberatory Furnace for Smelting Copper Ores," before the American Institute of Mining Engineers (*Trans.*, Vol. 44, p. 781). In this paper he states that charging hoppers above the reverberatory were in common use in 1848. Fettling was done once a month, but he does not mention side fettling. He shows a cross-section of the Cananea reverberatory with fettling openings in the arch contiguous to the side walls. On three other furnaces used at different plants no openings of this kind are shown. All of the reverberatories are shown with side doors.

THE ANACONDA METHOD

In the large copper-smelting reverberatories at Anaconda, according to H. O. Hofman, "Metallurgy of Copper" (1914, p. 284), the matte is first tapped out and "Two or three doors are opened on each side near the fire-bridge and about 20 tons of self-baking sand (SiO_2, 95 per cent) thrown in during the operation" [fettling].

L. V. Bender presented a paper on Feb. 15, 1915, before the American Institute of Mining Engineers (*Trans.*, Vol. 51, p. 743) in which he described the coal-dust-fired reverberatories at the Washoe Reduction Works, Anaconda, Mont. In the furnace described, he states that there were no side doors to this furnace "as it was thought that with the arrangements for feeding, no 'fettling' or 'claying' would be required." The charging was done in either side of the furnace from longitudinal hoppers, extending a distance of 74 ft. from the back end of the furnace (124 x 21 ft.). Leading from the hoppers into the furnace were 6-in. pipes, spaced 19½ in. apart, through which the charge was intermittently dropped. The charge was kept well above the slag line at all times; in this way the side walls were protected and no fettling was required on this portion of the furnace, but it was necessary on the remaining portion. In a larger furnace at that time being planned he stated that the side feeding would be extended the full length of the furnace. A cross-section of this furnace is shown in the paper.

In February, 1915, David H. Browne described the furnaces of the Canadian Copper Co. (*Trans.*, A. I. M. E., Vol. 51, p. 752). He states that during 1913 the reverberatories were modified to make use of the Cananea system of side fettling. "Long and shallow pockets were provided along the side walls, and through holes in the roof, green-ore fines were fed to protect the sides."

DEVELOPMENT OF SIDE FEEDING IN ARIZONA

In September, 1916, F. N. Flynn presented a paper on "Smelting at the Arizona Copper Co.'s Works" before the Institute (*Trans.*, Vol. 55, p. 805). In this he states that the 100 x 22-ft. reverberatories were constructed with 6-in. holes, spaced at 24-in. centers, in the roof along the side walls and across the back, to allow the fettling material to be piped into the furnaces from trough-shaped bins. Seventy-five per cent of the total solid charge was introduced from hoppers at the end of the furnace and twenty-five per cent from the side hoppers. For fettling purposes, ores and by-products were crushed to 2½-in. size. "Prior to July, 1914, the height of fettling was carried not to exceed 6 in. above the slag line. This height was gradually increased until October, 1914, when the practice of fettling to the holes in the roof was begun and later successfully adopted after the size of fettling material was increased from ¾ in. to the present 2½ in. size. The coarse size stands better. It reposes at an angle of 45 deg. above and 45 to 60 deg. below the slag line."

Under the same date (September, 1916) A. G. McGregor describes the International Smelting Co.'s reverberatories at Miami (*Trans.*, Vol. 55, p. 781). Mr. McGregor states: "The method of charging, instead of fettling only, along the side walls of reverberatory furnaces, now so successfully used by the Canadian Copper Co. and the Anaconda Copper Mining Co., was developed after the construction of this plant was well along. The plant was laid out for charge tracks running at right angles to the furnaces near the firing end. In order to distribute the charge along the sides of the furnaces, charge hoppers were located under the charge tracks directly over the side walls of the furnaces. Drag-chain conveyors were installed, one over each side of the furnace, which received the charge from the charge hoppers. Under these conveyors, approximately every 30 in., suitable down-spouts with gates were provided so that the charge may be distributed along the side walls of the furnaces throughout their length."

FETTLING ESSENTIALS

The two essentials for fettling are highly siliceous material and the depositing of this material along the walls at the corrosion groove. There has been no change in principle since Peters described the method in 1899. Side-wall protection from corrosion has always been accomplished by either the careful ramming of siliceous material, bonded by clay to enable it to hold together, or by simply shoveling enough siliceous material to fill the groove. Necessarily, the thrown material assumed an angle of repose, and a sufficient surplus was necessary to bring the top edge of the fettling material well above the top of the corrosion line.

The substitution of highly siliceous ore for highly siliceous material was a natural development, and necessity in some cases compelled metallurgists to use ore instead of barren material. The introduction of the siliceous material through holes in the reverberatory arch contiguous to the side walls was undoubtedly an improvement, as it enabled the banks of siliceous material along the side walls to be added to at any time without interfering to so great an extent with the operation of the furnace as by the method of shoveling through the side doors. Side doors became unnecessary, and coarse siliceous ore was substituted for the more efficient siliceous material because it was more economical to do so in most instances. Thus the novelty concerned itself with the manner of depositing the material for fettling, and not with the protection of the side walls. The change from feeding the charge in two parts, the greater part through the usual charge hoppers and the remainder on the sides, to feeding the entire charge through the side hoppers, was a gradual development in practice.

The first description of fettling through the arch of the reverberatory appeared in a paper by L. D. Ricketts, published in the *Transactions* of the Institution of Mining and Metallurgy, Vol. XIX, 1909-10, p. 160, in which Mr. Ricketts states, "Fig. 5 illustrates the method of charging the furnace to protect the side walls from corrosion at the matte line. This method originated in Cananea, I think, and was suggested by Mr. Gmahling and installed by Mr. Shelby. The wide walls are built with a slight batter, as shown in the sketch, a 5 x 5-in. aperture is left in the arch close to the side walls on either side, and these apertures are 18 in. between centers for the entire length of the furnace. A hopper on either side of the furnace travels on a rail, so that the charge of fine siliceous ores, previously wetted down, may be brought over one of the holes in question." This paper was subsequently published in the *Engineering and Mining Journal*, Vol. 89, p. 317, and in the *Mining World*, Vol. 31, p. 1,116.

On March 14, 1914, the *Engineering and Mining Journal* (Vol. 97, p. 583) in an editorial, referred to fettling through the roof of the reverberatory. This elicited a letter from Henry L. Charles, who was then at La Fundicion, Peru. In this letter, published on Oct. 31, 1914, (written on Aug. 18, 1914,) (Vol. 98, p. 798), Mr. Charles claims to have been the first to discover the idea of side fettling with ore and calcines to prevent corrosion of the side walls of the reverberatory, and refers to his patent No. 871,477. In the *Engineering and Mining Journal* of Jan. 23, 1915, (Vol. 99, p. 206) L. D. Ricketts, in a letter under date of Nov. 13, 1914, said: "The first fettling through the roof of a reverberatory furnace of large size was planned and put in operation by Charles F. Shelby and William Gmahling, in the winter of 1906, at Cananea, Sonora, Mexico. Mr. Gmahling thrust holes along the side walls and the bridge, and experiments were tried in fettling the furnace through these holes. The device proved successful, and when the furnace was closed down in December, 1906, and given a general overhauling, fettling holes were made in the arch at about 2½-ft. intervals along both walls and over the bridge, and when the furnace was started immediately thereafter, and prior to March, 1907, the method of fettling was proved to be a success and has been followed ever since."

Henry L. Charles replied to Mr. Ricketts' letter in the *Engineering and Mining Journal* of Oct. 16, 1915 (Vol. 100, p. 648), by referring to his work in Butte and Salt Lake in 1905, 1906, and 1907. He stated that in the spring of 1905, at Butte, Mont., while in charge of the Montana Ore Purchasing Works, he drew his first plans of a reverberatory furnace with side hoppers to feed siliceous ore for fettling and smelting purposes. Subsequently, in the spring of 1906, he started to remodel the reverberatory furnace at the Bingham Consolidated plant at Salt Lake with the idea of incorporating his feeding and fettling scheme. He secured the services of W. N. Tanner at that time in preparing plans and working out the unfinished mechanical details. Mr. Charles' statement, so far as we are aware, stands uncontroverted, and appears to be the last word in the rather meager history of this important improvement in copper reverberatory design and practice. Apparently Mr. Charles and Charles F. Shelby and William Gmahling were working at about the same time along similar lines. In point of time Mr. Charles, according to his statement, anticipated Cananea. All three of these men were practical metallurgists and developed their ideas in operating plants.

The recent lawsuit in San Francisco in which the claim was made that the use of fettling and ore feeding through the arch of the reverberatory at the side walls of the furnace was an infringement of certain patent rights granted to George C. Carson brings about an interesting situation. Mr. Carson won his suit against the Afterthought Mining Co., and was awarded nominal damages of $1. Application for patent was made by Mr. Carson on Jan. 15, 1907, and a patent was finally granted to him on Aug. 10, 1915, (No. 1,149,495), in which he claimed: "In a metallurgical furnace having receptacles arranged above the roof thereof, passages from said receptacles leading to said furnaces arranged in such a manner that the material in said receptacles passes out into said furnace by gravity and forms the lining thereof." The drawing in the patent specification shows an arrangement similar, in principle at least, to the ordinary fettling arrangement, but also indicates that the inventor intended the bottom or hearth of the reverberatory to be renewed by the accession of material from the side hoppers. Under date of April 29, 1919, (No. 1,302,307, applied for June 26, 1915), Mr. Carson was allowed three claims as follows:

"1. In a furnace roof for open-hearth and reverberatory furnaces, having charging ports around the outer edges thereof; said ports being made of metal cooling blocks that serve the purposes of protecting said roofs from the scorification of materials fed through said ports, and stresses caused by varying temperatures within said furnaces.

"2. The method of protecting the walls of an open-hearth or reverberatory furnace which consists in feeding the ores or fettling materials into the furnace chamber near the upper part thereof, and in causing the same to form a sloping embankment resting upon the floor of the furnace chamber and along the walls within the chamber between the bath and walls

"3. In an open-hearth or reverberatory furnace, a floor, walls extending upwardly from the floor, and feeding ports leading into the upper part of the furnace chamber and being so located that the ores or fettling materials entering therethrough may have unrestricted vertical movement downwardly to the said floor near the walls and may form sloping embankments against the walls to protect the latter from the heat and corrosive action of the metal bath."

On Nov. 29, 1907, (patent No. 871,477, applied for March 26, 1907), Henry L. Charles was granted a patent which covered substantially fettling through the arch adjacent to the side walls. This patent, we are informed, was sold to the American Smelting & Refining Co. On Aug. 2, 1910, (No. 966,285), a patent was granted to F. W. Winkler, which describes, as a part of reverberatory furnace construction, side feeding of ore through the arch adjacent to the side walls, with the object of protecting side walls.

BRITISH PATENT OF 1867 MAY ALSO APPLY

An additional element of interest is afforded by the fact that Charles William Siemens was granted a British patent on March 20, 1867, (A.D. 1866, Sept. 20, No. 2,413, provisional specification), that involves the idea of feeding ore through the arch of a reverberatory furnace in close proximity to the side walls. Quoting from the specification: "My invention further consists in the construction of furnaces by which the above-described process may be carried into effect, the same being modification of the regenerative gas furnaces described in the Specification to certain Letters Patent granted to myself, in conjunction with Frederick Siemens, on the 22d of January, 1861, No. 167, which improved form of furnace may also be used with advantage for the fusion and reduction of copper and other metallic ores. The arrangement of furnace which I prefer to employ for this purpose consists of an oblong or polygonal firebrick chamber, two or more sides of which are formed as inclined surfaces, which chamber is closed in at top by means of a firebrick arch having openings, which may be provided with slides through which the ore is introduced on to the inclined surfaces."

Although the Siemens invention was primarily intended for steel furnaces of the open-hearth type, Siemens' statement shows that he believed that it was not restricted to steel making but might be used for the reduction of copper and other ores. A United States patent was taken out by Mr. Siemens on April 11, 1871 (No. 113,584).

The patent situation, involving as it does four American patents, excluding the older Siemens patent, is intricate. Although Mr. Carson's application for patent was first in point of time, Mr. Charles' patent was the first granted. Unless an applicant reveals to the art in a substantial manner the idea involved, there is no way by which this information can be obtained. Thus the copper smelters knew about the Charles patent in November, 1907, whereas the first Carson patent was revealed on Aug. 10, 1915, and the second on April 29, 1919. Before either of these dates, practice had advanced by slow stages until the side feeding of both charge and fettling material had become established.

George C. Carson, the patentee, had worked in refineries and subsequently became an assayer and reported on mines. According to his testimony at the trial he evolved the conception of the principle of his patent in 1902, but made no practical application of it, nor was it used by anyone. After applying for patent he tried to have the practice adopted by the Montana Ore Purchasing Co., but was unsuccessful. His efforts to interest other companies and individuals also failed.

The first patent was under consideration in the Patent Office from Jan. 15, 1907, to Aug. 10, 1915, or over eight years. According to our San Francisco correspondent's report in the *Engineering and Mining Journal*, Sept. 10, 1921, p. 247, the Carson application of Jan. 15, 1907, was referred back to Carson, as it covered three separate and distinct inventions. Mr. Carson cancelled his claims covering specific hearth structures and specific roof structures, and a patent was issued on Aug. 10, 1915. On June 26, 1915, Carson filed a second application in which he disclosed a furnace having two rows of holes arranged along the sides of the arch but without any hoppers being provided. A broad patent was issued on this application in 1919. Judge Van Fleet ruled during the trial that the application for the second patent was not a proper divisional application, and that, therefore, the date of such application could not be carried back to Jan. 15, 1907, but must be deemed to be June 26, 1915. If this ruling is sustained in subsequent suits, it would appear to invalidate the broader patent if it is not invalidated for other reasons.

The Afterthought case did not clear the situation, and it appears to us that only further action at law can establish the validity and scope of the patents involved. As far as can be ascertained from the testimony of Mr. Carson, he conceived the idea first, but was not able to get any one to try it in practice. Mr. Charles seemingly was the first to try the method on a practical scale, this being done at the plant of the Montana Ore Purchasing Co. at Butte. Some months later, apparently, Gmahling and Shelby, working independently of Charles, established the practice at the Cananea smelter, which seems to have been the first plant at which the method of feeding was made the permanent practice.

BY THE WAY

A Copper Shop

My attention was directed to a tiny advertisement in the paper I held. It said Ye Copper Shop—The Romance of Copper—East 44th St. The "romance of copper"! What could it be, I speculated. Then I picked up hat and coat and started out for an explanation. I turned off Fifth Avenue and soon found a modest shop. My attention was first attracted to the polished copper trim upon the plate-glass front and then to a bronze figure of a gnome that upheld a copper lantern bearing upon its translucent glass sides the sign "Ye Copper Shop." I entered the attractive room, mentally noting the bronze door handle and elaborate plate, my eye catching sight of the bronze hinges at the same time. The room was like a drawing room. Red-brown rugs, mahogany tables, and comfortable brown wicker chairs were tastefully distributed about. On the right was a beaten-copper jardinière, out of which grew an exuberant fern. On the left was the bronze statue of a miner. Just beyond was a copper-bound glass showcase, in which I noted many extraordinary specimens of copper minerals, native copper, azurite, malachite, chrysocolla, and others. Then my eye caught sight of the walls of the room. Some artist of more than ordinary ability had spread the story of the copper mining districts in a series of drawings which made the room appear to stretch out in all directions. Here was the ocatilla of Arizona in the foreground and a great smelting plant in the background; next a bit of sage brush, and beyond that the slashed and terraced hills representing a great open-pit copper mine. Other well-known copper mining centers were depicted and then a splendid series showing the different stages in the reducing of the ores.

I was entranced. I retraced my steps and thoughtfully looked each picture over again. Here was an industrial epic in colors, I said half aloud. Then I stepped past a portière draped with copper-colored hangings and into an alcove. On the one hand was a slim pedestal of wrought copper, and surmounting it a tiny bronze, the "Flower Girl." Its outstretched hands appealed to me. Suddenly over me came the desire to possess. I wanted that statuette. An attendant had noiselessly appeared at my side. Without taking my eyes from the little bronze, I laconically and perhaps pessimistically said, How much? Ten, he said. Mine, I said, reaching for my purse. Then he left and reappeared in an instant, handing me a package in exchange for the bill. At the same time, he said: "The Copper Shop is the idea of a skilled artist who delighted to work in copper. He believed that if quantity production could be applied to the more highly artistic work of gifted sculptors the selling cost could be made low enough to be within reach of many who appreciated art but whose desire for possession was repressed by their inability to purchase. The little bronze you purchased under ordinary conditions would have cost you at least six times the price you paid."

With a great feeling of satisfaction I clasped the package in both hands. I turned. My eyes were delighted by a ruby red copper bowl which reposed in gorgeous splendor upon a small table. How much? I asked again. Two-fifty, he said. Mine, I said. With my purchasing power for the moment satisfied, I went from alcove to alcove. In each there was some rare object of art made from copper or bronze. I wanted them all, but, I reflected, I can come again. In the last alcove was an exhibit of brass, bronze, and copper building hardware and opposite many other architectural and decorative uses of copper and brass. I was looking them over carefully reflecting: So this is the romance of copper—when suddenly everything faded away and I found myself looking at the metal price page of *Engineering and Mining Journal*. "Some dream," I said to myself as I noted the copper price, 13c. per lb. "Well, I must have paid a royal per pound cost for that copper junk I bought," as I shook myself and rubbed my eyes.

The Renaming Contest

Replies are beginning to pour in from contestants for the prize offered for making the best suggestion as to a more suitable name for Mrs. H. P. Whitney's creation which she has named "The Engineer." The figure referred to, that of a man crouching over a shovel, is shown on page 777 of the issue of Nov. 12. L. P. Kerruish, of Sullivan, Mo., says that it looks more like a prospector, and states that he has done a great deal of prospecting. P. Kelly, of Butte, thinks they mixed the babies at the christening, so to speak, and that the figure represents a mule skinner clearing the track after a spill, cussing profanely the while. Izzy Solowski, a dealer in secondary metals, of Pearl St., New York, thinks that it's all a fake—that it isn't an engineer at all. "Take it from me," said Izzy, when he called, "more should it be a statue of this here feller, Henry Ford, digging the boys out of the trenches by Christmas." Izzy's opinion will not be considered, however, for we know he is prejudiced against Mr. Ford.

In the near future we shall run a photograph of the prize, a box of Chiclets, to arouse a keener interest in the contest. Eleven weeks more to go! It is urged that answers be sent in as early as possible, so that the mails may not be congested around the holidays.

Introducing Charles Sharp

The days of the burro are gone, but Charles Sharp, of Hanford, Cal., is now with us, so let gloom chase itself and joy be unconfined. The orthodox way of discovering bonanzas formerly was to lose a donkey out and let him kick a few chunks off the landscape. Then, hopefully examining the freshly exposed rock surface, one was almost sure to find evidence that he was standing over a great storehouse of untold mineral wealth. But Charlie works differently. "For over forty-one years I have watched with interest the career and achievement of my old friend and co-worker, Luther Burbank, in the study, investigation, and mastery of the vegetable kingdom," says Mr. Sharp, "and for a like time my attention and study have been directed toward the mastering of the mineral kingdom." He has succeeded, and, apparently going with divine right, uses a divining rod of [illegible] [illegible]. Germany is the only country that will patent mineral instruments, he says; hence he does not sell them. In this he is wrong, for a glance at the *Patent Gazette* shows that one can patent anything, no matter how peculiar the idea. All success to Mr. Sharp! May he bring back the days of '49 to California

Preparation of Fuller's Earth in Florida

Open-Pit Mining Is Followed by Crushing, Drying, and Grading Of the Mineral, Which Is Used Chiefly in Clarifying Vegetable And Mineral Oils—Finely Ground Grades Are the Most Expensive

BY STRAUSS L. LLOYD

Written for *Engineering and Mining Journal*

CLAYS having the properties of fuller's earth are widely distributed in the United States and are confined to no particular geological horizon, although the largest known deposits belong to the Cenozoic Age. By far the greater part of fuller's earth occurs as a distinctly stratified sedimentary deposit, from which an overburden must be removed in mining. In Arkansas, however, some fuller's earth is known which is of exceptional occurrence in that it is residual, having been formed in place from the disintegration of basaltic dikes.

The fuller's earth of southern Georgia, which is worked at Attapulgus, near the Florida line, represents a northward extension of Florida deposits. In central Georgia near Macon, however, is found a different type of fuller's earth, which, according to the Georgia Geological Survey, is the Claiborne formation of the Eocene. This mineral differs in some important respects from that of Florida, being used chiefly for the clarification of vegetable oils, whereas the Florida grade finds its chief application at present in the clarification of mineral oils. The fuller's earth of Arkansas is also used chiefly in clarifying vegetable oils. The fuller's earth of Colorado is said to be used in bleaching cottonseed oil, and that of Massachusetts is used in fulling woolen goods. The fuller's earth of California is used, according to the state mineralogist, as a clarifying agent in the refining of crude oil.

Florida is practically the chief producer of fuller's earth in the United States. The deposits being worked are those of Gadsden County, in northern Florida, and of Manatee County, in the southern part of the state, the mineral being found at both localities in the Alum Bluff formation of the Upper Oligocene.

All the sedimentary deposits of fuller's earth are mined by the open-pit method, the overburden being removed by steam shovel in the larger mines and by mule team and scraper or pick and shovel in the smaller ones. The depth of overburden that can profitably be removed is variable, depending, as it does, upon the thickness and quality of the fuller's earth stratum beneath and upon the character of the overburden itself. In the Florida mines the maximum overburden removed is from 12 to 14 ft. thick. This consists of sand, clay, and in some cases marl. The fuller's earth in these mines includes two strata, each from 6 to 10 ft. thick, and separated by a thin stratum of sandy or calcareous material. As a rule only the first stratum is worked. The fuller's earth itself is dug with pick and shovel, and loaded on to cars to be drawn to a plant, where it is broken up by passing through a crusher, thus facilitating both handling and drying. Although the material is usually taken directly to the crusher, in some instances it is placed in storage bins and air dried before being crushed.

The driers employed are for the most part rotary cylinders. Those in use in Florida are 40 to 60 ft. long and about 6 ft. in diameter. When in operation they rotate slowly, the mineral being moved along by means of flanges attached to the inside of the cylinder. These cylinders are heated to a moderate temperature by petroleum burners, the heat being applied either at the end where the wet earth enters, or at the opposite end, from which the dry earth escapes. No precautions are necessary to prevent overheating in these plants, as the earth is used for filtering mineral oils, but when fuller's earth is to be used for edible oils precautions are taken to avoid overheating, as driving off the combined water is supposed to be injurious. To guard against overheating, especially constructed rotary cylinders are used, or the mineral is run into brick form and dried in tunnel driers through which hot air is forced. Although the English fuller's earth is injured by driving off the combined water, it has been found that some of the American earths bleach fully as well after the combined water is removed. It is probable that precautions against overheating for the use of edible oils are sometimes unnecessary.

In grinding, a variety of mills are in use. After grinding, the fuller's earth is bolted. That intended for refining petroleum is bolted to a definite size and placed on the market graded as 15 to 30 mesh, 30 to 60 mesh, and 60 to 80 mesh. The coarser sizes are in most demand, but as a rule no market exists for material passing a 90 mesh, which is not infrequently a total loss, being thrown into the dump. For edible oils it is said that fuller's earth should be ground to pass 100 mesh, but that there should not be an excess of exceedingly fine material, which would clog the pores of the coarser material and prevent successful filtering. The grades differ in the degree of fineness to which they can be successfully ground. Whereas English fuller's earth is ground to 120 mesh without having an excess of very fine particles, much of the American mineral cannot be ground finer than 100 mesh, for edible oils. It is true also that the mill employed must be adapted to the particular fuller's earth for which it is to be used.

Most fuller's earth imparts more or less taste to the edible oils, and formerly American grades were rejected by refiners of edible oils on this account, but methods are now known for removing taste and odor from the oil by blowing dry steam through the refined oil heated to a temperature above the boiling point of water. A serious difficulty in its use is the rapid oxidizing action which some fuller's earths have on edible oils. In milling practice, air is blown through the filter press to force out the oil remaining in the fuller's earth after treatment. With some of it, the oxidizing action is so rapid that the oil remaining in the mineral takes fire, or is liable to take fire. It is hoped that this difficulty will be overcome.

Fuller's earth used in clarifying mineral oils, which includes by far the greater part of that produced in America, is sold at the mine, ground, bolted and sacked for shipment. That used for refining vegetable oils brings a somewhat higher price, as more expense is incurred in handling the material, as it must be ground finer for vegetable than for mineral oils.

HANDY KNOWLEDGE

Neighborly Chats With the Foreman

Tool Waste

By Duncan MacGregor

Written for Engineering and Mining Journal

Yesterday, Jim, I went over our small-tool account with the storeroom clerk. He was telling me that the number of small tools served out to the mine had increased greatly over some of our good records of past years. You say that you have a pretty poor crew on the whole. Possibly, Jim, you haven't put your mind on this detail. I know that you are hard put to get tonnage and keep it moving, but perhaps some improvement is possible. Let me suggest that you get your notebook busy and first set down under each unit, muckers, stopermen, raise men, shaft men, timber men on drift and crosscut work, drillers on drift and crosscuts, pipe men, pump men, trammers, electricians and underground mechanics, the tool kit each is required to have for the efficient performance of his respective tasks. Take several trips through the mine at the end of the shift and note where tools are mostly placed. Then decide the best places for them and make each man or one in each gang responsible for placing the tools in these places. When you go your rounds get a report from each unit or responsible head as to whether the tool kit was complete and in its customary place. You will quickly spot the careless men, and by discussing the trouble with them in your tactful way, you can get them to come through in the course of a couple of shifts. No, I wouldn't post rules and regulations about this. Just let your shift bosses and your men know what you want. Make up your mind, however, on what you want first.

For tools that are most used, pick out places close to the working places, as you can't waste a man's time in going long distances to get his tools. The two important time losses, you know, are making ready and preparing to quit. Tools that are rarely required but that are needed on a level should be placed in a locker at the station, and tools that are needed for special jobs, as by electricians and mechanics, should go to and from the job with the worker. A tool room in the surface plant near the shaft is best for them, and the respective workers should be made responsible for their safe return. Give them also a proper bag in which to carry the necessary tools. A plumber or a carpenter seldom loses his own tools, for he will have his own box or a bag.

Have your tool nipper keep a close account of the drill steel required for each shift, and of the sizes and kinds for each level. Have a rack made at the station for all the sizes and kinds and have one half or a full shift's supply always on hand. Have a special car designed for receiving the used steel and place one of these cars on each level where much steel is used. This will avoid rehandling of used steel at the station. After the men are hoisted, the steel car can be returned to the shop and reloaded with an equivalent amount and kind and returned to the level. Have a number of extra tools of the kind most used in stock at the station. Unfit and broken tools should be returned to the shaft station and replaced from this stock.

Have plenty of tools. It isn't the number that you have in stock or in circulation that counts, it's the waste of them that brings us nearer to the red. Tools dropped into waste fills or hidden back of timbers or dropped into chutes count on the cost sheets. A worn-out tool is the best evidence that its cost has been earned in service.

Air-Lift Calculations

By George J. Young

Written for Engineering and Mining Journal

S. F. Shaw, in his article on "Air Lifts for Mine Drainage," in *Engineering and Mining Journal* of June 5, 1920, p. 1,263, gives data for the computation of the proportions of air lifts. An approximate calculation can be more readily made by use of the following figures:

Air Pressure Lb. per Sq. In.	Free Air in Cu. Ft. per Min. for 1 Hp. (a)	Gallons Water per Minute Lifted 100 Ft.: 1 Hp. Assumed Efficiency, Per Cent 40	35	30	25
110	6.19	15.82 (0.391)	13.85 (0.447)	11.86 (0.521)	9.89 (0.625)
100	6.48	15.82 (0.409)	13.85 (0.467)	11.86 (0.546)	9.89 (0.655)
90	6.82	15.82 (0.431)	13.85 (0.492)	11.86 (0.575)	9.89 (0.689)
80	7.26	15.82 (0.459)	13.85 (0.524)	11.86 (0.612)	9.89 (0.733)

(a) Theoretical amount of air for two-stage compression. Figures in parentheses are cubic feet free air per gallon per minute lifted 100 ft.

As efficiency increases with an increase in per cent of submergence, the lowest efficiency may be assumed for a submergence of 20 to 25 per cent; 30 per cent efficiency for 25 to 30 per cent submergence, and 35 per cent efficiency for 40 per cent submergence. It should be noted that for a given position of the air lift the submergence grows smaller as the level of the water falls. As a consequence, either the amount of compressed air must be increased or the capacity falls. A constant capacity cannot therefore be looked for under such conditions unless increased air is available or submergence is maintained at a constant figure by lowering the air lift as the water recedes. In this situation, the lift is also increasing, and this would lower capacity. By assuming a velocity of from 500 to 1,000 ft. per minute for the air-water mixture at the foot piece (volume of free air reduced to volume at working pressure), the cross-section of the lift pipe can be calculated. The first velocity may be used where the column is to be of uniform diameter and the second where the upper 20 per cent of the lift pipe is made of larger diameter than the lower. By calculating the expansion of the air as it rises in the lift column it will be observed that the relative expansion is greatest in the last 20 per cent of the lift. Hence the lift pipe may be made of uniform diameter for about 80 per cent of its length (including the submerged portion), and then increased within reasonable limits from this point to the point of discharge. The discharge velocities of air-water mixture noted by S. F. Shaw range from 2,500 ft. per minute at a maximum efficiency to over 5,000 ft. per minute when operating at maximum capacity.

The conditions attending the operation of the air lift for mine drainage are unlike those pertaining to air lift pumping from wells, and as a consequence exact methods for calculating portions of the air lift are not of special value. These conditions are: Submergence limited by obstructions in the shaft; a decreasing submergence and increasing lift as the water is lowered; the necessity for periodical lowering of the air lift as the water level recedes.

The maximum pressure upon the lift column is at the water level, as below this level the column is surrounded by water which exceeds in hydrostatic head the hydrostatic head of the air-water mixture in the column. The strength of the column, therefore, need be no greater than necessary to meet the internal pressure of the air-water mixture at lift height and water level corresponding to least submergence. A pipe calculated to withstand the maximum air pressure used will be more than sufficient to meet this condition. Where the lift column is suspended, the cross section of the metal and the connections should be calculated to withstand the weight of the pipe.

The Size of the Stick of Powder

Written for *Engineering and Mining Journal*

Miners get into the habit of using a certain number of sticks of powder for a hole of given depth. Sometimes more but seldom less is used, depending upon the miners' judgment. If the hole breaks well the miner is satisfied, although an excess of powder may be used. As the miners' operations are distributed over many working places, it is a difficult matter to effect economy in the use of explosives. By counting the sticks of powder, some miners have secured increased efficiency. This is a method to which the careful miner responds.

Nevertheless, a stick of powder is a stick of powder, whether it is "extra" dynamite or a 35 per cent powder. There are, however, about 100 1¼ x 8 in. sticks or cartridges of extra dynamite and about 135 sticks of certain brands of ammonia dynamite to a 50-lb. box. The higher-grade explosive is much more expensive, and there are fewer sticks to the box, so that the cost per stick is relatively much greater.

Here is where the foreman can secure more economical use of powder. By using the lower-grade explosive where the nature of the rock or ore is such as not to require the higher-grade explosive, the same number of lower-priced sticks of powder will serve the purpose. It is possible by counting the sticks and using the lower-grade powder to affect a saving of 35 per cent in the weight of explosives used. In a year's time this economy results in a considerable sum.

Lower-grade powders averaging 150 sticks per 50-lb. box are also manufactured, and experimentation is worth while with these powders. If they will do the work, a still greater economy is possible.

Increasing Shaft Capacity

Written for *Engineering and Mining Journal*

In small mines with cage hoisting, a limit is speedily reached with respect to maximum hoisting capacity. The most effective way of increasing capacity is to increase the load hoisted at one time rather than to increase the speed of hoisting. This can be done by adding another deck to the cage.

Rope diameters must be suitable for the added load, and where the hoist is motor driven, it is necessary to change the motor to a larger one if the first motor was closely proportioned to the single-deck load and the speed of hoisting. By the use of skips instead of cage hoisting, a still greater increase in capacity can be obtained without special changes in the hoisting engine.

Treatment Rates on Gold Ores

Rates recently charged by the Golden Cycle Mining & Reduction Co., of Colorado Springs, Col., for treating gold ores are given in the following table:

To and including $4.50 per ton value,	$2.00 per ton plus $1 freight
Over $4.50 and including $8 per ton value	$2.25 per ton plus $1 freight
Over 8.00 and including 10 per ton value,	4.00 per ton f.o.b. mill.
Over 10.00 and including 15 per ton value,	5.25 per ton f.o.b. mill
Over 15.00 and including 20 per ton value,	6.25 per ton f.o.b. mill.
Over 20.00 and including 25 per ton value,	6.60 per ton f.o.b. mill.
Over 25.00 and including 30 per ton value,	6.90 per ton f.o.b. mill.
Over 30.00 and including 40 per ton value,	7.50 per ton f.o.b. mill.
Over 40.00 and including 100 per ton value,	8.60 per ton f.o.b. mill.
Over 100.00 value per ton.	5.50 plus freight (graduated).

A Problem

Did Columbus discover America, or was it some darker-hued explorer from Africa? This is a question propounded by the Copper and Brass Research Association. Bulletin No. 3, issued by the organization on Nov. 10, prints the following:

"Did African slaves roam the soil of West Virginia two centuries before Columbus discovered America?

"That is a question puzzling coin collectors and ethnologists of that state.

"A Sparksburg boy has just dug *a copper coin, approximately 600 years old*, from a virgin vein of coal at a small mine near his home, finding it firmly embedded in the seam while helping his father at the mine.

"On one side of the coin is a crude picture of a human head and skull. On the other side is the date 1330, while there also appears a unique design similar to that found on a rare specimen of African postage stamp, thus indicating that the coins may have been of African origin.

"Now, this being the case, could African slaves have roamed what is now West Virginia six centuries ago? If so, how did they get here? Furthermore, could the seam of coal be formed geologically within that time?"

This is a problem to stagger the wits of Sherlock Holmes. What a large number of questions rolled into one, and each a baffling one at that! That copper should have lasted six hundred years is nothing. Roman coins of copper or bronze are common enough. We direct the attention of the research scientists of the Copper and Brass Association to the Book of Mormon, which may shed some light on the subject. In this volume is an account of an American civilization that antedated Columbus' time.

As to whether a seam of coal can be formed in 600 years, briquets can be made in ten minutes!

A Bad Name Lived Down

The reputation that smelters have "enjoyed" among their customers needs no telling. Whether it is justified is another matter. Likewise the custom assayer is often tarred with the same stick, in the minds of some, who hold that he throws their samples away without running them, but charges for them just the same. It is interesting to note that in parts of Latin America the proper Spanish equivalent of "custom mill" is *molino de trasquila*, by which no reflection on the millman's honesty is intended, though literally it means a mill where "shearing" is done, in the Wall Street sense. Years ago the term was undoubtedly used with its implication of dishonesty, but time has made it commonplace.

THE PETROLEUM INDUSTRY

Oil Prospects in Australia of Little Consequence

SPECIAL CORRESPONDENCE

The discovery of oil would be an event of great importance in the development of Australia, but apart from the oil shales being worked in a perfunctory fashion, it cannot truthfully be said that the prospects of discovering petroleum are alluring. There is quite a boom in the organization of oil companies, and a great deal of money is being spent in putting down bores, but there is no geologist of standing who will risk his reputation by recommending such work. One recent prospectus may be quoted as showing how little justification there is for the expenditure of money in this direction:

"This company is being formed to prospect for oil on Block 16 on the Roper River, Northern Territory, containing about 1,000 square miles, on information supplied to our Darwin agent who writes as follows:

"The information I received was that this man camped at a certain spot for about a week some four or five years ago, in a large swamp, and on pulling up some roots to put on the fire the roots blazed up as if they had been soaked in oil, and smelt of kerosene. He also said that the water about the swamp had an oily coating on the surface; also that when lying on the ground at night he could hear rumbling sounds underneath, similar to what might be heard in coal country or where there was gas escaping. He has marked the place out on the plan for me."

Considerable excitement was occasioned in Western Australia recently by sensational reports as to the discovery of oil sands at Bremer Bay, in the southwest of Western Australia. The government promptly sent a geologist to the locality. He took samples for analysis, with the result that no trace of petroleum was detected nor any trace of ozokerite or asphalt such as form surface indications of the existence of oil seepages. Oil has been found in the territory of Papua and also in New Zealand, but not in payable quantities.

The Commonwealth Oil Refineries, Ltd.,—in which the Anglo-Persian Oil Co. and the Commonwealth government are associated—is proceeding with the erection of reservoirs for the storage of crude oil in Sydney and Melbourne, and refineries probably will be installed next year. The crude oil will be imported from Persia until local sources are developed.

The Elk Hills Oil Field

At present there are two limited areas of development in the Elk Hills oil field of California, according to R. E. Collom, in *California Oil Fields*, one within and one not within Naval Petroleum Reserve No. 1. At the end of May, 1921, the area inside of Naval Petroleum Reserve No. 1 had produced 1,840,178 bbl. of oil and 3,228 bbl. of water since January, 1919. The area outside of Naval Petroleum Reserve No. 1 had produced 14,487,930 bbl. of oil and 3,713 bbl. of water since February, 1920.

The most notable observation from this record is the exceptionally small quantity of water produced in the Elk Hills oil field. This is due principally to careful drilling and close co-operation between the responsible representatives of operating concerns and the Department of Petroleum and Gas.

The Elk Hills oil field was dormant for a period of ten years prior to January, 1919. The petroleum land withdrawals of 1909 and the subsequent creation of Naval Petroleum Reserve No. 1, along with litigation between the Federal Government and private concerns as to titles passed from the Government, prevented rapid development of the Elk Hills field such as that which took place in the Midway-Sunset area, and, to the public at large, its value as an oil field was indeterminate because of the conflicting claims advanced by contending litigants.

It is probable that the boundaries of Naval Petroleum Reserve No. 1 were originally laid out to cover, and therefore indicate, the estimated areal extent of the "geologic structure" of the Elk Hills field. The Naval Reserve covers an area of slightly over 38,000 acres. Recent developments have emphasized the hazard of attempting broadly to delineate the outer confines of a subterranean reservoir almost solely upon the evidence of surface geology.

The development by the Standard Oil Co. on the Hay lease[1] in Section 36, Township 30 south, Range 23 east, M. D. B. and M., in the years 1918 and 1919, showed that in addition to being an oil field of promise, the Elk Hills also contained highly productive gas reservoirs. The first well drilled by the Standard Oil Co. on the Hay lease was not an exceptional oil producer, yielding an initial production in January, 1919, of 255 bbl. of oil per day. The Hay lease is practically in the center of Naval Petroleum Reserve No. 1.

In February, 1920, the Standard Oil Co. brought in well No. "Tupman" 1 on Section 36, Township 30 south, Range 24 east, M. D. B. and M. This extended the area previously recognized as probably productive. The Tupman lease is just outside the easterly limits of Naval Petroleum Reserve No. 1.

During February, 1920, the discovery well produced at the rate of 5,200 bbl. of oil per day. Rapid development by the Pacific Oil Co., and the Standard Oil Co., of their holdings along the eastern boundary of Naval Petroleum Reserve No. 1, soon made the newer portion of the Elk Hills oil field the key factor in the relations between production and consumption of oil in California. Early in 1921, twenty-five wells in the easterly portion of the Elk Hills oil field were contributing 50,000 bbl. daily to the production of the state.

Americans Diligent in Quest for Oil In Foreign Fields

WASHINGTON CORRESPONDENCE

An intimation that American interests have had a keen appreciation of the need for securing foreign petroleum rights brought from H. C. Hoover, Secretary of Com merce, recently a statement that American companies are showing commendable enterprise in their search for petroleum in foreign countries. He declared that throughout that vast expanse of territory from Colombia to Chile, on each side of the Andes, which gives some promise of the occurrence of petroleum in great quantities, American geologists and other types of petroleum specialists are engaged in systematic search for new sources of oil supply. He pointed out that an American company is very active in the exploration work being conducted in northern Canada.

---

[1] [illegible]

Mr. Hoover's information with regard to the petroleum situation in the Russian field is that production has receded until it is less than 10 per cent of the pre-war output. It is his opinion that the entire production is coming from flowing wells. He thinks this oil is being handled and that no waste is resulting from the demoralization of the Russian petroleum industry under present conditions.

Improvement in Rumanian Petroleum Trade

The American Minister to Bucharest reports that the situation of the oil companies in Rumania is more satisfactory at present than it has been since the war, according to *Commerce Reports*. The government has apparently abandoned the project of an export monopoly of petroleum products. On Aug. 25 it reduced the high export tariff on petroleum products to a level which will increase exportation. The new tariff is valid for only three months, but will possibly be continued thereafter. It is expected that the lower export tariff on petroleum products will decrease the cost of the fuel oil purchased by the Rumanian railroads.

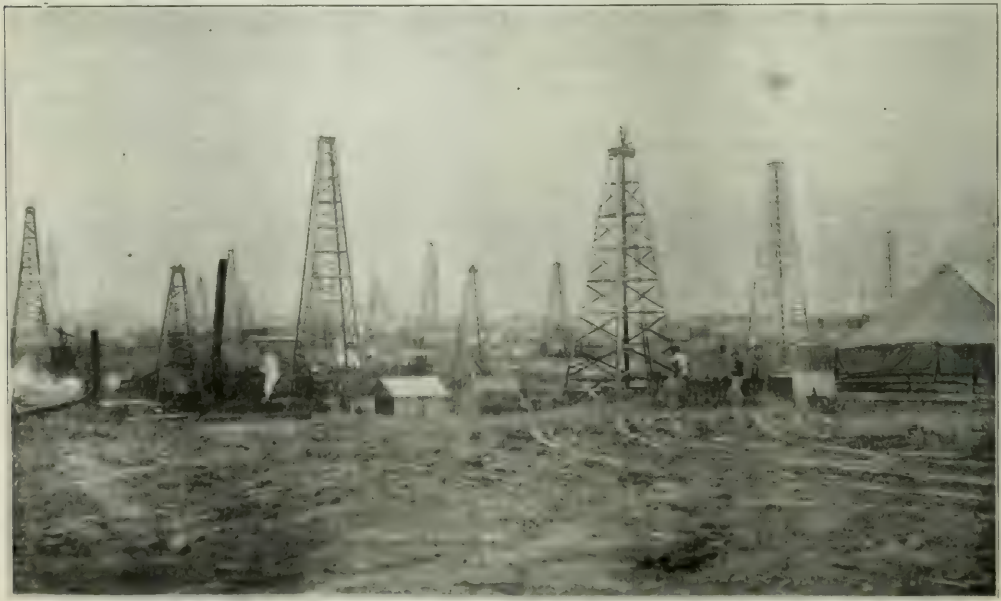
A decree published on June 16, 1920, requires the consent of the Council of Ministers to every petroleum concession or lease acquired by private companies. For a time this decree hindered the acquisition of new petroleum lands; but lately no difficulty has been encountered by the companies in securing such permits, other than the delay which is always involved. This delay may occasion losses, several parties paying for the same lease before registration (which depends upon the approval of the lease by the Council of Ministers) can be made in the courts.

The law of April 18, 1919, covers the procedure by which all state lands may be given for exploitation. This law provides that all state petroleum lands shall be divided into four parts. One of these parts shall be reserved to the state, and this cannot be leased except by special law; a second part can be leased to companies having only Rumanian shareholders; a third part can be leased by auction to existing petroleum companies; and the remainder may be leased by auction to anyone wishing to bid for it. Although this law is in force, the present government decreed by a ministerial decree, published in the Monitor Official of Sept. 5, 1920, that 80 hectares (about 198 acres) of the choicest state lands be leased to the I. R. D. P.—a Rumanian company. This transaction was later approved by parliament, and an additional 80 hectares were leased to another Rumanian company, called the Credit Minier.

Gulf Coast Crude Price Increased

The price of Gulf Coast crude oil was advanced 25c. on Nov. 9 by the Texas Co., making the price $1.25 per bbl. except for Pierce Junction oil, where the price is $1.05. This raise will undoubtedly be met by the other pipe line companies in the near future.

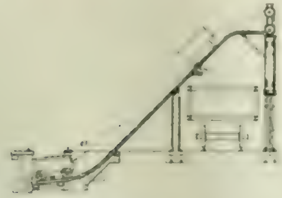
On this same day the Magnolia Co. posted an advance of 2c. per gal. on on gosoline and 1c. on kerosene, making the price 23c. and 13c. respectively.



NORTHWEST EXTENSION, BURKBURNETT FIELD, TEXAS, THREE MONTHS AFTER DISCOVERY

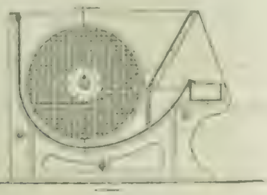
Recent Patents

Hoisting Cylinder—No. 1,378,901. William Robertson, Chicago, Ill. A vertical cylinder containing a piston, the latter supported by a hollow rod. On admission of fluid under pressure into the hollow rod, the cylinder descends and a pull is exerted on a cable to which the cylinder is attached.



Flotation Machine—No. 1,389,674. L. D. Lyons and C. F. Hoff, Butte, Mont. The invention consists chiefly in means to remove the froth from a mechanically agitated flotation machine. The device operates regardless of the pulp level.

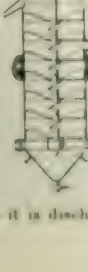
Flotation Machine—No. 1,394,306. D. P. Hynes, Evanston, Ill. A flotation machine in which the air is beaten into the pulp by means of perforated disks partially submerged in the pulp revolving in a vertical plane.



Ball-Mill Feeder—No. 1,395,089. H. H. Burhans, Newark, N. J. This patent covers a device for automatically feeding a ball mill. The ball mill is driven by an individual motor, as is the apron conveyor which feeds it. As the current consumption of the motor driving the ball mill rises, the circuit of the motor driving the conveyor is opened, thus cutting off the feed for a time.

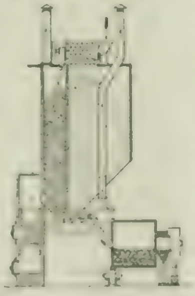
Flotation—No. 1,394,958. A. Schwarz, Joplin, Mo., assignor to Metals Recovery Co., New York. The use of selective agents preliminary to flotation.

Ore Washer—No. 1,392,413. A. M. Gow, Duluth, Minn. An ore washer for separating magnetic from non-magnetic particles of different degrees of permeability. A vertical tank is used with means for drawing magnetic particles to the inner surface. A rotating shaft causes these to descend and a supply of water washes the gangue upward where it is discharged



Flotation—The *Journal of Chemical Industry* describes a British patent recently issued to Minerals Separation, Ltd. (E. P. 154,870, 9.6.20) Oxidized metallic ores, *e.g.* those containing carbonates, silicates, or oxides of copper or lead, are ground wet to 80 mesh, during which process a small quantity of oleic or similar fatty acid (say, 3 lb. or less per ton of ore) is added. The pulp containing one part of ore to four or five parts of water is then treated with a small quantity (say, 2 lb. per ton of contained ore) of sodium silicate, carbonate, hydroxide, or other suitable alkali, and the mixture subjected to agitation and aëration by known processes. The first froths may be re-treated without further addition of the frothing agent, but with a further small quantity of alkali, if necessary.

Dry Grinding Moist Material—No. 1,394,294. J. S. Fasting, Frederiksberg, near Copenhagen, Denmark, assignor to F. L. Smidth & Co., New York. A trommel separates the large from the small material which is to be ground, the large material going to a separate bin, where it may be subjected to heat, after which it is mixed with the fine material and charged to a ball mill. The large hot particles are supposed to dry the fine material and keep it from packing in the mill.



Jig—No. 1,395,716. H. D. Kostenbauder, Aristes, Pa. A design for a jig for separating coal or mineral from waste rock.

Hydrometallurgy of Copper—No. 1,395,755. G. A. Bragg, Thomson, Nev., assignor of Metals Research Co. The copper-bearing material is leached to obtain a copper sulphate solution which is then heated and treated with sulphur dioxide.

Book Reviews

A Manual of Determinative Mineralogy. By Charles H. Warren. Lamp binding; 7¾x5¼; pp 163. First edition. McGraw-Hill Book Co., 1921. Price, $2.

This manual was prepared for use in the beginner's course in mineralogy, at the Massachusetts Institute of Technology, in response to a demand for a relatively inexpensive but satisfactory determinative text. Even a casual perusal of the book will show that it is admirably arranged and much of the superfluous matter appearing in the larger textbooks has been left out. Chapters cover the use of the blowpipe, simple tests for the elements, tabulation lists of reactions and like related matter. Useful in determinative mineralogy and the determination of minerals. D. E. A. C.

Technical Papers

Wolfram, Bismuth, Molybdenite—The treatment of wolfram, bismuth, and molybdenite ores at the Burma Queensland Corporation's mill at Wolfram, N. Q., is described in a twelve-page paper in the *Proceedings of the Australasian Institute of Mining and Metallurgy* No. 40, Melbourne. The ore is essentially quartz, the chief minerals being molybdenite, wolfram, metallic bismuth, bismuth sulphide, bismuth carbonate, and rarely a little scheelite. It is crushed by 1,250-lb. stamps, run at 100 drops per minute with from 6 to 7 in. drop. The stamp duty varies from 5.5 to 5.8 tons per twenty-four hours. Following the crushing, the flow sheet is somewhat complicated, as would be expected from the nature of the ore. Wilfley, Buss, and Krupp tables are used, from which bismuth-wolfram concentrates are obtained. These are sized and then separated in magnetic separators of the Dalbouze bracket type. The products are a clean wolfram concentrate and a bismuth concentrate containing a little wolfram. The tailings from the tables already mentioned are treated on other apparatus, including buddles, Isabel vanners, Luhrig vanners, and slime frames, and then subjected to flotation in machines of the cone type, producing concentrates running from 80 to 94 per cent MoS_2. The methods used in the chemical laboratory are also given, including an acid method for estimating WO_3 in concentrates and ores; the colorimetric estimation of bismuth and molybdenite; the estimation of bismuth in bismuth-wolfram concentrates; and the volumetric estimation of molybdenite.

Mica—The mica deposits of Alabama are described in a 115-page book recently issued by the Geological Survey of Alabama, University, Ala. The book contains forty pages of general data on mica, which includes production, stocks, consumption, value, imports and exports, occurrence, properties and characteristics, uses, commercial grades and specifications, associations, and distribution of deposits. This information is all of general interest to mica producers in other parts of the country. The rest of the book is confined to a detailed description of the various Alabama deposits, together with a short chapter on Alabama kaolin.

Mineral Resources—Recent publications of the U. S. Geological Survey in the "Mineral Resources of the United States" series (obtainable on request) include: "Gold and Silver in 1919," forty-four pages; "Abrasive Materials in 1920," four pages; "Sand and Gravel in 1920," nine pages; "Lime in 1920," twelve pages; "Feldspar in 1920," two pages; "Mineral Waters in 1920," six pages; "Slate in 1920," nine pages; and "Gold, Silver, Copper and Lead in South Dakota and Wyoming in 1920," nine pages.

New Jersey Iron Ores—Two articles which appeared in the Nov. 10 and Nov. 17 issues, respectively, of *Iron Trade Review*, entitled "Developing North Jersey Iron Ores," by E. C. Kreutzberg, outline the mining and milling methods used on magnetite ores at the Beach Glen mines, controlled by the North Jersey Steel Co., near Rockaway, N. J.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Federated American Engineering Societies Have Rendered Constructive Service

Activities Cover a Number of Accomplishments and Show Increasing Range of Federation's Influence

In a statement summarizing general conditions in the Federated American Engineering Societies, the executive secretary, L. W. Wallace, expresses the belief that the federation has made substantial progress. At the annual meeting of the American Engineering Council to be held in Washington Jan. 5 and 6, this progress will be shown by reports covering activities in many fields.

"Unquestionably," says Mr. Wallace, "the federation has made favorable and permanent contacts in Washington. Through the activities of Congress and of the new Federal administration, we have had the opportunity of rendering some really constructive service. We feel, however, that the great body of engineers are not adequately informed of the organization of the federation, of its aims and purposes and of its activities.

"This lack of information is serious, and until engineers in general are more fully informed, we shall not hope to function to the best advantage. The Executive Board should, therefore, give serious consideration to methods of informing engineers as to the aims, policies, and activities of the federation. Some member societies have been and are now, perhaps, rather indifferent to a continuation of their affiliation. As far as we have been able to ascertain, this condition is due to the officials and the members of such organizations not being fully informed.

"While it may be true that during the first year, the federation has not been able to accomplish all that was expected on the part of some, and that it has not fully found itself, so to speak, yet the progress has been such as to justify optimism rather than pessimism as to the future usefulness of the federation. The federation has been fairly well established in the minds of the public and in Government circles. This is evidenced by the character and quantity of publicity that the federation has received.

"The report of the publicity committee to the executive board clearly shows that the activities of the federation have attracted attention and notice in all of the leading cities and many of the towns and villages of this country. Constant reference is being made to the federation in the technical, daily, and periodical press. It is also being referred to in the official proceedings and publications of many commercial and trade associations. This alone is one reason for encouragement."

The general activities of the federation during the year have embraced the following: Assistance in organizing a conference of engineers to consider the advisability of fall letting of highway construction contracts; co-operation in arranging for the Unemployment Conference; action to prevent a miscarriage of justice which would result from reopening the cases disposed of by the War Minerals Relief Commission; promoting the movement for a National Department of Public Works; representation through Colonel Arthur S. Dwight on the deputation of engineers that visited England and France; appointment of a committee to frame a plan for a permanent employment service; adoption of a policy to avoid confusion and antagonism on the question of licensing of engineers; co-operation in reforming conditions in the United States Patent Office; approval of certain recommendations contained in the report of the Committee on Types of Government Contracts; appointment of a committee to form an engineering education policy; indorsement of the classification of engineers as proposed by the Committee on Classification and Compensation of Engineers of Engineering Council; appointment of a special Committee on Length of Shifts in Continuous Industry; conferences with a committee of the American Association of Engineers; investigation by Committee on Elimination of Waste in Industry; co-operation through a committee in New York State Government Reorganization; appointment of a Committee on Co-operation with the American Institute of Architects; establishment of a Federation Bulletin and Digest Service; and preparation of a Digest of State Laws covering the registration of engineers.

This list of federation activities, though incomplete, serves to show the increasing range of the federation's influence and its potentialities. The leading activity of the federation was the work of the Waste Committee, whose findings have just been published in book form.

The federation has now more than 43,000 members. Despite the financial depression and the ordinary difficulties of organization, the membership is growing. The Engineers' Club of Kansas City, Mo., is considering the question of applying for membership. The president of the Engineers' Club of Philadelphia has appointed a committee to investigate and to report upon the advisability of that society joining the federation. The American Society of Testing Materials considered joining the federation, finally deciding it was financially unable to accept the invitation to become a charter member.

Recent societies admitted to membership in the federation are the Vermont Engineering Society and the Associated Engineers of Spokane. The Vermont Engineering Society has named George A. Reed, of Montpelier, as its representative on the American Engineering Council.

Dean Mortimer E. Cooley and Mr. Wallace are now carrying out plans for more intensive organization, aiming particularly to link up the member societies in a more cohesive scheme of action so that the influence and benefits of the federation may be more directly and systematically communicated to the societies. Mr. Wallace for several months has been appearing throughout the country before member societies and other organizations. Mr. Wallace's speeches outlining the aims of the federation have been widely noticed in the public press. He plans to continue these visits to the member societies so far as his executive duties, which are constantly growing, will permit.

Many matters not the subjects of committee action are occupying the attention of the headquarters staff in Washington. Not the least among the influences which the federation has developed is a growing function of its place in the political life of the nation as evidenced by requests of Government departments and bureaus for aid and advice. The reports to be submitted at the January meeting in Washington will, it is stated, show the federation to be in a healthful condition, with every prospect that its usefulness, measured by its accomplishments of the year, will continue to expand in the way contemplated by its founders.

Alaska's Development To Be Slow, Dorsey Lyon Thinks

Definite Information as to Territory's Resources Scant—Work at Berkeley Successful

Good judgment was used in selecting the Seward-Fairbanks route for initial railroad development in Alaska, in the opinion of Dorsey A. Lyon, chief metallurgist of the U. S. Bureau of Mines, who has just returned to Washington after having spent the field season in Alaska and in the mining districts of the Western states. In his opinion, it is going to be many a year before the Government's railroad in Alaska will be self-sustaining. He believes, however, that its construction is a necessary step in the development of that territory and that the investment will be amply justified by results. It is Mr. Lyon's belief that the development of Alaska will be gradual. He is firmly convinced that no good can come from holding out hope that there is to be a mushroom type of growth in the territory. The country tributary to Fairbanks lends itself particularly, he thinks, to the development of small mines. He believes that there are many properties in that section where practical mining men, willing to take personal charge of operations, will be able to establish themselves profitably. He is also impressed with the possibilities for agricultural development in the Tanana valley. This valley is capable of supplying the food requirements sufficient for a population large enough to operate every available mineral resource in the region.

Although there is no lack of definite pronouncements as to the possibilities of Alaska, Mr. Lyon was impressed on his visit with the lack of definite information available as to the resources of the territory. This applies even to those limited areas where there has been some development, but Alaska, as a whole, he regards as a great unknown. He thinks the Government has great responsibility toward Alaska and should see to it that the people who go there are reasonably encouraged to stay.

Mr. Lyon is pleased with the success of his plan in placing technical control of the non-ferrous work at the experiment stations under the immediate direction of O. C. Ralston, at Berkeley. This makes a sort of service station at Berkeley to which all other experiment stations can refer their most difficult problems and where the fundamental physical chemical work can be done. That more expert attention may be brought to apply to the chemical side of these non-ferrous problems, L. E. Roberts, a physical chemist who has distinguished himself in colloidal chemistry, has been added to the staff of that station. He obtained his doctor's degree at the University of Chicago and for two years was an instructor in chemistry at the University of Pittsburgh. For the last eighteen months, he has been in charge of the research laboratory of the American Writing Paper Co., at Holyoke, Mass.

Mining Councils To Be Formed In Spain

Royal Decree Orders Organization in Various Districts—To Act in Advisory Capacity

In an effort to stimulate the mining industry in Spain, the King by royal decree has made obligatory the formation of mining councils in the various mining centers of the kingdom. The councils are to be regarded as advisory bodies to the ministry of public works. They are given the right of hearing in customs modifications, taxes, and in all administrative matters which effect the mining industry. It is the prescribed duty of these councils to initiate proposals to the government which will lead to the greater development of the mining industry. They are to compile statistics which are to be available to the government. They are to aid in the extension of mining education, prescribe sanitary codes for mines and are to assist in the compilation of labor statistics. With the previous authorization of the Minister of Public Works, they may contract loans to provide for the expenses of carrying out the decree. When called upon by the Minister of Public Works, the separate councils are to unite in assemblies for the general discussion of the problems affecting the industry.

The Minister of Public Works is to designate the number of members which is to make up each council. He is to take into account the number of mines in the district, the capital employed, the number of operators and the number of laborers. No council may have less than ten members nor more than forty. The Minister of Public Works must promulgate prior to Dec. 23 complete regulations for carrying the decree establishing the mining councils into effect.

Board of Northwest Mining Association to Continue

No election having been held, the board of the Northwest Mining Association of Spokane will serve for another year. The board consists of G. B. Dennis, Frank M. Smith, Frank A. Ross, F. C. Bailey, Leigh Nicholls, Oscar Cain, and W. H. Linney. Mr. Dennis has been elected by the board to succeed Mr. Cain, who has resigned as president.

British Protest Sale of Scrap

The inclination on the part of the British Disposals Board to sell its remaining surplus of scrap brass and gun metal for £4,000,000 to the British Metals Corporation, Ltd., is bringing forth protests from metals brokers, who insist that there should be competing bids for this material.

MEN YOU SHOULD KNOW ABOUT

G. M. Colvocoresses is in New York.

Frank J. Nagel was recently in Guadalajara, Mexico.

George Huntington Clark has been examining bauxite deposits in Alabama.

Herbert C. Jussen is in the Presbyterian Hospital in Chicago in a serious condition.

Paul Kern has joined the forces of the Great Eagle Fluorspar mine, at Lordsburg, N. M.

Colonel J. C. Greenway is visiting the property of the Erupcion Mining Co. in Chihuahua, Mexico.

Wilber Judson is on an extended business trip through some of the central and southern European countries.

K. Hasegawa, metallurgical engineer of the Imperial Steel Works, Yawata, Japan, recently visited Lehigh University.

D. C. Jackling has been in Salt Lake City and in Bingham and Garfield, visiting the properties of the Utah Copper Co.

J. Ward Williams, formerly connected with the American Metal Co.'s Mexican division, has opened offices at 405 Lexington Ave., New York City.

G. Herbert Jones, vice-president of the Inland Steel Co., Chicago, has tendered his resignation and will devote his time to personal interests.

Frank Estes returned to New York recently from Salvador, where he has spent the last few months investigating mining property of the Salvador Silver Mines Co.

P. G. Beckett, general manager of the Phelps Dodge Corporation, and **Thomas H. O'Brien**, general manager of the Inspiration Copper Co., recently returned from a trip to England, France, Belgium and Germany.

George T. Harley, formerly efficiency engineer for the Burro Mountain Copper Co. at Tyrone, who later went to River Mines, Mo., with the St. Joe Lead Co., has been forced, on account of ill health, to move to Pueblo, Col.

A. C. Dinkey, president of the Midvale Steel & Ordnance Co., accompanied by **J. C. Agnew**, assistant to the president, recently visited the company's properties on the Mesabi and Vermilion ranges; also the plant of the Mesabi Iron Co. at Babbitt, Minn.

R. B. Moore, chief chemist of the Bureau of Mines, addressed the New Jersey Chemical Society at Newark on Nov. 14. He discussed the chemical work of the U. S. Bureau of Mines and reviewed the investigation and research which have been done on helium.

R. T. Stull, superintendent of the U. S. Bureau of Mines Ceramic Station at Columbus, Ohio, conferred last week in Chattanooga with officials of the Central of Georgia R.R. concerning the co-operative work being done on Georgia kaolins.

K. Yoshizawa, chief engineer of the Mitsui Mining Co. of Tokio, recently visited the Michigan College of Mines at Houghton. Mr. Yoshizawa is a lecturer in the mining school of the Japanese Imperial University. Gaichi Yamada, assistant professor of metallurgy at the Kyoto Imperial University at Kyoto, Japan, has also been visiting the mills and smelters of the Lake district. He is concluding a year's tour of the United States.

Mining and metallurgical engineers visiting New York City last week included: **E. H. Hicks**, Golden, Col.; **F. Winslow**, Washington, D. C.; **N. H. Emmons, 2d**, Framingham, Mass.; **Harold C. E. Spence**, New Glasgow, N. S.; **H. M. La Follette**, La Follette, Tenn.; **J. Lorenz Kalb** and **Gardner Gantz**, Rapid City, S. D.; **Allan Gibb**, London; **F. Crabtree**, Pittsburgh, Pa.; and **Francis Nicholson**, Charlotte Court House, Va.

SOCIETY MEETINGS ANNOUNCED

The ninth annual meeting of the **Colorado Metal Mining Association** and the fifth annual meeting of the **Colorado Chapter of the American Mining Congress** will meet in joint session at the State Capitol Building in Denver during the week of Jan. 16, 1922. The chief questions for consideration this year will be freight-rate adjustments, particularly in reference to a change in the basis of rate making from gross to realized value, after smelting charges have been deducted. Plans will be considered for co-operative action to secure lower costs for powder, steel, and other supplies and equipment. The smelter situation as affected by the closing down of various plants in Colorado, and the resulting increase in the cost of smelting, will also be considered with the purpose of devising some form of relief.

OBITUARY

E. G. Bush, for ten years active in the development of a number of copper mines near [illegible], Ariz., died on Nov. [illegible].

George D. Sherman died suddenly on Nov. [illegible] of heart trouble at his home in Port Henry, N. Y. Mr. Sherman was one of the stockholders of the Witherbee-Sherman Co. and the Port Henry Iron Ore Co.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

Signs of improvements are to be noted in the week's news from many sections. The upward trend continues in the Birmingham iron district. Some mines are reported to have resumed or to be about to resume in the Lake Superior iron country, though it is possible that this is partly owing to a desire to ease the unemployment situation. The New York & Honduras Rosario Mining Co. has resumed operations in Honduras, owing to the improvement in the price of silver.

The American Smelting & Refining Co. has decided to complete the 50-ton test mill at the mouth of the Yak tunnel, in Leadville, Col. Tests on a commercial scale will be made to determine the possibility of concentrating the low-grade complex ores of the district, of which there is a large tonnage.

Arizona Commercial's side line suit, involving the Iron Cap company, will be heard at Tucson, Ariz., Dec. 12.

Union Sulphur's suit against the Texas Gulf company, for alleged illegal removal of sulphur, has been settled out of court and the case dismissed.

The Star and the Federal Mining & Smelting companies will be heard in court on Nov. 28 on the question of the proper compensation due the former for ore illegally removed.

Reuter's Agency reports that the labor dispute at the gold mines on the Rand has been compromised.

The East Butte and the Davis Daly copper companies have shut down.

A suit faces the Northwest Magnesite Co., a farmer charging that magnesite from the company's calcining plant has ruined his crops.

Senator Nicholson has decided to prepare a campaign to push his bill for a Federal Department of Mines. The War Minerals Relief Bill has been passed by the House.

A. S. & R. To Complete Test Mill At Portal of Yak Tunnel

Will Attempt To Treat Low-Grade Complex Ores of Leadville District on Commercial Scale

As a result of laboratory tests and experiments conducted for a year or more, E. L. Hartwell, local manager of the American Smelting & Refining Co.'s property at Leadville, Col., has been authorized to complete a fifty-ton mill at the portal of the Yak tunnel in California gulch. If as satisfactory results can be obtained in a commercial way as from laboratory tests, plans will be made at once for enlarging the plant to handle the enormous tonnage of low-grade complex ore available from the Yak tunnel.

The low-grade ores of the Yak are principally sulphides in which zinc, lead, or copper predominate, with a certain percentage of both gold and silver. The process will be a combination of jigging, concentration, and flotation, and the laboratory tests indicate that by this method about 80 per cent of the values can be recovered, instead of only 40 or 50 per cent by present methods.

The management hopes to have the mill in operation by April 1, 1922. The successful working of the mill will greatly stimulate production in this district, as there is practically unlimited reserves of this lower-grade material which cannot be profitably moved under present conditions.

Broken Hill Conference Fails

By Cable From Reuters to "Engineering and Mining Journal"

Broken Hill, N. S. W., Nov. 18—The conference between representatives of the mining companies and the men's unions, when proposals aiming at full resumption of operations at the mines were discussed, proved abortive.

Union Sulphur-Texas Gulf Suit Settled Out of Court

The suit of the Union Sulphur Co. vs. Texas Gulf Sulphur Co., in which the plaintiff asked $6,768,000 damages for sulphur removed from its land by the defendant, has been settled out of court and has been dismissed by the Federal court at Houston.

French Interests To Exploit Mexican Mines

By Cable From Reuters to "Engineering and Mining Journal"

Paris, Nov. 17—A company has been incorporated here with a capital of 15,000,000 francs, with headquarters in this city, to exploit mines in Mexico.

Rand Labor Dispute Compromised

By Cable From Reuters to "Engineering and Mining Journal"

Johannesburg, Nov. 17—An important compromise has been effected with regard to the conditions of labor in the gold mining industry of the Rand, the men having expressed their approval of various alterations which practically insure eight hours' work by natives under white supervision.

According to an earlier dispatch, Sir Evelyn Wallers, former president of the Transvaal Chamber of Mines, in a statement outlining the attitude of the mining industry toward the proposed government amendment covering mining regulations, said that even with the present substantial premium the Randfontein and East Rand Proprietary companies were unable to pay the standing charges for October. He had considered that the suggested amendment would improve efficiency but it did not go far enough.

The Chamber maintained that the management must be free to allocate the available force of mine workers.

Magnesite Plant Damaged Crops, It Is Claimed

Northwest Magnesite Co. Sued by Farmer — Company Retains Agricultural Specialists

John Ehorn, a farmer of Chewelah, Wash., has brought suit against the Northwest Magnesite Co., in which he alleges that the dust and smoke particles from the stacks of the company's calcining plant has destroyed vegetation on his land and that livestock which has eaten the vegetation had died. He seeks damages for $56,427 for alleged destruction of crop, death of four cattle, and damage to 185 acres of land. Also, he asks that the magnesite company be prohibited from again operating its plant as it has been previously operated.

Until recently the Northwest company has been operating four rotary calcining kilns for dead-burning its magnesite. Ehorn's farm is closely adjacent to the plant, and it is his contention that the dust coming out through the stack has settled on his land to form a crust and seriously hamper the growth of crops.

Roy N. Bishop, general manager for the company, has employed Dr. E. M. Ledyard, a specialist in agriculture, and his staff, consisting of Charles B. Weeks, horticultural specialist, Fred C. Mathews, soil specialist, and Dr. F. C. Connelly, veterinary surgeon, to investigate crop conditions surrounding the calcining plant at Chewelah.

New York & Honduras Rosario Resumes

The New York & Honduras Rosario Mining Co. has resumed operations at its mines owing to the improvement in the price of silver. The conditions prevailing in the industry forced the cessation of production last June.

Compensation Hearing in Star Case To Be Held Nov. 28

Opposing Sides Disagree Greatly as to Value of Ore Wrongfully Extracted

In the spring of 1917 the Star Mining Co. started an action against the Federal Mining & Smelting Co. alleging trespass upon Star ground through the operation of the Morning mine. The subsequent trial resulted in a decision by Judge Dietrich, of the U. S. District Court, in favor of the Federal, from which the Star appealed to the appellate court, which reversed the lower court. Thereupon the Federal company applied to the U. S. Supreme Court to review the case, which application was denied. This disposed of all questions except the very essential one of compensation due the Star for ore removed.

For many months engineers and accountants for each company have been engaged on the problem. The claims of both have now been filed with the court, and the hearing has been set for Nov. 28 at Coeur d'Alene. Considering the difficulties in making underground measurements to determine the amount of ore removed and the differences in method of the opposing engineers, the results so far as tonnage is concerned are not so far apart as might be expected. The Federal engineers found that 456,327 tons had been removed, whereas the Star engineers placed the figure at 470,035. But when it came to fixing the value of the ore and the amount the Federal should pay, they were about as far apart as possible. The total net smelter returns for the ore shipped as given by the Federal was $1,230,075.59 and the net profit, the amount for which it was liable, is placed at $71,786.14. In making the report, however, Federal claims that despite the decision, it is the rightful owner of the ore in dispute, reserves the right to correct the decision, and makes its showing under protest.

The contention of the Star is that the net smelter returns amounted to or should have amounted to $2,404,110.56, that the net profit was $1,615,902.74 and that the interest was $861,168.39, making the total due to the Star, in the event that the court holds that the trespass was innocent, $2,477,071.13. If the court finds that the trespass was wilful, the claim for principal is $2,404,110.56, for interest, $1,317,686.41, and the total, $3,721,796.97. The Star objects to making the computation based upon sales of ore to the American Smelting & Refining Co. on the ground that the returns were not as great as would have been received if the ore had been sold in the open market.

Texas Sulphur Co. in Hands of Receiver

The Texas Sulphur Co. has been placed in the hands of a receiver following the petition of a group of stockholders and the vice-president of the company. T. B. Doty, president of the First National Bank of Beaumont, Texas, is receiver. This company is a corporation of Arizona, with headquarters in Orange, Texas, and mining lands in Culberson County, Texas, and should not be confused with the Texas Gulf Sulphur Co. of Matagorda County.

East Butte and Davis Daly Shut Down

The East Butte and the Davis-Daly copper companies suspended production on Nov. 14. Adverse metal-market conditions are unofficially stated to be the reason. It is admitted that negotiations are under way looking to the consolidation of the properties on a basis of exchange of stock. East Butte is reported to have offered one of its shares for two of Davis-Daly, to which the latter is said to have refused to consent.

East Butte, it is said, cannot continue without Davis-Daly's ore and the latter, according to one explanation, does not care to ship ores at present copper prices and pay war-time smelting costs. Davis-Daly has dismissed 300 men. East Butte employed in its mines, smelter and mill upwards of 1,000. Davis-Daly's shutdown comes as a surprise to some, at a time when the copper market is strengthening.

Bunker Hill & Sullivan To Start Second Lead Furnace

A second lead furnace is to be blown in at the Bunker Hill & Sullivan smelter at Kellogg, Idaho, soon, to treat increasing tonnage of custom ores.

Zinc Used in New Building

Zinc is to be used at every available opportunity in the building being constructed by the University of Missouri to house the experiment station of the United States Bureau of Mines. As much of the work of this experiment station will be on zinc problems, it was decided to make the building itself something of an experiment in demonstrating the extent to which zinc can be used in construction.

Lower Rates on Ore Sought in Nevada

The Chamber of Commerce of Reno, Nev., in conjunction with the State Public Service Commission, is endeavoring to collect data which will be instrumental in effecting a reduction in rates on ore from Nevada points to smelters in Utah and California. Such a reduction would undoubtedly be a stimulus to the mining industry in this state. A hearing with representatives of the railroads was held on Nov. 18.

Hill Top Suit Dismissed

The suit pending in the superior court of Maricopa County, Ariz., concerning the transfer of a block of stock in the Hill Top Metal Mines Co. has been dismissed. It was brought against the company about three years ago by Chicago stockholders, who claimed an interest in the stock transferred, and has been terminated by the withdrawal of the suit by the plaintiffs. The Hill Top company began mining operations on its property in the Chiricahua Mountains, Cochise County, Ariz., eight years ago, and has been working a large force steadily ever since. Altogether $700,000 has been expended upon the property to date, and the orebody has been opened to the 1,700 level by a number of tunnels, one of which extends entirely through the mountain, a distance of [illegible] ft. The ores are silver-lead, but only a few test cars have been shipped.

Minnesota Advertising for Bids For Prospecting Permits

Action Is in Accordance With New Law Affecting State Lands

The auditor of the State of Minnesota is advertising for sealed bids for permits to prospect for iron ore on state lands in which the state has an interest, except lands situated under the waters of any public lake or river. The bids are to be opened publicly on the morning of Jan. 9, 1922, and permits will be awarded to the highest bidders.

The advertisement appears in accordance with a bill passed at the last session of the Legislature which places the leasing of the state lands on a competitive bidding plan. Each applicant must set forth in his bid the amount of royalty per gross ton of ore based upon the iron content of such ore when dried at 212 deg. F. The state reserves the right to reject any or all bids, and no bid shall be accepted which does not equal or exceed the minimum royalty per ton which is based on a revenue to the state of $1,250 for the first year and $5,000 for the second year.

The lands that have been listed for leasing purposes are divided into the following four classes: Class 1, lands containing iron ore, the larger part of which may be shipped without beneficiation; Class 2, lands likely to contain iron ore capable of being beneficiated by washing, drying, or screening; Class 3, lands likely to contain iron ore or iron-bearing material requiring magnetic-separation methods; and Class 4, lands containing iron ore or iron-bearing material where a combination of two or more of the foregoing processes of beneficiation may be necessary. The mining units upon which bids are to be submitted are not to exceed in the aggregate two contiguous forty-acre tracts for lands in classes 1 and 2 and three contiguous forties for classes 3 and 4.

Boom Reported at Royston, Nev.

Interest in the Royston or San Antone district, in Nevada, continues, and the town of Royston now contains over 100 people, all living in tents or light frame houses hauled from Tonopah. The deepest working is [illegible] ft. vertical, or 300 ft. on the dip of the vein, with several hundred feet of lateral drifts and winzes and considerable stoping. The vein is narrow, rarely exceeding [illegible] ft., but contains high-grade ore. There are old workings.

On the [illegible] claim, which is [illegible] new work, the shaft has reached a depth of [illegible] ft. in ore varying from 10 in. to 4 ft. in width, all of which is high grade. A [illegible]-ton trial shipment ran $[illegible] per ton. A second shipment of over thirty tons is ready, and this ore is said to be higher in grade. Several others have favorable surface showings over narrow widths.

Manganese Ore From Storage at Russian Ports

Appearance of considerable tonnages of manganese at Russian ports is not to be taken as an indication that the Russian mines have resumed operations, it is pointed out at the Department of Commerce. The ore which has lately made its appearance at the [illegible] ports apparently has been taken from storage, it is stated.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

To Push Mines Department Bill More Actively

Nicholson Preparing Campaign in Behalf of Measure—Want Public Familiar With It First

Senator Nicholson, of Colorado, is completing plans for an active campaign in the interest of his bill providing for the creation of a Federal Department of Mines. Although he introduced the bill early in the extra session, he has confined his activities since that time in circulating printed copies of it, so as to give those most concerned an opportunity to study the plan. He feels that a bill of that character had no place in a session of Congress intended principally for the consideration of tax and tariff legislation. With the beginning of the regular session of Congress in December, he expects to keep actively behind this measure, although it is not his purpose to call it up for passage until ample opportunity has been given for the public to become acquainted with its purport.

In January, it is expected that hearings will be had on this bill before the Senate Committee on Mines and Mining. A concise record will be made at that time setting forth the advantages of a separate department devoted to the mining industry and to the advantages that will come from having a representative of that industry at the Cabinet table. An opportunity also will be afforded those who are opposed to this legislation to set forth their objections. This testimony will be assembled in a single volume and will be circulated widely, thereby giving the public an opportunity to acquaint itself with each side of the question.

A favorable report on the bill by the Committee on Mines and Mining is practically assured. This will have the effect of securing a place for the bill on the Senate calendar. After an ample opportunity has been given for the public to familiarize itself with the purposes of the bill, it is the intention of Senator Nicholson to call it up and press it for final passage.

House Passes War Minerals Relief Bill

Amendment Stands Requiring Reappropriation of Funds To Meet Awards

By a vote of 177 to 137, the House of Representatives has passed the bill liberalizing the War Minerals Relief Act. It amended the measure, however, so as to require the reappropriation of funds to be used in paying additional awards. The Senate conferees, Messrs. Poindexter, Sutherland and Walsh, have agreed to a change of language which is expected to meet the objection of the House to the action of its Mines and Mining Committee, held to be usurpative of the exclusive right possessed by the Committee on Appropriations.

If the two houses accept the changes which have been agreed upon by the Senate conferees and Representative Rhodes, the chairman of the House Committee on Mines and Mining, and should the President approve the measure, it will mean that practically all of the claims filed with the War Minerals Relief Commission will be reopened. This new legislation will apply to more than the 610 claims, which were disallowed on the ground of there having been no specific request or demand, as many of the other claimants can now establish an earlier date of Government stimulation. In addition, the fifty-two claims that were mailed within the time limit set by the original act, but which did not reach the War Minerals Relief Commission until after the expiration of the time limit, will be entitled to full consideration.

Stimulation of Mineral Exports Discussed With Hoover

Metal, Coal, and Oil Representatives Meet Secretary—Joint Committee Named

In an effort to stimulate export trade in minerals, a full discussion of the subject was had on Nov. 15 with Secretary Hoover by committees representing the metals, petroleum, and coal industries. As a result of the conference with Secretary Hoover a joint committee was named to join with representatives of exporters of grain, cotton, and other American products to initiate plans which will permit of an enlarged export movement. Those selected to serve on that committee are T. H. Watkins, of the Foreign Trade Committee of the National Coal Association; George S. Davidson, of the Gulf Refining Co.; Bulkeley Wells, former president of the American Mining Congress, and B. B. Thayer, representing the copper producers. The conference with Secretary Hoover was arranged by the Mining Congress.

Army To Sell Metal as Scrap

A lot of 13,500,000 lb. of motor forgings and castings is to be sold by the Air Service of the Army. Informal bids will be received until Dec. 10. The material is to be sold on a scrap-metal basis. Quantities are as follows: Steel, 11,534,937 lb.; cast iron, 1,041,249 lb.; bronze, 750,000 lb.; aluminum, 189,022 lb.; brass, 12,407 lb. The materials are open for inspection at the Long Island Air Reserve Depot, Long Island City, N. Y.

Government Silver Purchases

Purchases of silver by the Bureau of the Mint during the week ended Nov. 19 totaled 2,654,000 fine ounces. This brings the total purchases under the Pittman Act to 82,762,863 fine ounces.

NEWS BY MINING DISTRICTS

London Letter

Gaika Gold's Position — Attempts To Revivify Cornish Tin Mining — Mexican Shares More Active

By W. A. Doman

London, Nov. 11 Attempts are being made to revivify Cornish tin mining. Much distress prevails among the miners in the duchy, and the government has again been approached for financial assistance. A comprehensive amalgamation scheme of various companies, including Tehidy Minerals, is under consideration, and a new shaft is being sunk to estimates by Berwick, Moreing & Co. in the Wheal Agar section of the East Pool & Agar mine. The work is expected to occupy almost two years and to cost £60,000.

The Transvaal gold mining companies are more moderate in their estimates of the price to be received in respect of the past month's production, a figure of 103/— per fine oz. being taken as against 110 — for September.

Mexican mining shares are being given a twist. Esperanza, which has provided so much sensation in the past, is moving up again to the accompaniment of rumors of favorable developments. These rumors have been in circulation for some days.

San Francisco Mines also are being bid for in the expectation that the new plant will soon be in operation.

In the last fiscal year the Gaika Gold Mining Co. treated a rather larger quantity of ore than in the preceding year. As the grade was a little lower, the value, including premium, was only £2,400 higher. There was, however, a set-off in the matter of working expenses, which were 2/1 per ton less, at 25/3, the outcome being an increase of about £3,700 in the net profit. Shareholders receive the benefit of this improved position, for the dividends and bonus at 12½ per cent compare with 7½ per cent in 1920. This year's payments slightly exceed the amount of net profit, the result being that the carry forward is reduced. The position as at the end of the two years is as follows:

	June 30, 1920	June 30, 1921
Tons treated	[illegible],724	[illegible],127
Oz. recovered	15,095	14,[illegible]
Value including premium	£80,173	£82,[illegible]
Working costs per ton	27 4	[illegible]
Net profit	£28,[illegible]	£12,[illegible]
Dividend per cent	[illegible]	10
Bonus per cent	2½	2½
Carry forward	£[illegible]	£[illegible],421
Ore reserves, tons	64,000	73,000
Average value, dwt	15.7	13.2

During the last year the new tonnage brought into the reserves was 49,127, and as will be gathered from the table, the additional ore was of lower value. The recovery last year was 7.4 dwt. from a feed of 8.25 dwt. The extraction was a little in excess of the 1920 figure of 88 per cent.

Of the reserves, 10 per cent is represented by pillars which will not be mined until all other sections are depleted. Apparently the mine position is none too comfortable, for C. E. Parsons, the consulting engineer, specially points out the difficulties that would attend treating ore only of the estimated value of the reserves, that is, 13.2 dwt. Nearly 14 per cent of the ore is represented by one block in the Rubble area, valued at 20 dwt., which so far is yielding ore of a grade below this estimate. The various orebodies have no defined walls. As regards the future, the extent in length and depth of recent discoveries is proved, and unless new ore can be found the reserves "are bound to show a considerable shrinkage at June 30 next." At present there are practically no new and promising developments to report.

CANADA

British Columbia

Work Resumed at North Star—Ottawa Mill Ships Concentrates

By H. W. Power

Revelstoke—A number of prairie and coast residents interested in the Multiplex mine, Camborne, visited the property recently, and inspected the development accomplished during the season.

Kimberley—Operations have been resumed at the North Star mine, which has been idle for about a year. A small crew has been put on, and the operators, Thompson & McKinley, plan to make occasional shipments from the old workings during the winter.

Kaslo—Lessees of the [illegible] mine, at 15 Mile, have uncovered two [illegible] [illegible] of the characteristic high-grade silver ore in the old workings of the mine. The long tunnel is being continued to intercept the two [illegible], and it is expected that the [illegible] ore will be reached soon. Sixteen men are employed.

Slocan City—The first shipment of concentrates from the Ottawa Mining & Smelting Co., which has a lease on the Ottawa mine on Springer Creek, near here, has been sent to Trail. The mill is small and was completed this fall. Material treated was mostly from old dumps.

Nelson—Improvement in inquiry with regard to possibilities for mining investment of the Kootenays is noted by local Board of Trade officials. A Kootenay branch of the British Columbia Mining Association, whose headquarters are in Vancouver, is in process of organization. E. W. Widdowson, who has been engaged in assaying in Nelson for a number of years, has again enlarged his ore testing plant in anticipation of an increase in business.

Edgewood—A new crosscut tunnel, which will be about 1,000 ft. in length, has been started on the Rampolla group, in the Lightning Peak section of the Arrow Lakes.

Victoria—J. J. Warren, president of the Consolidated M. & S. Co.; S. S. Fowler, of the Blue Bell mine, Riondel; Valentine Quinn, comptroller of the Granby Consolidated; Randolph Bruce, of the Paradise mine, Windermere; Gomer P. Jones, general manager of the Hedley Gold Mining Co., and T. W. Bingay, comptroller of the Consolidated M. & S. Co., constituted a deputation of provincial mining men that appeared before Premier Oliver and William Sloan, the Minister of Mines, recently, with a request for further reduction in assessments on mining property because of development, depreciation and depletion. The matter is under consideration by the provincial authorities.

Trail—Ore shipments received at the Consolidated smelter Nov. 8-14 inclusive totaled 8,642 tons, coming from the following shippers: Gem, Sandon, 10 tons; Horn Silver, Similkameen, 51; J. Osborne, Tulameen, 1; Queen Bess, Alamo, 35; Surprise (Rosebery), Rosebery, 97; Standard, Silverton, 109; Van Roi, Silverton, 92; Whitewater, Retallack, 42; and company mines, 8,205.

ALASKA

Alaska Juneau's Operating Profit in October Best Yet Made

Juneau—The following data refer to the operations of the Alaska Juneau in October:

A total of 143,200 tons was trammed; 91,630 tons fine milled; gold assay of mill fine feed, $1.47; gold recovered, $1.14; milling cost, $46,000; milling and tramming cost, $27,000; general cost, $4,000; total operating expense, $77,000; net operating profit, $27,500. This is the best profit showing made yet, it is stated.

ARKANSAS

American Manganese Co. Building Washing Plant at Polk-Southard Mine

Batesville—The American Manganese Co. is installing a washing and concentrating plant at the Polk-Southard mine, one of their properties near Cushman, Ark. The plant will have a capacity of approximately [illegible] tons a day, and they expect to make about [illegible] tons of concentrates daily. The same company will also install a large stone products plant at [illegible]. At this plant they will manufacture lime, ground limestone, cement and ground phosphate. The company lately took over the Independence Mining Co. They own several thousand acres of manganese land in the Batesville field which also contains commercial deposits of limestone, phosphate, marble and shale.

JOPLIN-MIAMI DISTRICT

King Brand Co. Leases Land Near Treece—Preparations To Be Made Against Smallpox—1,081 Injuries This Year

By P. R. Coldren

Joplin—Production of zinc ore in this field is approximately unchanged from what it has been for several months, and there seems no reason to expect notable change either in the way of reduced output or increased production in the near future. The ore in bins, though estimated by different persons at anywhere from 90,000 to 115,000 tons, is still held in strong hands and appears not to be a [illegible] influence on ore prices. One company alone has about 35,000 tons of concentrates, 1,000 of which are reported to be held in storage in the bins at one mine in the district.

The King-Brand Mining Co., which is owned by Jefferson City, Mo., investors, during the week ended Nov. 19 took over a lease known as the Longacre tract, immediately adjoining its mine near Treece, Kan., northwest of Picher, Okla., a short distance. The lease comprised twenty-two acres, which has been drilled thoroughly, and on which a shaft has been sunk 130 ft. The King-Brand Co. will finish sinking the shaft to about 230 ft. and connect it with its own mill by tram. W. T. Landrum is manager for the King-Brand company.

The Huttig Lead & Zinc Co. reports good drill strikes on its tract near Crestline, Kan., some distance north of Baxter Springs and in a part of the field comparatively undeveloped. It expects to proceed with development soon.

Accident statistics for the Tri-State field have been furnished to the Tri-State branch of the American Zinc Institute by Dr. D. L. Connell, physician and surgeon in charge of the Picher hospital, which is operated by the Institute. He reports that during the year 1921, up until November, a total of 1,018 injuries had been reported, 10 per cent being major injuries and 90 per cent of a minor nature. Of the total, 11 per cent were injuries received by miners from falling boulders, slabs, rocks, and [illegible] [illegible]; [illegible] per cent were eye injuries, of which the big majority were from flying rock, and only a few from flying steel; 10 per cent were injuries affecting the back, and 15 per cent were of other kinds.

Doctor Connell further reported that for the [illegible] part the [illegible] houses of the Tri-State [illegible] are in [illegible] condition and provided with shower baths, lockers [illegible]. He also reported that the sanitary [illegible] of the [illegible] of Picher has been [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] one half [illegible].

Upon the suggestion of A. [illegible] [illegible], president of the Tri-State branch of the Zinc Institute, and some of the [illegible] [illegible], [illegible] [illegible] it would not be [illegible] to [illegible] for smallpox, an outbreak of which is reported at [illegible] [illegible], [illegible], by [illegible] a [illegible] [illegible] to use for a detention hospital. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] for several [illegible].

MICHIGAN

The Copper Country

Bureau of Mines Studying Underground Loading Devices—Seneca Repairing Gratiot Shaft—Winona Sells Its Standing Timber

By M. W. Youngs

Houghton—It is estimated that there are 12,000,000 tons of sand in the Tamarack conglomerate tailings in Torch Lake, assaying 12½ lb. of copper to the ton. Calumet & Hecla plans to complete the reclamation plant there next summer, and the recovery of this metal will then begin. Though the deposit is not as extensive or as rich as that of the Calumet & Hecla proper, the copper can be recovered at low cost and the plant investment will yield a large return.

The Calumet & Hecla deposit originally contained 40,000,000 tons, running as high as 14½ lb. of copper to the ton. In 1920, the Calumet & Hecla tailings assayed 13.1 lb. to the ton, and of this amount 10½ lb. was recovered. A total of 14,138,240 lb. was produced, at a cost of 6.6c. per lb., exclusive of smelting and selling expense. This cost was high, on account of the abnormal price of coal and high cost of labor and supplies. It compares with a normal cost of 4½ to 5c. per lb. In the few years the Calumet & Hecla reclamation plant has operated it has recovered 48,537,488 lb. of copper. It is estimated the remaining sands carry over 450,000,000 lb. of the metal.

A study is being made by the Bureau of Miners of power shovels, stope and level scrapers, and other similar devices. A representative of the Bureau is now in the Lake district to continue the investigations. He has already visited other mining sections in the west, southwest and northwest. The findings will be incorporated in a report soon to be issued.

At the Gratiot shaft of the Seneca property extensive repairs are under way, preparatory to the resumption of sinking. The old shaft collar is being removed, and a new collar will be constructed. Steel sets will be used, and the collar will be concreted through the overburden, a depth of 95 ft. from surface. The present depth of the shaft is 1,420 ft. It will be sunk 1,800 ft. deeper, at which point it will be connected with the 3d level drift, north, from the Seneca shaft. The present hoist will be replaced with one having a capacity of 3,500 ft., purchased recently from the East Norrie mine, at Ironwood. The distance between Seneca's 3d level and the Gratiot shaft is approximately 4,000 ft. The 3d level drift is now about 1,900 ft. long. Seneca's forces have been somewhat increased to provide for the new work at the Gratiot shaft. It probably will be several months before sinking is resumed. All five drifts from the Seneca shaft, proceeding northward toward Gratiot, have been in good milling ground practically all the way. The showing in the 3d level drift, the longest, and in the 7th, the deepest, is important, inasmuch as these openings prove that values extend in the direction of Gratiot and also persist with depth.

The Winona Mining Co. has just concluded an important deal, having sold all of its standing sawlog timber to the Pampa Land Co., recently organized, which will establish a sawmill and tiemill at Winona. The transfer involves 20,000,000 ft. of timber, the greater part of which was owned by the Winona and the remainder by several small holders. The Winona company has arranged to sell power to the new concern and also will allow it to use its electric railway, houses, and other equipment in its work. The arrangement does not affect the mining rights of Winona, the company retaining all of its lands and other mining assets.

Gogebic Range

Operations Resumed at Newport and Palms-Anvil Mine

Ironwood — The Steel & Tube Co. of America has announced resumption of mining operations at its Newport and Palms-Anvil mines on Nov. 21. About 160 men have been employed at these mines, keeping them in repair and ready for operation. About 100 more will be taken on at the Newport and 150 at the Palms-Anvil. This will bring their forces up to about a quarter of normal strength.

The Newport will work three days per week and stock its ore, and the Palms-Anvil will work six days, but with no night shift, and will ship its ore to the company's furnaces at Mayville, Wis. The Eureka mine at Ramsay has taken on a few more men who were badly in need of work.

The Oliver Iron Mining Co. is preparing to sink "G" shaft of the Pabst mine another 120 ft. from the 23d to the 24th level. The latter level has been opened up from a transfer shaft and from "H" shaft.

Menominee Range

Carpenter and Monongahela Mines To Reopen Dec. 1

Crystal Falls—The M. A. Hanna Co. has given orders to reopen the Carpenter and Monongahela mines on Dec. 1. About 300 men will be given employment on full time. The mines have been idle since early in the summer. All ore mined will be stocked for shipment next summer. Prospects for the winter are far brighter than they were a few weeks ago, because of the Hanna announcement and the fact that the Steel & Tube Co. added 250 men to the forces at the Newport and Palms-Anvil mines on the Gogebic Range. It is expected that the Oliver Iron Mining Co. will soon issue a statement regarding winter operations.

Iron River—The Spies was the last mine to ship ore by water this year. An order was received recently to forward 28,000 tons to Escanaba, and this was soon loaded. Present indications are that Pickands, Mather & Co. will reopen some of their mines on Dec. 1. All of their properties are now idle.

Marquette Range

Kloman Mine Being Examined With View to Leasing

Ishpeming—The Holmes was the last property to move ore from stock this year. Twenty thousand tons was shipped by water this month. No announcements have been made regarding resumption of work at Marquette Range mines. A number of properties are being worked on a half-time basis and will probably continue to do so throughout the winter. Very little ore was sent out during the period of navigation and the stockpiles are well filled.

Republic—Engineers in the employ of R. W. Hunt & Co., of Chicago, recently inspected the Kloman mine for a Chicago concern which may take a lease. The mine has been idle for years, but it is known that it contains some low-grade ores. There is a possibility that a concentration of high-grade ore exists, such as found on the Republic, which adjoins on the east.

MINNESOTA

Mesabi Range

About 40 Per Cent of Men on Range Have at Least Part-Time Work

Hibbing—To reduce the rapidly rising number of unemployed in the Lake Superior iron district, the local managers of many of the independent operators have submitted plans to their eastern headquarters for the reopening of many of the mines after Dec. 1. The increase of the number of unemployed men is due to curtailment or temporary abandonment of road work and other construction activities. About 40 per cent of the 30,000 men employed normally in this district are now at work either full time, or part time, with married men given the preference.

Eveleth—The Oliver company's Leonidas mine has laid off most of its men, and only a few crews are now busy cleaning up. This is incidental to the closing of the shipping season. Stripping at the Spruce mine, operated by the same company, is being continued. The company plans to keep as many of the men employed as is possible.

Marble—To facilitate the handling and grading of ore next season at the Hill-Annex mine, the Interstate company has started to stockpile some of the cretaceous ore taken out, which it plans to treat at its washing plant next season.

Nashwauk—The Hanna Ore Mining Co. has started three diamond drills to work at its La Rue property to prove up the deposit lying south and east of the present pit limits.

Vermillion Range

Shift Added at Oliver Company's Pioneer Mine

Ely—Another shift of miners has been put to work at the Oliver's Pioneer mine. Recently a day shift of 100 men has been working steadily, but with the additional shift added it is estimated that the total number employed will be 250.

ALABAMA

Upward Trend Continues—Employment Conditions Much Improved in Birmingham District

By George Huntington Clark

Birmingham—Predictions as to iron making for the closing months of the year in the Birmingham district, based upon an expectancy of a steady although gradual upward trend toward normal, seem to have been reasonably well founded on fact. Authoritative figures for October production, now officially known, show that the pig-iron output has been actually 100,261 tons, or as premised.

Contributory, and in large measure auxiliary, to this pig-iron output, October coal production reached the highest mark since last February, being approximately estimated at 1,005,038 tons. The largest production for any week, or 266,000 tons, seems well advanced toward normal, which would be in excess of 300,000 tons. It is probable, however, that in some degree this output was measurably increased by anticipation of the threatened railroad strike.

Coke production, under the prevailing price basis, reached a total figure of 199,123 tons.

According to official figures, Alabama pig-iron production for the year steadily declined from the January output of 144,426 tons to the minimum of 66,573 tons reached in July. The upward trend, beginning Aug. 1, has been gradual but steady, culminating in the October output above stated, with an accredited total for the year, thus far, of 973,043 tons.

The output of steel realized was 65,000 tons, reflecting a recent order received from the Southern Pacific R.R. and now confirmed, for 44,600 tons of standard-steel rail, which represents the output of the Ensley plant of the Tennessee Coal Iron & Railroad Co. during a seven-weeks' period of normal operation.

Conditional rail orders from other southern and southeastern railroads, if confirmed, will bring the total steel rail business anticipated up to a total of about 130,000 tons already for 1922 delivery.

In view of the above encouraging upward trend of affairs generally, conditions of unemployment are naturally much improved, with no labor troubles or difficulties either under adjustment or expected.

CALIFORNIA

Central Consolidated and Norambagua Mines Merged—Engels Copper Increases Output

San Francisco—Consolidation of the Central Consolidated Mines, Inc., and the Norambagua Mines, Inc., both properties in the Grass Valley district, has been announced. Neither property has been in operation for some time. The Central Consolidated Mines, northeast of Grass Valley, was organized by John M. Nicol, a mining engineer of San Francisco. Mr. Nicol found it difficult to interest sufficient capital, and therefore made no attempt to work the property. The Norambagua is south of Grass Valley, and is an old property. After being closed down for a number of years it was reopened in 1916 by T. R. Pell and his associates, and the plant was modernized. The work was suspended during the war. The officers of the company are: President, N. J. Webster; vice-presidents, Theodore Roosevelt Pell, New York, John M. Nicol, San Francisco; vice-president and secretary H. B. Walmsley; treasurer, Leland Lyon; directors, Ernest Du Pont, A. De W. Foote, Parmeley W. Herrick, John Erickson and William H. Finley. Apparently, John M. Nicol is to be in charge of operations and F. A. Beauchamp is said to be retained as consulting metallurgist. No operating plans have been announced.

The organization of this company indicates the marked tendency toward the merging of small mining companies into larger groups that has characterized gold mining during the past ten years in this state.

An encouraging report is given by W. J. Loring upon the condition of the Plymouth Consolidated Mines. Because of the low grade of the ore and a large amount of development work the monthly returns have been unsatisfactory. Rich ore has been found in the small west vein on the 3,235 level, and this is expected to sweeten the bullion returns sufficiently to bring the property back to a paying basis.

The Engels Copper Co. is reported to have produced 1,100,000 lb. of copper and 17,000 oz. silver in October. This company has kept its properties steadily in operation during the period of the copper slump.

NEVADA

Tonopah Belmont and Extension Companies Providing Permanent Quarters for Men—Spanish Belt Mill Makes First Shipment

Tonopah—The Tonopah Belmont company recently shipped bullion valued at $153,000, representing the clean-up for the last fifteen days' operations in October. Since the strike of last April the Tonopah Extension and the Belmont have provided accommodations for their men, and both companies are now preparing permanent quarters suitable for winter. This is the first time in the history of the district that boarding and rooming houses have been provided by any company for its men.

The Cash Boy is sinking a winze from the 1,650 to the 1,770 level and is doing lateral drifting and stoping. About four cars of ore of milling grade are being shipped per month to the MacNamara mill. About twenty men are employed at present, part on development work in connection with apex litigation with the Tonopah Extension.

Divide—The Tonopah Divide shaft has nearly reached the 1,200-ft. point without striking the water level, and no change is reported. Development work, consisting of drifting and raising on the vein, on the 1st, 2d, 3d and 8th levels, progressed normally. Regular daily fifty-ton shipments are being made to the Belmont mill at Tonopah.

Spanish Belt—The Spanish Belt Consolidated Silver Mining Co., operating fifty miles north of Tonopah, made its first shipment of concentrates on Nov. 15. Tonnage was about thirty, and values approximately $200 per ton. With normal operations the company expects to ship two cars per month in the future.

ARIZONA

Old Dominion Said To Have Broken Diesel Records—Iron Cap Suit Up at Tucson Dec. 12

By James H. McClintock

Phoenix—On a stormy night last July, a daring thief stole the platinum tips from the ends of eight copper lightning rods that projected high above the coping of the new 27[illegible]-ft. smokestack of the International smelter at Miami. The tips have just been replaced.

From the Old Dominion power plant comes report that one of the company's 1,[illegible]-hp. Diesel engines has broken all Diesel records by continuous operation for 66 days. It is furnishing all power now consumed by the Old Dominion and Arizona Commercial properties.

The side line and apex dispute between the Iron Cap and Arizona Commercial companies will be heard in Globe, in the Gila County Superior Court, Dec. 12, before Judge Samuel L. Pattee, of Tucson.

A contract has been awarded for leveling the site of the new United Verde crushing plant, which is to be on one of the low hills on the edge of the Verde Valley, west of Clarkdale. There will be 35,000 cu.yd. of excavation and 18,000 cu.yd. of fill. More than three months will be required for the work. The buildings of the company's Cottrell smoke treatment plant at Clarkdale are completed and the stack is being erected.

James Douglas, president of the United Verde Extension, states that negotiations are in progress with the railroads in the hope of securing a freight rate of $5 a ton on copper bullion from this section to San Pedro harbor, on the Pacific coast, with expectation of shipping thence by water to New Jersey refineries. The pre-war rail rate to New York on bullion loaded at Douglas was less than $9 a ton. This has been raised to about $16, constituting a serious barrier for the southwestern copper industry to surmount.

NEW MEXICO

Possible Freight Reduction Encouraging—Gold Strike in San Mateo Mountains Causes Activity There

By James P. Porteus

Lordsburg—Mining men generally are encouraged at the promised freight reductions on mine necessities. New rates on coal from the mines in northern New Mexico and southern Colorado will re-establish the old relationship of 15c. per ton higher for coke than on coal, and rates on slack coal, which has never had a rate before, will be established on a basis of 80 per cent of the lump rate.

The new gold strike in the San Mateo mountains, thirty miles north of Palomas Hot Springs, is still attracting attention. Many locations are being made and additional pits are being sunk. It is claimed that the quartz ledges, which are in rhyolite, have been traced for six miles. Picked samples brought out show free milling quartz, and assays of from $10 to $40 are not unusual. The arroyos and gulches are being panned for gold, with fair results, the gold being fine but of good quality.

The 85 mine has cut the station on the 1,350 level, this point being [illegible] ft. below the apex of the vein. The shaft will be carried [illegible] ft. deeper to make room for ore pockets. A drift will be run to cut the vein, estimated to be 110 ft. distant.

The Co-operative mine continues to work, having shipped a car of high-grade silver ore to the El Paso smelter last week. [illegible] continues to move, with three cars from the [illegible] Eagle mine here and [illegible] from Las Cruces, all to Chicago [illegible].

A compressor and gas engine have been moved onto the [illegible] King ground in the [illegible] district. Development work will start at an early date under the lease and option held by the [illegible] & Arizona company.

Chloride—[illegible] has almost completed the [illegible] flotation mill on the [illegible] property.

The Midnight company also has men working on the construction of a fifty-ton mill. All machinery has been purchased, but some heavy pieces are still at the railroad. Bad roads have been a serious handicap.

Silver ores are being shipped to the El Paso smelter by Stauber and Wright from Lake Valley, by Stauber, Wright, Bell and Anderson from Chloride Flat, near Silver City, and by the Lady Franklin mine, at Kingston.

Under date of Oct. 26, 1921, Judge Colin Neblet, of the U. S. District Court for New Mexico, entered a decree in the case of Fleming et al vs. the Monte Rico Mining Co., Lawrence R. Boyd et al, which put an end to litigation which has tied up the affairs of the company named for more than four years. The judge directed in the decree that the bill of complaint be dismissed at the plaintiff's cost and that the defendants recover from the plaintiff their costs expended in the case.

TAMARACK & CUSTER CONSOLIDATED MINING CO.'S PLANT, SUNSET, IDAHO, THREE MILES FROM WALLACE

COLORADO

Diamond Drills Active in Cripple Creek District—Scotia Mill Being Remodeled

Silverton—Development work has been resumed at the Kittimac property, and drifting is in progress on both north and south veins.

Recent development work in the Gladstone tunnel opened a 4-ft. vein of silver lead ore. A mill test resulted in making concentrates assaying about 30 oz. silver and 25 per cent lead.

Cripple Creek—The work of advancing the Roosevelt deep drainage tunnel a distance of about 2,500 ft. from the Portland to the Vindicator mine is now under way. Work on the extension will also be done from the Vindicator end. The new connection will greatly reduce the cost of pumping at the Vindicator, and make available considerable promising ground for deeper exploration.

Rich ore has been found on the 20th level of the Ajax, where the development work is on company account. An 18-in. vein of $60 ore has been opened for a distance of 40 ft. on the Phillips lease.

The Le Brun Co. is developing the South Burns mine under lease, and extensive prospecting with diamond drills is progressing. Holes will be drilled from the 12th level of the South Burns to the Pharmacist, from the 3d level to the Findlay, and from the bottom level to the Pauper. The 11th level has been advanced 260 ft. north of the shaft, to cut the ore shoot mined above the 10th level, and a recent strike on the 13th level is developing favorably.

The Bull Raven Mining and Development Co. will undertake extensive prospecting by diamond drill, under the direction of E. P. Arthur, consulting engineer. The company will also unwater the Maude Helena shaft.

The Sangre de Cristo property is being reopened by Samuel MacDonald and associates. Compressed-air power is being installed preparatory to a campaign of development.

Telluride—During October the shipments of concentrates were as follows: Smuggler-Union, 90 cars; Tomboy, 56; Liberty Bell, 6 cars from clean-up around mill; total, 152 cars, compared with 109 cars for October last year.

Idaho Springs—Many properties that have been closed down for some time are being reopened, and there is a general revival of mining activity. The Little Mattie company will install a new wood-stave pipe line for power purposes, unwater the mine, and overhaul the mill, preparatory to resumption of active operations early next year.

IDAHO

Coeur d'Alene District

Gold Hunter Planning To Resume Production—Day Mines May Reopen About Jan. 1—Paragon Consolidated To Use Electric Power in Mine and Mill.

By A. J. Dunn

Wallace—The Gold Hunter Mining & Smelting Co., operating at Mullan, is planning to resume production soon after Jan. 1, according to a statement recently made by C. L. Herrick, general manager. The company has been inactive during the last year, the chief cause of suspension being the excessive freight rates on smelter products to the east. A substantial reduction was made several months ago, but in the meantime the price of lead had declined to a point that made it impracticable to resume operations. The more recent advance in the price of lead and favorable outlook for the metal now justify the company in preparing for an early resumption. The Gold Hunter employs normally about 160 men.

The belief also prevails that the Hercules and the Tamarack & Custer, commonly referred to as the Day mines, will also become active about Jan. 1, but of this there is no authoritative information. It is known that a large amount of coal has been delivered at the Hercules during the last few weeks to be used for heating surface buildings; that a carload of powder has recently been delivered at the mine, and that a large order has been placed for mine timbers. At present probably not more than twenty-five men are employed at the Hercules, and naturally the delivery of these large orders is taken to mean that a large force is soon to be put to work. At the Tamarack probably not more than a dozen men are employed, the mine being in excellent condition for production. The mill has been undergoing repairs. These movements in connection with the Day mines, taken with the favorable metal situation, are responsible for the prevailing belief that they will soon be active.

The directors of the Paragon Consolidated Mining Co. have placed an order with the Washington Water Power Co. for the immediate installation of electric power for both mine and mill. It is thought that this may mean the placing of that company in position for uninterrupted development and production, but it is also expected to have a direct bearing upon the reconstruction of the Prichard Creek branch of the O.-W. R. & N. Ry. from Prichard to Paragon, a distance of about fourteen miles. This branch was washed out four years ago. War conditions prevented reconstruction at the time, and unfavorable mining conditions subsequently discouraged the enterprise. The Paragon has a mill of 100 tons' capacity and tonnage available with which to supply it. With this company using motor trucks for the delivery of its product to the railroad, and several other properties in position to ship, it is believed that the reconstruction of the railroad will be amply justified. In fact, a company has been organized for the purpose, and it is expected that the action of the Paragon company in preparing for production will materially assist in financing the enterprise.

Clarks Fork. — Operations at the Lawrence mine have been resumed under the management of Joe Reed. A crew was started Nov. 5 stoping ore from above the level of the main tunnel. Milling operations will be resumed as soon as enough ore is in the bins.

By a suit filed in the district court, Helen F. Thibadeau, secretary and treasurer of the Copper Giant Mining Co., seeks to recover $58,500 from John G. Lake and associates as damages caused by the sale of treasury stock, which, it is claimed, rendered her holdings valueless.

The Clarinda Mining Co. has awarded Oscar Nordquist, of Murray, the contract for completing tunnel No. 5 to the Lone Pine vein. The tunnel has been driven 1,190 ft. and will cut the vein within the next 205 ft., it is estimated. Some promising mineralized stringers carrying chalcopyrite have been cut in driving the tunnel.

MONTANA

Helena Smelter Still Looking for Suitable Ore—Anaconda To Resume at Bonner Lumber Works

By A. B. KEITH

Butte—In view of the high silver content of the concentrates of the Butte & Superior Mining Co., it will occasion no surprise if production is resumed within thirty days. In fact, an eastern officer of the company is credited with the expression of an opinion to this effect. Development of copper ore on the 2,200 level continues.

Damages of $11,900,000 have been named by the Minerals Separation North American Corporation as due it from Butte & Superior thus, according to the estimate placed before the master who has been taking testimony in New York in the accounting resulting from the flotation litigation. This sum is given as the measure of damage as representing the difference between water concentration and flotation.

Anaconda is continuing development work to the extent necessary as a measure to help relieve the unemployment situation. At its phosphate deposit, near Soda Springs, Idaho, development work is apparently going ahead.

It is officially announced that Anaconda will resume operations at its Bonner lumber works on Dec. 1. This plant is situated west of Butte, near Missoula, and will afford employment for about 700 men. Anaconda has been building a new logging line, and with the men which it will put in the timber or has there already considerable relief will be given the unemployed.

The Tuolumne Copper Co. is finding the eastern territory on the 1,600 level encouraging. There is a possibility that development of other veins besides the Spread Delight on this level will be undertaken, particularly the Sinbad fissure, after which the original shaft on the Tuolumne's Main Range mine was named. This vein on the upper levels produced a good grade of copper ore, with the copper content running up to from 5 to 6 per cent. This showing was had on the 500 level and was the development which prompted the entry of the Tuolumne into the Main Range property.

The Barnes-King Development Co. is building a road to its recently acquired gold prospect near Waterloo, Mont. This property is promising on the surface.

Superior—Rich copper ore is reported to have been found near Cedar Creek, about four miles from Superior.

Montana City—The dredging possibilities of a tract of ground situated about ten miles from Helena below the early-day placer camp of Montana City, is attracting attention. Placer tracts in Avon Gulch and the Ruby Valley, where dredging has been in progress for years, are slowly becoming exhausted.

Helena—The following statement has been made by an official of the East Helena plant of the American Smelting & Refining Co.: "It has been rumored that the American Smelting & Refining Co. has withdrawn from the custom ore business in the Butte district. While it is true that we have found it necessary to place an embargo on the very low grade highly siliceous ores from Butte, we still are in the market for such Butte ores which will stand the necessary treatment charges."

WASHINGTON

Springdale—Dr. [illegible], of Cleveland, [illegible] property [illegible] ore [illegible] by [illegible] last summer. The mill is being put in condition for operation, in the hope of early production.

UTAH

Pittsburg Tramway To Be Completed Next Month—Prospecting Active in Big Cottonwood Section

American Fork—The Pittsburg mine, which was productive of high-grade carbonate silver-lead ore in the early days, will have its tramway completed by the middle of December. Shipments are promised from sulphide ore carrying silver, lead and zinc said to be left in the mine. There is also considerable unprospected ground. Silver-lead ore of milling grade that has proven for 300 ft. and ranges from 2 to 4 in. in width, is reported to have been found at the Pacific mine. There is a mill on the property, which has not been operating for some time.

Ophir—Directors just elected for the Ophir Silver Mines are: [illegible], president and general manager; H. W. Lane; L. F. Adamson; W. G. Goodart, and Ira Tichenor.

Park City—Shipments for the week ended Nov. 11 amount to 1,962 tons, as compared with 1,979 tons the week preceding. Shippers were: Judge allied companies, 934 tons; Silver King Coalition, 603; Ontario, 425. A station has been started at the top of the contact raise from the Spiro tunnel at a point just under the black limestone. Prospecting from here will be done along the contact. The second car from the new find at the Quincy mine will bring about $66 smelter net. The ore runs well in silver.

Salt Lake City—Owing to the opening of a new producer, the Alta Tunnel & Transportation, in addition to the Cardiff, which has been a successful shipper for a number of years, activity has been stimulated in the Big Cottonwood section. Prospecting is being carried on at the Howell, Tar Baby, Price, Reed's Peak, and other properties. The Alta Tunnel & Transportation has made its fifth shipment from the new find, although it is being hampered by lack of hauling facilities. Considerable ore is accumulated in the workings.

Eureka—Ore shipments from the Tintic district for the week ended Nov. 11 totaled 177 cars. Shippers were: Tintic Standard, 69 cars; Chief Consolidated, 38; Victoria, 12; Dragon, 12; Centennial-Eureka, 7; Eagle & Blue Bell, 6; Iron Blossom, 5; Colorado, 5; Swansea, 5; Bullion Beck, 2; Empire Mines, 2; Gemini, 2; Showers, 1; and Sunbeam, 1. Shipments are considerably less than those for the week preceding, owing to an order for curtailment of shipments of dry silver ores by the smelters, affecting a number of shippers, among them the Chief Consolidated and the Tintic Standard. The restrictions upon dry silver ores are felt to be temporary, as the smelters have made special arrangements for this class of material.

The Iron Blossom will pay a dividend of 2½c. a share on [illegible] on Dec. [illegible]. This will bring dividends to date to [illegible]. The last payment was made Jan. 26, 1920.

The Tintic Standard has [illegible] two new roasters at its mill near Goshen. This will make a total of [illegible] roasters and the mill's capacity will be increased to approximately [illegible] tons daily. The new roasters are expected to be ready for operation early in December. At the Water Lily shaft of the Chief Consolidated the work of [illegible] has been completed, and other improvements preparatory to resuming sinking have been made. The air pipe is [illegible] in diameter, and the ventilating system is working satisfactorily, and will effectively remove any gas encountered in sinking. New guides have been placed in both compartments of the shaft and a new headframe has been built.

At the [illegible], the shaft is down [illegible] ft. and is being sunk at the rate of 4 ft. daily. The projected length of the shaft is [illegible] ft.

THE MARKET REPORT

Daily Prices of Metals

Nov.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
17	13.00	28.75	29.125	4.65@4.70	4.35	4.65@4.70
18	13.00@13.125	28.75	29.125	4.65@4.70	4.35	4.65@4.70
19	13.00@13.125	28.75	29.125	4.65@4.70	4.35	4.65@4.70
21	13.125	29.00	29.625	4.65@4.70	4.35	4.65
22	13.125@13.25	29.25	29.625	4.65@4.70	4.35	4.65
23	13.25	29.50	29.625	4.65@4.70	4.35	4.65

*These prices correspond to the following quotations for copper delivered: Nov. 17th, 13.25c.; 18th and 19th, 13.25@13.375c.; 21st, 13.375c.; 22d, 13.375@13.50c.; 23d, 13.50c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
17	66	67	74½	159¼	161¼	24¼	23¾	25⅞	26½
18	66½	67⅜	74½	158¾	160¾	24¼	23¾	25⅞	26½
19	...	...	..	....	...	..	...	..	...
21	66⅜	67⅜	74½	160⅝	162½	24½	24	25¾	26⅜
22	66⅝	67⅝	74½	161½	163¼	24¾	24¼	25⅞	26½
23	66¾	67⅝	75	160½	162¼	25¼	24⅝	25⅞	26½

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver			Nov.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
17	399¾	99¼	68¾	38¾	21	399⅝	99⅝	69¾	39¼
18	399	99⅝	69	39	22	398	99⅝	67¾	38
19	399½	99⅝	69¾	39¼	23	399	99⅝	68¼	38½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Metal Markets

New York, Nov. 23, 1921

The metal markets have not moved in unison. Copper has been the feature of the price movement through the week, advancing regularly and continuing to exhibit the strength it has shown for the last few weeks. The zinc market has eased off and shown a slight decline, and lead shows no change in price. Tin has continued its advance. On the whole, the metal markets had a satisfactory week.

Copper

All sorts of prices have been quoted and received in the copper market during the week, copper being sold last Thursday for 13¼c. delivered, prices ranging upward to 13¾c., the price received by one producer yesterday for forward copper. The strength of the market and the upward tendency that were noted in the columns of the market report for last week are still characteristic of it. The demand continues to be for forward copper, very little metal for prompt shipment being sold. Some large-sized tonnages were sold as far ahead as next June, and at prices that were being quoted for first-quarter delivery, 13⅜@13⅝c. delivered. One producer expressed himself as being willing to consider sales for the entire year 1922. Several consumers have availed themselves of this opportunity to procure copper at the present attractive prices. No doubt the gradual advance in copper prices which began a few weeks ago has induced many manufacturers to come into the market now to fill requirements rather than to risk a possibility of being unable to obtain satisfactory tonnages at some future date. Prompt copper was obtainable yesterday at 13½c. delivered, but the amounts of metal offered today at this price are not heavy. The larger producers have kept consistently above the market, but have seemingly had no difficulty in transacting business. They are generally quoting 13¾c. delivered for delivery up to the end of February. Sales of copper have been so large for the first three weeks of this month that already it begins to appear that the 140,000,000 lb. sold in October will be handily eclipsed in November. The improvement in the copper market brings the date of resumption in production much closer. The subject is being talked of, but it is much too early to take such a step.

Export trade has been good, the metal having been sold both to Europe and the Orient by the Copper Export Association. It is reported that the European business has been booked on a 13.75c. c.i.f. basis.

Lead

The official contract price of the American Smelting & Refining Co. continues at 4.70c., at which level it has remained for about two months. The market was fairly active during the week, and New York transactions were made on a 4.70c. and a 4.65c. level, which is our range for the week. The St. Louis market has shown no change from the last report, and continues at 4.35c. One consumer expressed himself as being able to obtain the metal below this price, but we have heard of no sales to indicate that better than this has been done. Owing to the prospective reduction in freight rates from Missouri, producers in that state have been able to compete in the New York market. Several sales were made at the New York level quoted above for delivery after the reduction takes place, on Dec. 10. Competition from the West with New York will not be felt at such interior points as Pittsburgh and Cincinnati, for the freight decrease does not affect traffic to cities between St. Louis and New York.

Mexican lead is still going to Europe, where a much better market awaits it. Today's London price is the equivalent of about 4.53c. New York. The Spanish and Australian lead positions are none too good, which, coupled with the insistent demand from Europe and small stocks available, has led to an improvement in the London market.

Zinc

The market has been exceptionally quiet. Of the largest producers but one has been active in disposing of ordinary Prime Western metal. The lull has continued for almost two weeks, and has now found a reflection in the price, as zinc has been sold down to 4.65c. East St. Louis, for which it is readily obtainable today. Producers in a good financial position are generally unwilling to meet this price, and again it is the smaller operators who are setting the market.

The galvanizing trade has been interested more in high-grade than in other varieties of zinc. One producer reports that he is experiencing the best month of the year in high-grade metal, which is being sold at prices corresponding to those of the last few weeks, 6c., with freight allowed.

Tin

The market has risen, and prices are close to 30c. Large tinplate interests have been active in the buying of the week, the rise in the market evidently having induced prospective purchasers to fill their needs at the present time before the market has an opportunity to get away from them.

Tin for February delivery: Nov. 17th, 29.375c.; 18th, 29.375c.; 19th, 29.375c.; 21st, 29.625c.; 22d, 29.625c.; 23d, 29.625c.

Arrivals of tin in long tons: Nov. 17th, China, 100; 21st, London, 25, Straits, 375.

Gold

Gold in London: Nov. 17th, 102s. 8d; 18th, 103s.; 21st, 102s. 11d.; 22d, 103s. 3d.; 23d, 102s. 11d.

Foreign Exchange

Sterling has been the feature of the market, quotations crossing $4 during the week, but failing to hold the advance. Other exchanges have been quiet. On Tuesday Nov. 22, francs were 7.13c.; lire, 4.123c.; and marks, 0.36c. New York funds in Montreal, 9⁹⁄₁₆ per cent premium.

Silver

Silver has fluctuated violently the last week. During the first few days China banks were keen buyers, both in New York and abroad, but toward the close of the week speculators sold in London, and China became a reluctant buyer in the local market. Rupee exchange continues weak, with no buying by the Indian bazaars. At the close the market appears steady, with China again a buyer. On Nov. 18, the New York quotation for bar silver of "domestic origin" was raised from 99½c. to 99⅝c. per ounce .999 fine. This advance in price was caused by the decreased cost of transportation, owing to the fact that the U. S. Government is now accepting delivery of silver purchased under the Pittman Act at the Philadelphia Mint only. Previously, when the quotation was 99½c., the Government had required deliveries to be made at Denver or San Francisco Mints.

Mexican Dollars—Nov. 17th, 52⅞; 18th, 52⅞; 19th, 53¼; 21st, 53¼; 22d, 51½; 23d, 52.

Other Metals

Quotations cover wholesale lots unless otherwise specified

Aluminum—List prices of 24.5@25c. are nominal. Outside market, 17.50@18c., with practically no sales.

Antimony—Chinese and Japanese brands, 4.60c.; W. C. C. brand, 5.25@5.75c. per lb. Cookson's "C" grade, spot, 9c. per lb. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, [illegible].

Bismuth—$1.50@$1.55 per lb.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $3@$3.25 per lb.; black oxide, $2@$2.10 per lb. in bbls.

Iridium—Nominal, $150@$170 per oz.

Molybdenum Metal—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominal, $55@$60 per oz.

Platinum—$80 per oz.

Quicksilver—$39@$41 per flask. San Francisco wires $41. Market dull.

The prices of the following metals remain unchanged from the figures published in these columns on Nov. 5: Rhodium, Selenium, Thallium, and Tungsten.

Metallic Ores

Manganese Ore—$23@$24 per unit, seaport; chemical ore, $55@$60 per gross ton, lump; $75 per net ton, powdered. Nominal.

The market is generally exceedingly quiet, and prices on the following ores remain unchanged from the figures published in the Market Report in the Nov. 5 issue: Chrome, Iron, Magnetite, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, Zircon, and Zirkite ores.

Zinc and Lead Ore Markets

Joplin, Mo., Nov. 19—Zinc blende, per ton, high, $27.70; basis 60 per cent zinc, premium, $26; Prime Western, $26@$25; fines and slimes, $23@$22; average settling price, all grades of blende, $24.74.

Lead, high, $63.40; basis 80 per cent lead, $55@$52.50; average settling price, all grades of lead, $60.50 per ton.

Shipments for the week: Blende, 7,750; lead, 1,180 tons. Value, all ores the week, $292,980.

Almost 9,000 tons was purchased this week, for next week's delivery, on $26 basis, advancing the market $1 over last week. The high school-tax assessed against bins of ore in the Picher and Cardin school districts in Oklahoma has caused the sale of some reserve ore, and a few other bins may be offered for shipment at an early date. Ore on hand at the year-end will be subject to tax, said to amount to $2 to $3 per ton. The matter was fought out in the Oklahoma courts last year, with all decisions against producers of zinc ore.

Platteville, Wis., Nov. 19—Blende, basis 60 per cent zinc, $29. Lead ore basis 80 per cent lead, $55 per ton. Shipments for the week: Blende, 535; lead ore, 80 tons. Shipments for the year: Blende, 10,719; lead ore, 1,763 tons. Shipped during the week to separating plants, 461 tons blende.

Non-Metallic Minerals

Asbestos—Crude No. 1, $1,000@$1,200; No. 2, $600@$850; spinning fibres, [illegible]@$400; magnesia and compressed sheet fibres, $150@$250; shingle stock, $80@$150; paper stock, $45@$65; cement stock, $15@$25; floats, [illegible]@$10, all per short ton, f.o.b. Thetford, Broughton and Black Lake mines, Quebec, Canada.

Generally dull markets also exist for the non-metallic minerals, and there is no quotable change in the following from the prices published in our Nov. 5 issue: Barytes, Bauxite, Borax, Chalk, China Clay, Emery, Fluorspar, Fuller's Earth, Graphite, Gypsum, Kaolin, Limestone, Magnesite, Mica, Monazite, Phosphate Rock, Pumice Stone, Pyrites, Silica, Sulphur, Feldspar, and Talc.

Mineral Products

Arsenic—6¾c. per lb., f.o.b. New York. Price has risen and the market is firm. Importations have been small and the insecticide business has improved, agricultural buying for next Spring being a feature of the market. Forward deliveries command a premium.

Potassium Sulphate—Powder, domestic, $1@$1.10 per unit, basis 90 per cent, f.o.b. New York.

The prices of Sodium Nitrate and Sodium Sulphate are unchanged from the quotations published in these columns Nov. 5.

Ferro-Alloys

No quotable changes have taken place in the following ferro-alloys from the prices quoted in the Nov. 5 issue: Ferrotitanium, Ferrocerium, Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotungsten, Ferro-Uranium, and Ferrovanadium.

Metal Products

Zinc Sheets—$9 per 100 lb., less 8 per cent on carload lots, f.o.b. works.

Copper Sheets—Current New York list price, 21c. per lb.; wire, 14.75@15c.

Lead Sheets, Nickel Silver, and Yellow Metal unchanged from Nov. 5th quotations.

Refractories

Prices on the following are unchanged from the figures published in the Nov. 5 issue: Bauxite Brick, Chrome Cement, Chrome Brick, Fire Brick, Magnesite Brick, and Silica Brick.

The Iron Trade

Pittsburgh, Nov. 22, 1921.

Though the finished-steel market in general is commonly reported as being distinctly dull, there is a fair degree of activity, making a favorable comparison with conditions in July and August but an unfavorable comparison with the latter part of September and the forepart of October.

There is important improvement in one respect, in that railroad buying on a scale of importance has been resumed. Orders for more than 5,000 freight cars have just been placed, and inquiries total more than 10,000 cars.

Steel production is ranging between 40 and 45 per cent of capacity, against a rate of 44 per cent in October, the highest rate since February.

Steel prices continue to show a slight sagging tendency. In the past fortnight there has been much shading of [illegible] for black sheets and [illegible] for galvanized sheets, but in the last two or three days many low prices have been withdrawn. The Steel Corporation is likely to announce [illegible] sheet prices within a week or so. Bars, shapes and plates are [illegible] at 1.50c., but the general tone of the market is a shade above that figure.

Pig Iron—The market continues dull. Foundry iron has yielded [illegible] to [illegible], Valley. Bessemer remains at [illegible], Valley. Though basic is still quoted at $18, Valley, by producers, resale iron is available at less.

Coke

Connellsville—Furnace, [illegible]@$3.50; foundry, [illegible] per ton.

Disarmament and the Metals

Producers Undisturbed Over Cut in Naval Construction—Iron and Steel Trade Hardest Hit—Copper, Zinc, and Lead Producers' Prosperity Built Upon Sound, Peaceful, Industrial Applications

EDITORIAL MARKET STUDY

WAR IS WAGED WITH METALS. Therefore metal producers have a natural interest in war and anything that affects its conduct or regulates armament. Fortunately, this interest is not vital to the prosperity of any metal producer, as normal industrial applications greatly outweigh the uses of the metals in the prosecution of war. At the height of an active campaign or in preparation of a great offensive the effect of armament demand is felt most; during periods of peace it is at a minimum.

The Disarmament Conference at Washington, acting on the initiative of Secretary Hughes, has taken a sudden and bold step in adopting a plan of limiting naval armaments and scrapping some costly existing men-of-war. The curtailment of naval building comes just at a time when the three largest naval powers are preparing to enter on an extensive period of naval construction. The first reaction of everyone engaged in industrial pursuits to the Washington decisions is, "How will they affect me or the industry I am engaged in?" The answer is necessarily of especial interest to the metal-mining industry.

The most important metals used in war from the standpoint of quantity are iron, copper, lead, zinc, and nickel. Iron is by far the most important, particularly in naval armament, with which the Washington Conference is chiefly concerned, yet none of the leaders in the iron and steel trade seem particularly disturbed over the prospect of a severely curtailed or entirely abandoned naval-construction program. Comments have been decidedly optimistic and cheering. Judge Gary sums up the subject by saying, "Disarmament is a good thing—steel included." The recent convocation of the American Iron and Steel Institute found an echo of this expression in the speeches of Charles M. Schwab and others sharply affected by the turn of affairs.

Although statistics are not available to indicate exactly what proportion of the entire steel consumption of the United States enters into naval armament, it is estimated that the scrapping of fifteen capital ships now under construction would involve about 420,000 tons of steel. The further elimination of fifteen other war vessels would bring the total close to 600,000 tons, a small figure compared with the total rolled-steel output of the United States in 1920 of about 32,350,000 tons. However, the figures cannot readily be compared, as the building of so many ships would be spread over a period of possibly eight or ten years. The amount of steel required for a year's building would be only a fraction of 1 per cent of the entire country's tonnage. Even this small fraction will, nevertheless, cause a readjustment among employers and employees engaged in naval construction. It will be a wholesome readjustment. The world can still find use for many plows, railroads, steam engines, and other equipment and devices. This readjustment will be nothing compared with the great change that was made directly after the armistice, or with other great industrial alterations.

Copper producers are not at all perturbed over naval disarmament. Copper is more handmaiden to that wonderful servant of the twentieth century, electricity, rather than to the god Mars. The modern battleship uses relatively small amounts of copper; brass fixtures, electrical machines, copper in the ship's magazine, copper in various other manufactured forms account for the most of it. Copper and brass are most important in munitions manufacture—land and naval. Inasmuch as little prospect exists for a reduction of land armament, copper consumption normally entering into that channel may not be greatly affected.

Prior to 1914 the war demand for copper was an important market factor. Germany imported large amounts of copper for use in the manufacture of ammunition, and it is generally admitted that the war chest built by Germany accounted in a great measure for the heavy purchases of American copper, the question may readily be asked whether, in view of Germany's disarmament, her future purchases of copper will be greatly reduced. The record for 1921 would answer strongly in the negative, as Germany has consistently been the heaviest buyer of American copper ever since the first of the year. The fact that a huge export trade will have to be built up by Germany in order to pay reparations presupposes that much copper will have to be imported for manufactures, such importations replacing to an unknown extent the copper imported for munitions. At the same time other European countries which remain on a war footing or one closely approaching it add to the demand for copper.

Estimates of normal copper consumption in the United States in munitions and armaments are unavailable. A guess would place the figure at not more than 20,000,000 lb. Of course, there are a great many uses for copper in electrical machines, instruments, or devices that are requisite in war, which may be considered to be affected by disarmament, but this is an unimportant consideration, as practically all these machines can be used for some peaceful pursuit.

Lead and zinc are important in war. Lead is used in making shot, shrapnel, and other ammunition, and zinc, as an important constituent of brass, is used in cartridge cases and other important applications. Here again no accurate statistics are available indicating what amounts of these metals are normally used in armament. The War Industries Board, however, has made an estimate for the war years 1917 and 1918 which would show that 2.6 per cent of domestic lead production for that period entered into shrapnel manufacture, 1.77 per cent into shot, 1.46 per cent into military small arms, and 1.39 per cent into sporting ammunition. For the first ten months of 1918, the ratios were still higher, 5.37 per cent for shrapnel, 1.38 per cent for shot, 3.10 per cent in military small arms, and 1.43 per cent in sporting ammunition.

The present demand for lead is not built upon consumption in most of these channels. The uses of lead in cable, pipe, sheets, storage batteries, foil, paints, and sporting ammunition are the healthy normal pillars of the lead-mining industry. Disarmament will not shake them.

Although the war demand for zinc raised that metal to unheard-of prices, prosperity among zinc producers is happily not predicated on war uses. Hence producers are untroubled over the proposed cut in naval armaments.

Perhaps the metal to feel the change most keenly is nickel. Large amounts of nickel are used in the manufacture of nickel steel, an especially tough and valuable armor. The peace uses of nickel have not been developed to the extent that other metals have, principally because of its higher price—from 30 to 40c. per lb. Nickel producers will undoubtedly feel the decreased naval building, both in the United States and abroad. Of the other metals, antimony, quicksilver, platinum, little need be said, as the United States is a small producer of them.

Even were the entire mining industry of the United States to stand a heavy loss by the cut in arms, the sacrifice would, we can rest assured, be gladly made for the advancement of civilization. The minor readjustments to be made consequent upon the Washington conclave will be concluded without great difficulty. The non-ferrous metal-mining industry will not be disturbed to the extent that the iron and steel trade will be affected.

The many industrial applications for all the metals which aid in promoting industrial development and in making life more comfortable offer a large enough field for the outlet of those normally consumed for war purposes.

COMPANY REPORTS

Hollinger Consolidated Gold Mines, Ltd.

A report of Hollinger Consolidated Gold Mines, Ltd., for 1920 states that profits amounted to $[illegible]. Nine dividends of 1 per cent each were paid, or $2,214,000. There was 650,205 tons of ore milled, the average value of which was $9.9[illegible] per ton. The net value recovered was $6,219,664.80. Bullion shipped in 1920 amounted to $6,634,129.80. Profit and loss account follows:

PROFIT AND LOSS STATEMENT

[illegible]			$[illegible]
[illegible]			222,982 70
			$7,[illegible]
[illegible]		$[illegible]	
[illegible]		[illegible]	
[illegible]		[illegible]	$[illegible]
[illegible]			$4,[illegible]
[illegible]	$66,427 26		
[illegible] $35,000 [illegible]	46,356 72		
[illegible] of Canada [illegible]	112,[illegible]	$[illegible]	
[illegible]		[illegible]	
[illegible] Hollinger [illegible] written down		260,872 27	
[illegible] written off		[illegible]	
[illegible]		1,959 31	1,343,007 47
[illegible]			$2,67[illegible],274 93
[illegible]			2,214,000 00
[illegible]			$461,274 93
[illegible] 1919			$2,670,577 08
[illegible] Dec. 31, 1920			[illegible]
			$6,462,918 67
[illegible]		$2,[illegible]	
Plant depreciation		[illegible]	
[illegible] written off		[illegible]	
[illegible]		[illegible]	
[illegible] written down		[illegible]	
[illegible]			[illegible]
			$[illegible]

The company is capitalized at $25,000,000, of which $24,600,000 in stock is outstanding. General charges per ton of ore were $0.5262, mining charges, $2.8[illegible], milling charges, $1.4628; a total of $4.8[illegible].

Wallaroo & Moonta Mining & Smelting Co.

Copper; Australia

A report of operations of the Wallaroo & Moonta Mining & Smelting Co., Ltd., for the year ended June 30, 1921, shows a loss for the year of £71,86[illegible]. A total of 3,206 tons of refined copper, 1,600 oz. of gold, and 1,400 oz. of silver was produced. Working expenses were £[illegible] 19s. 1d., and office expenses and other charges brought this total up to £[illegible] 11s. 4d. The deficit of the company on June 30, 1921, was £87,747 3s. 4d. Capitalization, 200,000 shares of £2 each, of which 160,000 have been issued.

Broken Hill South, Ltd.

A report of operations of Broken Hill South, Ltd., for the year ending June 30, 1921, discloses that a loss of £56,761 17s. 11d. was incurred by the year's operations before depreciation and debenture redemption had been considered. There was produced a total of 14,501 tons of concentrates having a metal content of [illegible] tons of lead, 510,[illegible] oz. of silver, and 1,730 tons of zinc.

Broken Hill South has large interests in other companies, among them being the Broken Hill Associated Smelters Proprietary, Ltd., of which it has 200,000 shares of £1 each; the Electrolytic Zinc Co. of Australia, Ltd., 150,000 shares of £1; the Globe Proprietary Co., Ltd., 11,250 shares of £1; the Barrier Roaster Co. Proprietary, Ltd., £10,000 of £1 each; the Zinc Producers Association Proprietary, Ltd., 720 of £1; and the Australian Ore & Metal Co. Pty., Ltd., 300 of £1.

Operations of the company have been beset with many difficulties, mainly labor troubles.

Caledonia Mining Co.

Lead, Silver; Idaho

A review of operations of the Caledonia Mining Co. for the nine months ending Sept. 30, 1921, with financial report of Sept. 30, 1921, states that production during the above period is from the shipment of a small amount of ore, but comes mainly from reclaiming of material in stope fillings and dumps left from the early operations of the property and on which a profit is now possible because of improved working facilities, the good silver market, and the excellent marketing arrangements at the local smelter. It is estimated that it will require upward of a year to reclaim the material which still remains in old stopes and dumps. The standing ore in the mine is practically all gone, and development work done since the last report, which is being continued, so far fails to disclose new ore, and there is no substantial reason for expecting new disclosures. All of the company's ground will be thoroughly tested and prospected, however, before development work is finally terminated.

A statement of production and operating costs and a report of the financial condition of the company follow:

PRODUCTION AND OPERATING COSTS

	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]			
Pounds lead	[illegible]	[illegible]	[illegible]	[illegible]
Ounces silver	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]			[illegible]
[illegible]				$[illegible]
[illegible]				[illegible]
[illegible]				$[illegible]
[illegible] $[illegible]			[illegible]	
[illegible] $[illegible]			[illegible]	$[illegible]
[illegible]				$[illegible]

FINANCIAL STATEMENT

[illegible]

[illegible]	$[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	$[illegible]
[illegible]	$[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	$[illegible]

Transvaal Gold Production

The following table summarizes Transvaal gold production since 1917:

RAND GOLD [illegible]

	1921	1920	1919	1918	1917
January	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
February	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
March	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
April	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
May	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
July	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
August	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
September	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
October		[illegible]	[illegible]	[illegible]	[illegible]
November		[illegible]	[illegible]	[illegible]	[illegible]
December		[illegible]	[illegible]	[illegible]	[illegible]

MINING STOCKS

Week Ended November 19, 1921

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Ahmeek	Boston	55	52	55	Sept. '20, Q	$0.50
Alaska-Br. Col. new.	N. Y. Curb	3⅜	3⅛	3⅛		
Allouez	Boston	24½	23½	23½	Mar. '19	1.00
Anaconda	New York	45	42½	44¼	Nov. '20, Q	1.00
Arcadian Consol.	Boston	2⅝	2½	2⅝		
Ariz. Com'l	Boston	9⅜	8¾	9	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*34	*30	*30		
Bingham Mines	Boston	13½	13¼	13½	Sept. '19, Q	.25
Calumet & Arizona	Boston	....	....	52½	Sept.'21 Q	.50
Calumet & Hecla	Boston	245	240	244	June '20, Q	5.00
Canada Copper	N. Y. Curb	*29	*28	*28		
Centennial	Boston	8½	8½	8½	Dec. '18, SA	1.00
Cerro de Pasco	New York	32¼	31	32¾	Mar. '21, Q	.50
Chile Copper	New York	12⅜	12⅛	12½		
Chino	New York	26⅞	26	26¾	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*14	*14	*14		
Con. Arizona	N. Y. Curb	*3	*2	*2	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1⅛	1	1		
Copper Range	Boston	36	34	35½	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*41	*39	*41		
Davis-Daly	Boston	6⅞	5½	5¾	Mar. '20, Q	.25
East Butte	Boston	10¼	9⅛	10	Dec. '19, A	.50
First National	Boston Curb	*75	*70	*70	Feb. '19, SA	.15
Franklin	Boston	2¼	2	2		
Gadsden Copper	Boston Curb	†*50	†*40	*40		
Granby Consol	New York	26¾	23½	26	May '19, Q	1.25
Greene-Cananea	New York	24½	23	24	Nov. '20, Q	.50
Hancock	Boston	2½	2½	2½		
Howe Sound	N. Y. Curb	2⅝	2½	2⅝	Jan. '21, Q	.05
Inspiration Consol	New York	38	36	37⅞	Oct. '20, Q	1.00
Iron Cap	Boston Curb	7	6	7	Sept. '20, K	.25
Isle Royale	Boston	22	20	21	Sept. '19, SA	.50
Kennecott	New York	24½	23⅜	24⅛	Dec. '20, Q	.50
Keweenaw	Boston	†1½	†1⅛	1⅛		
Lake Copper	Boston	2⅞	2½	2⅝		
La Salle	Boston	2	1½	1⅞		
Magma Chief	N. Y. Curb	....	....	*8		
Magma Copper	N. Y. Curb	22	21	21½	Jan. '19, Q	.50
Majestic	Boston Curb	*8	*6	*8		
Mason Valley	Boston	1⅜	1½	1½		
Mass Consolidated	Boston	2⅛	2	2	Nov. '17, Q	1.00
Miami Copper	New York	25½	23⅞	25⅛	Nov. '21, Q	.50
Michigan	Boston	2½	2½	2½		
Mohawk	Boston	52½	51	51	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	5⅝	5	5⅛		
Nevada Consol	New York	13⅜	12⅞	13⅜	Sept. '20, Q	.25
New Cornelia	Boston	15¼	15	15¼	Aug. '20, K	.25
North Butte	Boston	11⅛	10½	11½	Oct. '18, Q	.25
North Lake	Boston	*18	†12	*18		
Ohio Copper	N. Y. Curb	....	....	*7		
Old Dominion	Boston	25	24	24¾	Dec. '18, Q	1.00
Osceola	Boston	32	29	31	June '20, Q	.50
Phelps Dodge	Open Mar.	†185	†175	....	Oct. '21, Q	1.00
Quincy	Boston	42½	39	40	Mar. '20, Q	1.00
Ray Consolidated	New York	14⅛	13⅜	14⅛	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*23	*20	*23		
St. Mary's Min. Ld.	Boston	42	39	41½	June '20, K	2.00
Seneca Copper	Boston	....	....	20½		
Shannon	Boston	1⅛	1	1⅛	Nov. '17, Q	.25
Shattuck Arizona	New York	6¾	6	6⅜	Jan. '20, Q	.25
South Lake	Boston	1	*35	*50		
Superior & Boston	Boston	1½	1⅛	1½		
Tenn. C. & C. cfs.	New York	9⅜	9½	9½	May '18, I	1.00
Tuolumne	Boston	*40	*36	*37	May '13	.10
United Verde Ex.	Boston Curb	28	26⅞	27½	Nov. 21, Q	.25
Utah Consol	Boston	3 1/16	1⅛	2	Sept. '18,	.25
Utah Copper	New York	58	55⅜	57¾	June '21 Q	.50
Utah Metal & T.	Boston	2	1½	1 1/16	Dec. '17,	.30
Victoria	Boston	†1⅜	†1⅛	1½		
Winona	Boston	*46	*45	*45		
Wolverine	Boston	11½	10¾	10¾		
NICKEL-COPPER						
Internat. Nickel	New York	14⅛	12¾	12¾	Mar '19,	.50
Internat. Nickel, pf.	New York	72½	68	69	Nov. '21, Q	1.50
LEAD						
National Lead	New York	82⅛	78	81½	Sept '21, Q	1.50
National Lead, pfd.	New York	106½	106½	106½	Sept '21 Q	1.75
St. Joseph Lead	New York	13⅜	13	13⅜	Sept. '21, Q	.25
QUICKSILVER						
New Idria	Boston	†*50	....	*50		
ZINC						
Am. Z. L. & S.	New York	11	9½	11	May '20,	1.00
Am. Z. L. & S. pfd.	New York	35	33	35	Nov. '20, Q	1.50
Butte C. & Z.	New York	5½	4⅜	5½	June '18,	.50
Butte & Superior	New York	17½	14½	16¾	Sept. '20,	1.25
Callahan Zn-Ld.	New York	6⅞	4⅜	6¾	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	125	124	124¾	Nov. '21 Q	2.00
Success	N. Y. Curb			2	July '16,	.03
Yellow Pine	Los Angeles	*40	*35	*40	Sept. '20, Q	.03

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	New York	½	⅜	½		
Alaska Juneau	New York	¾	½	½		
Carson Hill	Boston	14¼	12⅞	13⅞		
Cresson Consol. G.	N. Y. Curb	2	1⅞	2	June '20, Q	$0.10
Dome Extension	Toronto	*75	*70	*73		
Dome Mines	New York	20¼	19¼	19	Oct. '21, Q	.25
Florence Goldfield	N.Y. Curb	*37	*31	*32		
Golden Cycle	Colo. Springs	*72	*70	*72	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*4	*3	*4	Dec. '19,	.05
Hollinger Consol.	Toronto	7.94	7.53	7.90	Nov. '21, 4 wks.	.05
Homestake Mining	New York	55	53	55	Oct. '21, M	.25
Kirkland Lake	Toronto	*34	*25	*30		
Lake Shore	Toronto	1.24	1.18	1.23	Nov. '21, K	.02
McIntyre-Porcupine	Toronto	1.94	1.91	1.93	Sept.'21, K	.05
Porcupine Crown	Toronto	*15	*13	*15	July '17,	.03
Porcupine V. N. T.	Toronto	*18	*17	*17		
Portland	Colo. Springs	*34	*34	*34	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	....	....	*4	May '19,	.05
Schumacher	Toronto	*27	*23	*27		
Silver Pick	N. Y. Curb	....	....	*8		
Teck Hughes	Toronto	*16	*15	*15½		
Tom Reed	Los Angeles	*40	*38	*40	Dec. '19,	.02
United Eastern	N. Y. Curb	2 1/16	2 1/16	2⅜	Oct. '21, Q	.15
Vindicator Consol.	Colo. Springs	†*25	†*22	*23	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*4	*4	*4		
Yukon Gold	N. Y. Curb	1⅛	1	1⅛	June '18,	.02½
SILVER						
Arizona Silver	Boston Curb	....	....	*18	Apr. '20, M	.03
Batopilas Mining	New York	⅜	⅜	⅜	Dec. '07, I	.12½
Beaver Consol.	Toronto	*21	*19½	*21	May '20, K	.03
Coniagas	Toronto	1.20	1.10	1.15	May '21, Q	.12½
Crown Reserve	Toronto	*12	*9	*10	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3⅜	3⅛	3⅜	Oct. '21, Q	.12½
La Rose	Toronto	*35	*31	*32½	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*19	*14	*17	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.15	1.03	1.04	Sept '20, Q	.12½
Nipissing	N. Y. Curb	6¼	5¾	6	Oct. '21, Q	.03
Ontario Silver	New York	4½	4½	4½	Jan '19, Q	.50
Ophir Silver	N. Y. Curb	....	....	*12	Jan. '12,	.10
Temiskaming	Toronto	*27	*25	*27	Jan. '20, K	.04
Trethewey	Toronto	*13¾	*10¾	*12	Jan. '19,	.05
GOLD AND SILVER						
Boston & Montana	N. Y. Curb	*97	*85	*89		
Cash Boy	N. Y. Curb	*4	*4	*4		
Consol. Virginia	San Francisco	†66	†65			
Dolores Esperanza	N. Y. Curb	1⅜	1⅛	1⅛		
El Salvador	N. Y. Curb	*16	*8	*11		
Jim Butler	N. Y. Curb	*7	*7	*7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb			*4	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	⅛		
MacNamara M.& M.	N. Y. Curb	*13	*11	*12	May '10,	.02½
Tonopah-Belmont	N. Y. Curb	1½	1 1/16	1⅛	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*72	*65	*67		
Tonopah-Extension	N. Y. Curb	1½	1⅜	1 1/16	Oct. '21, Q	.05
Tonopah Mining	N. Y. Curb	1⅜	1¼	1 1/16	Oct. '21, SA	.05
West End Consol.	N. Y. Curb	*90	*85	*85	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*9	*8	*8	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	*94	*82	*82	Dec. '20,	.15
Chief Consol.	Boston Curb	3⅜	3¼	3⅜	Aug. '21, Q	.05
Consol. M. & S.	Montreal	19	18½	18½	Oct. '20, Q	.62½
Daly Mining	Salt Lake	....	†1.00	....	July '20, Q	.10
Daly-West	Boston	1½	1⅛	1½	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	2½	2½	2½	Apr. '21, K	.05
Electric Point	Spokane	*4	*4	*4	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*48	*34	*34		
Federal M. & S.	New York	9	9	9	Jan. '09,	1.50
Federal M. & S., pfd	New York	31½	26½	31	Sept. '21 Q	1.00
Florence Silver	Spokane	*10	*2½	*9½	Apr. '19,	.01½
Grand Central	Salt Lake	....	†*15	....	June '20, K	.03
Hecla Mining	N. Y. Curb	4¼	4	4⅛	Sept. '21, Q	.10
Iron Blossom Con.	N. Y. Curb			*17	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	....	†2.00	....	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*3	*3	*3	June '21, I	.02
Prince Consol.	Salt Lake	†*8	†*5	*7	Nov '17,	.02½
Rambler-Cariboo	Spokane			*2	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*10	*8	*8		
South Hecla	Salt Lake	†*50	†*20		Sept '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*10	*10	*10	Oct. '17,	.05
Stewart Mining	N. Y. Curb	*3	*3	*3	Dec '15	.05
Tamarack-Custer	Spokane	1.90	1.85	1.90	Jan '21 K	.04
Tintic Standard	Salt Lake	2.00	1.97½	2.00	July '21, Q	.05
Utah Apex	Boston	3⅛	2	2⅜	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	....	....	*2	Nov. '17,	.01
VANADIUM						
Vanadium Corp.	New York	32¼	30½	30½	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	†58½	†57	59½	Oct. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	†79½		79½	Oct. '21, Q	1.75
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	41½	39¼	41½	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	82¼	81¼	82	Sept '21, Q	1.75
Am. Sm. pf. A	New York	85¼	81½	85½	Oct. '21, Q	1.50
U. S. Sm. R. & M.	New York	33⅜	32½	33⅜	Jan. '21, Q	.50
U.S.Sm R.& M. pf.	New York	42½	39¾	42½	Oct '21, Q	.87½

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, December 3, 1921 Number 23

The Mining Industries in Washington

IT IS DIFFICULT for us, engaged in playing our little individual parts in the vast stage of the world, to visualize how the whole play would look to the audience. Even in our little section of the great spectacle, the detached and unofficially remote view and perspective of the problem of the mining industry is very difficult. What shall be our major policies as a mining group? Shall we have a mining group, working together?

Recently, the Representatives in Congress from the great farming states have organized for mass action, to represent and further the interests of the farmer or the agrarian group—and have formed what is known as the agricultural "bloc." It has naturally proved a powerful and successful political device. We understand that, impelled or compelled by this example, the Western group of Senators are contemplating or have already arranged for a similar organization, which would essentially form a mining "bloc," for although many interests other than mining are represented in the West, it goes without saying that the West will stand up for the mining industries, against the indifference of the agricultural Middle States and the commercial East.

All this represents an important and serious permanent tendency. The foundations of our Republic were based on representation by population and by geographic groups. Each Congressman represented, and theoretically still represents, a certain number of constituents of all occupations and varieties, and so the Government is ostensibly conducted. But the days of the foundation of the Republic were simple days—of agriculture and local and simple small trade. Modern mechanical inventions have made possible and entailed vast industrial grouping—great corporations, combinations of corporations, and the segregation, into great central areas, of agriculture and manufactures of various types; and have resulted in the growth of a vast and complex urban civilization.

Unquestionably, a certain socialization is being naturally accomplished, as compared with the days when the Lexington farmer dropped his scythe and grasped his musket, to uphold his ideals of personal freedom and independence. Therefore, in actual practice, we are slowly discarding the government by geographical representation, and substituting the government by industrial groups—not by classes, for that is already far in the past. Accordingly, we have numerous organized and highly respectable organizations in Washington—lobbies in the clean sense of the word—whose object is actively to represent, in the Government at Washington, special industrial groups.

Senator Thomas once said that we have a hundred and eighty organized lobbies. That was over a year ago—probably there are two hundred by this time. In our own industrial group or groups, we have the American Mining Congress, representing the mining group, and the Federated American Engineering Societies, representing the engineer group; and we have others representing individual mining industries and metal trades. The coal operators have also their well-organized representation.

It has become an apparently necessary though unofficial part of our government—these group advisers and special advocates who make it possible for the actually elected members of Congress to evaluate the numerical, industrial, and political strength of these various groups, and to shape their legislation accordingly. For this is what Congress—the Congress of the Constitution—essentially does; steers its legislative way, as skillfully as may be, between the rocks as indicated by the lighthouses of organized unofficial industrial representation, so as to come out whole and unbroken at the end of the elective term.

One correspondent has called our present government "a government by noise," which is an accurate way of putting it, for those industrial groups not vociferous, and not represented by organization in Washington, will make little impression. In this organization the technical and scientific bureaus of the Government act as consulting engineers to Congress, frequently consulted, important as balance wheels, frequently an important factor, frequently overruled for practical considerations. For in the end it is the *vox populi*—the voice of the whole people—since each one has a vote and, therefore, an equal right to consideration—to which Congress, and the President as well, is bound to listen, and act accordingly, and not to any group of advisers, whether special industrial representatives or fellow Government servants.

The Conference at Washington

THE CONFERENCE on limitation of armaments at Washington, off to a better start than any of us had expected, gives promise of achieving real results. A cessation of the mad race of England, Japan, and the United States to build the most and biggest warships seems to be virtually assured, and there is some prospect of land forces also being curtailed and that certain subjects likely to cause trouble will be settled. As armament and munitions are composed of metals and chemicals, one might think that the industries producing these materials would be affected adversely by any policies of military curtailment. However, the amount of iron, copper, zinc and lead used for military purposes is, over a long term of years of peace and war, insignificant compared with the total amount produced. Even the Bethlehem Steel Co., one of the greatest munition plants, would not, according to Mr. Schwab, suffer to a great extent, and others seem to agree with him, for shares in that corporation are not falling below their general price level in the stock market.

Without doubt the nickel industry would feel the loss of armament business, which, before the Great War, took a considerable percentage of the world's nickel production. However, we do not believe that the International Nickel Co. would be likely to suffer greatly, for the increasing use of Monel metal may more than offset the possible loss. Eliminating even a part of the enormous normal expenditures for military preparedness would be sure to hasten the return of prosperous times and international solvency, without which our mineral industries must remain impoverished. Therefore, from a selfish and sordid point of view as well as from a humanitarian standpoint, we hope that maximum armament limitation can be arranged.

In fact, this conference appears the last chance for the United States to gain even one desirable end from the so-called Allied victory. Of course, the Allies had to fight Germany, or we would all have been German slaves; but from the victory we expected greater things. We hoped that America would be made "safe for democracy"; so far it is not as safe as before the war. We hoped to chastise Germany; if there is any general chastened spirit there or inclination to accept responsibility for the conflict, our information is in error. We were going to do away with the German war-lords; our last bulletin was that the Kaiser, von Hindenburg, Ludendorf and the rest were still as healthy as ever and enjoying more of the perquisites of luxury than the average Allied soldier—far more.

After winning our military victory we had a right to expect that just punishment would be meted out to the perpetrators of the war and to those guilty of atrocities. The actual result has been that a high degree of leniency has been shown to those who gave the orders, because they did not actually do the deed; and to those who did the dirty work, because obedience to orders is expected of a man when in the military service of his country. A case in point has just been reported in the newspapers. During the war the Canadian hospital ship "Llandovery Castle" was torpedoed. The submarine commander who ordered that her lifeboats be fired upon was given a sentence of *four years* in a German jail for this outrage. He has just broken out of confinement, and we are sardonic enough to believe that he will not be compelled to flee from Germany to escape the clutches of the law.

We had a right to believe that Germany would not be a haven for our slackers. Yet there is Grover C. Bergdoll, an escaped American prisoner whom we should, in all justice, have the right to apprehend if Germany refuses to do so. Germany merely laughs at us in this case. We expected that if we won we would be more prosperous thereafter than our enemies. Reports from abroad indicate, however, that conditions are better in Germany than in France, or in England, and we are certainly not in the throes of general prosperity here.

Another thing that we were fighting for was the right of self-determination for small nations. Yet we have seen no referendum on this subject offered to the people of Ireland, India, French Africa, Southern Manchuria, or the Philippines. Some of the Allied nations profited to the extent of some of Germany's foreign possessions, but these were paltry pay for the sacrifice of human lives and wealth. As far as the United States goes, we did not even get one of these souvenirs of the party; at least we do not remember what it is if we did. A few reparations payments have also been made, but compared to the cost of the war the amount is decidedly insignificant. And already Germany is reported having difficulty finding funds to meet the next payment, which has already been postponed, and the Allies do not know what to say. How about taking some of the gold out of the German treasury, which is said to be there in approximately the same amount as before the war? Is that to be considered sacred?

We have mentioned these things briefly to indicate that our military victory was a defeat in every other sense of the word. This is not to say that we made a mistake in entering the war against Germany, for we would probably have been much worse off if we had offered no resistance. But anything which will make nations less likely to launch wars of aggression is to be promoted. We believe the Washington conference will have certain favorable results in this way. Limiting armaments is a small matter, if we consider simply the dollars and cents part of it. We should all work toward the division of this earth among the various groups of peoples so that the maximum of happiness may come to all the inhabitants; then, should any nation attempt, by armed force, to extend its territory, every other nation should automatically become its enemy. Of course the first difficulty lies in making the division of the earth an equitable one.

All success to the distinguished gathering!

State and Local Mine Taxation

THE PROBLEMS of Federal mine taxation are not giving much concern to our specialists in mining taxation these days. There is a general feeling that the existing conditions are as favorable as can be expected, given the fact of onerous general taxation. The individual applications of the existing laws, of course, do not offer any simple solution, and important cases are being worked out more or less painfully. Therefore, our various taxation committees of the mining societies are devoting more of their thought to state taxation, which varies widely in principle and in weight in the different states, ranging all the way from giving mining a fair show to taxing it all the traffic will bear; stopping, in theory, apparently, only so far short of confiscation as to allow the mines to operate. This considerate plan does not always work to the extent of securing the necessary continuity of operation, and the result is the closing down of the mines, and the net loss in tax revenues to the state. In some of these states socialistic ideas have become strong, especially among the dominant agrarian and farmer class—in such states as the Dakotas and Minnesota, for example. An underlying belief and conviction comes to be held that mineral supplies belong to the state—that is to say, to the people in general. Why they do not extend the same theory to agricultural lands is difficult to see in theory but easy to discern as a practical proposition. It is the same reason why the income tax has come to stay, for it enables ninety-five per cent of the voters to compel the other five per cent to pay inordinately the expenses of the state, though without corresponding beneficial or even government-participating privileges.

Conditions in Biblical times, which exemplified the text "Unto every one that hath shall be given . . . but from him that hath not shall be taken away even that which he hath" have been happily subverted to "from him which hath shall be taken." The dangerous point is reached in this policy when the incentive of the getter and payer to get more is destroyed. This has been done on a wholesale scale in this country, and is one of the many contributing factors to our business lethargy.

The taxes of the Mahoning iron mine, on the Mesabi Range in Minnesota, we are reliably informed, have increased since 1916 in the following ratio (the figures are per ton of product): 1916, \$0.17; 1917, \$0.19; 1918, \$0.30; 1919, \$0.62; 1920, \$0.68; 1921, \$4.02. Going some! as the small boy would observe. The taxes, it must be remarked, are based on an ad valorem figure, and the rate mentioned is not directly assessed, but is obtained by dividing the ad valorem taxes assessed on the ore reserves by the tonnage shipped, thereby producing the exceptional figure quoted for 1921, a year of the conjunction of high taxes and low production.

Socialism, and the approach to socialism, is attractive and promising. Easy work and good feed appeal to us all, and relief from the necessity of strenuous competition. The only trouble with the leveling ideas is that they fail to retain individual and corporate incentive and initiative, and the production of wealth dwindles, and all hands get poorer together.

A comparative study of our state mining laws will be valuable. Of course, uniform state mine taxation would be desirable, but is probably impracticable in the near future. It is even not desirable that we should have too complete federalization. On the other hand, in our economic system, state mine taxation is not purely a state affair. The Minnesota taxes of the United States Steel Corporation in 1921 approximate \$1 per ton of ore produced. Unavoidably, this charge is handed on to the ultimate consumers, the railroads, the factories, and so to the increased expense of every one of us. It is not the Steel Corporation that is being penalized, but American industry in general.

Factors of Safety

NOT LONG AGO we heard a financier who, in addressing a body of engineers, mining, civil, electrical, mechanical, and others, indicted them somewhat in the following manner: "You engineers provide elaborate formulæ for the solution of your many calculations and plans and then you calmly multiply or divide your result by five, or some other factor of safety, and use the product in the practical application of your work." Those were not the exact words used, but the idea is there. At first blush it would appear that our financier friend had indulged in a fine bit of sarcasm or had pulled a rich joke on the engineers. A moment's serious reflection, however, shows that either our friend does not have the right conception of engineering analysis and the solution of engineering problems, or engineers have created a wrong impression with the term factor of safety and its use.

A factor of safety is an important little number. It represents contingencies, human, material, and otherwise, which the engineer is unable to gage precisely in his calculations. An unknown flaw in a hoisting rope may affect its strength; the flywheel of an engine may be run at a speed far above that specified by the engineer; a storm of unusual severity may threaten a headframe, machines may be subject to use and abuse beyond the original plans of the designing engineer. How can such important contingencies be accurately measured and reduced to exact formulæ? They cannot, but that is no reason for discarding the application of some precise formula and substituting guesswork in engineering analysis.

Consciously or unsconsciously the banker also uses a factor of safety when he withholds dividends or profits in the form of a surplus. Were the events that are likely to influence his activities known with any degree of precision, a surplus would be unnecessary, but, as all prudent financiers realize, it is required to cushion the blow of unforeseen business conditions or reverses outside of the banker's control.

The element of safety enters into practically every human endeavor. The factor of safety argument has been aired frequently before, but we think there is not much to it.

Unprofessional Practice

WE ARE ALWAYS GLAD to receive comments, be they criticisms or encomiums, regarding articles appearing in *Engineering and Mining Journal*, and it is for that express purpose that we have established our "What Others Think" pages as the readers' forum, in which we purpose publishing such correspondence and discussion as may reach us through the customary channels. Every publication of repute is provided with similar means for the expression of readers; some adopt a rigid censorship, and a very few, if any, maintain an "open door" course. We believe that our policy is liberal and strikes a happy medium.

Some of the letters received are specifically marked for publication; others are confidential, and are so indicated; and a third class includes that correspondence which reaches us in the regular course of business and is sent in with no intention save comment. Editorial judgment governs the publication of the first and third mentioned letters, although the publication of the latter is subject to the permission of the writer; respect for confidences governs the disposal of the second type. So much for our *modus operandi* with regard to correspondence.

But the adoption of such a course does not completely relieve us from all responsibility, even if we did wish to assume an attitude of aloofness—which we don't. Let us quote a particular case.

We have recently received a letter criticising the appearance of a certain article; the attitude of the correspondent is a just one from his point of view, but he withholds permission to have his letter published. The instance involves our sponsorship or a denial of unprofessional procedure, so we feel in duty bound to make our attitude clear in the matter.

In our issue of Nov. 5, we published a short article detailing a method of measuring the depth of an oil well by means of a transit. The criticism expressed was to the effect that the article embodied a suggestion for securing information rightfully belonging to another, namely the person or company which was paying for the drilling.

We believe our readers are possessed of sufficient discrimination to enable them to realize that our purpose in publishing the article was not to promulgate a practice which engineers cannot recognize as professional or honest. We know that the writer of the article is an engineer of high standards and we do not believe his intention was other than that of giving a method that had been used, regardless of the abuses to which it might be put. Our idea in publishing the article was solely for the purpose mentioned. We wish to make it plain that the *Journal* does not at any time sponsor unprofessional practice.

What Others Think

The Disposal of Copper and Copper Products

The article entitled "The Opportunity for Copper Producers," on page 601 of the Oct. 15 issue of *Engineering and Mining Journal*, appeals to us as an excellent idea of great worth, and one that could best be put into action by the Copper and Brass Research Association for the greatest benefit to the public and the copper-producing and copper-selling industry.

To establish stores in leading cities, as suggested in this article, would greatly increase the demand for copper, and to such an extent, in fact, that never again would it be necessary for the copper mines of the country to suspend, either entirely or in part.

It would seem better for the Copper and Brass Research Association, composed of the leading producers and fabricators of the metal, to establish and control these important distributing agencies than for a few of the producers to handle such a great undertaking.

Stores where real copper products of quality—not the thinly coated kind made to look like the real article—such as copper sheets, wire, copper screens, shingles, roof gutters, drain spouts, coils, radiators, hot-water tanks, pipe and fittings, copper radiators for automobiles, kitchen utensils, locks, door knobs, hinges, screws, gas and electric fixtures, copper, bronze and brass articles of all kinds, and other manufactures of copper, either of utility or ornamentation, could be bought if offered at reasonable prices, would provide a real demand for copper metal. Together with the better-known uses for copper, such as are required in the building and equipment of power plants, power lines, trolley lines, railways, tramways, telegraph and telephone, transports, and similar applications, it might prove to be a question of importance where sufficient copper could be found to meet the requirements. There might even be danger in time of the demand exceeding the possibilities of supply to such an extent as to advance the price for the metal to where such general use would become prohibitive.

A general public, once aroused to the merits of a given cause and having a trend in that direction, is likely to progress in action to such a state of momentum that the happy medium of affairs is past with a rush and they are carried on to the opposite extreme. This perhaps could be guarded against by providing a balance wheel, such as an accurate barometer of the red-metal trade, edited and published periodically, under supervision of the Copper and Brass Research Association.

In the beginning it might be well to stimulate the buying of these commodities by conservative and constructive advertising broadcast throughout the country. In the Southwest we now have the slogan, "Buy Something Made of Copper." Display advertisements in the various journals and magazines, acquainting the public with the duration value, superior appearance, and cheapness in cost of such products, as compared to those made of less suitable metals, should produce the desired results. I note that *Engineering and Mining Journal* is willing to devote a lot of space free to such a cause. Now that we have turned the corner of depression, and business in general is on the upward trend, it would seem fitting for these measures to be put into immediate effect. **James W. McAlpine.**

Pinos Altos, N. M.

Early Records of the Michigan Copper Industry

I do not think that the article "Early Records of the Michigan Copper Industry" on page 776 of your issue of Nov. 12 conveys a correct impression. "Radisson's Voyages" were translated from the French manuscripts in the British Museum and Bodleian Library prior to 1885. In that year they were published in Boston by the Prince Society, Gideon D. Scull, editor. This publication contains *in toto* all the exact words quoted.

These extracts from Radisson's narrative have been taken from fifty different pages of the account and are descriptive of widely separated localities. The "small river" referred to was reached east of "Pictured Rocks." The passage beginning "Having passed that place" undoubtedly refers to the discovery by white men of the Keweenaw Peninsula. The last two extracts given refer to Indians living far to the west of the Keweenaw Peninsula.

The impression I obtained from these extracts is that Radisson is giving a description of one locality. It seems to me that inasmuch as Radisson's account has been quite widely known and was translated in English in 1885, and that as your extracts represent descriptions of widely separated places, the account conveys a wrong impression in both these respects.

However, I am glad to see attention called to Radisson's account, which is one of early Americana of extraordinary interest. **F. W. Paine.**

Boston, Mass.

Converting Dolomite Into Magnesite

In *Engineering and Mining Journal* of Oct. 15, in the contribution by Djevad Eyoub on the subject of "Converting Dolomite Into Magnesite," the statement is made that "samples were subjected to calcination at 800, 1,200, and 1,500 deg. F." (The equivalent Centigrade temperatures are 427, 649, and 816 respectively.) Also, "from 950 to 1,000 deg. F. was found the most suitable for the purpose of the investigation." (The equivalent Centigrade temperatures are 510 and 538, respectively.)

According to Richards, the decomposing temperature of calcium carbonate is from 600 to 800 deg. C., or 1,112 to 1,472 deg. F. In my own experience I have never noted any decomposition of calcium or magnesium carbonate below a dull red heat, approximately 1,200 deg. F., or a little above 600 deg. C.

In *Chemical and Metallurgical Engineering* of Nov. 9, on page 891, under the heading "Separation of Lime From Dolomite," H. G. Schurecht's study of the subject shows that "Magnesium carbonate in dolomite is decomposed by calcining for one hour at 800 deg. C. Calcium carbonate is not completely decomposed until after calcination at 960-1,040 deg. C. for one hour. (The equivalent Fahrenheit temperatures are 1,472, 1,760 and 1,904 respectively.) And that "The best results by flotation were obtained by removing the fine material from the raw dolomite and the calcining at 920 deg. C." (1,688 deg. F.)

So it is clearly evident that the temperatures stated in Mr. Eyoub's article should be Centigrade and not Fahrenheit. **William H. Hampton.**

New York, N. Y.

Concerning California Magnesite

Harry C. Boydell contributed an interesting and illuminating article in the issue of Nov. 12 of *Engineering and Mining Journal* on the subject entitled "The Eubœan Magnesite Field." Ill advisedly, Mr. Boydell asserts, "Greece produces . . . the world's purest magnesite." Having recently been a joint purchaser in some cargoes of Grecian magnesite amounting to several thousand tons, as well as being a producer of California magnesite for nearly five years, I feel qualified to make a positive statement regarding the comparative quality of the two magnesites.

California does produce and is producing a purer and better magnesite than Greece. Perhaps Mr. Boydell has never visited any California magnesite mines. It would not be difficult to show him mines that are producing ore that needs no "cobbing" or "dressing" like Grecian.

It is obvious that selected ore could be taken from any mine or mines, wherever situated, but it is distressing to note this bold assertion of the "world's purest" passing unchallenged in the editorial columns, considering the article of the Editor's in the issue of Oct. 22, where he dwells on the fact that he had all the data of the war minerals in the United States at his finger tips. If this were correctly stated it would have been possible to have either personally or editorially modified Mr. Boydell's superlativeness.

San Francisco C. S. MALTBY.

Still Further Air-Receiver Calculations

Theodore Simons in *Engineering and Mining Journal* of Aug. 13, 1921, made some rather pointed criticisms of my article, "Air-Receiver Calculations," which appeared in the issue of June 11, 1921. Mr. Simons deduces the formulas in what he says is a "simpler manner." The relative simplicity of two expositions is, I should say, a matter of individual opinion.

In deducing formula No. 1 of Mr. Simons' paper, he states: "Then, from Boyle's law, volume, V_0, the free air occupied in the receiver before being withdrawn, is

$$V_1 = \frac{V_0 \cdot P}{P_1},$$

where V_0 is the volume of free air withdrawn during t minutes, P_0 is the atmospheric pressure and P_1 is the initial absolute pressure in the receiver.

This statement is incorrect.

V_1 is the volume of *compressed* air that will be withdrawn in t minutes.

In formula No. 8, as Mr. Simons has deduced it, the right-hand member should be inverted.

In this problem of the storage of air to help compressors, Mr. Simons states that the hoists use and the compressors supply a certain amount of compressed air. A statement involving compressed air is meaningless unless the pressure is stated.

The hoists consume air and the compressors deliver air at a constantly reducing pressure, and so the assumption that is made in the calculation, that the pressure in the receiver is constant at 102 lb. per sq.in. absolute, is incorrect unless the actual weight of the air or the number of cubic feet of free air which the receiver must supply is determined, and then the volume that this weight or volume of free air would occupy at 102 lb. is calculated for substitution in the formula. If this was done it should be so stated.

The volume of free air per minute supplied by a compressor is nearly constant through a pressure range of 13 lb. because the volumetric efficiency of the compressor changes very slightly.

The third problem in my paper shows how this receiver problem is attacked from the point of view of free air. I gave the formula for determining the size of a stationary storage of a compressed-air haulage system, so that the tanks of the locomotives might be charged instantly to a given pressure.

In regard to this Mr. Simons offers the following:

"This presumes that no air is supplied to the storage system while the locomotives are being charged, a condition that does not obtain in practice, except where there has been an accident to the compressor. In that event no amount of storage will keep up the pressure long enough for practical operations. Receiver or storage capacities are therefore not calculated according to the above formulas."

It is exactly what it presumes. We may conceive an automobile tire to be the tank on the locomotive. When the tire gets flat there are two methods of inflating. First we may connect with the air receiver at a service station, and in a few seconds our tire is inflated; or second we may get out the hand pump. Charging a locomotive is comparable with the first.

One of the main arguments for compressed-air haulage is the absence of peak load. A locomotive is charged and starts on its trip, which may take half an hour. During that time a comparatively small compressor plugs away replacing the air in the stationary storage against the time when the locomotive will need another "shot." The charging usually occupies but a fraction of a minute, so the amount of air supplied by the compressor in that time is usually neglected. Of course the locomotive could be run up to the compressor and pumped up, but it is not done.

I took the trouble to go to Pittsburgh to visit the H. K. Porter Locomotive Works, that I might get first-hand information as to that company's methods of calculation. Its operators calculate the stationary storage as I have shown. A model calculation may be found in the company's catalog.

The danger of explosion in air receivers is great with such high pressures, so the pipe is made the storage whenever possible. The makers of the high-pressure pipe furnish a table showing the number of feet of each size necessary to give 1 cu.ft. of storage. When, however, the pipe line is too short to give adequate storage, receivers must be put in. These receivers look more like giant air bottles than like the ordinary receiver.

In regard to Mr. Simons' statement that in case the compressors are stopped no amount of storage will keep up the pressure in an operating system, I think we all agree. WALTER S. WEEKS.

Berkeley, Cal.

[Both Mr. Weeks and Mr. Simons have used different methods in making their calculations. Mr. Weeks' method of using weights of air is much less confusing than Mr. Simons' use of volumes of air under different pressures. Less confusion would have resulted if Mr. Simons had reduced each volume to the free-air volume. Our knowledge of the operation of compressed-air locomotives leads us to agree with Mr. Weeks in his contention that the amount of air received from the compressor while the locomotive is being charged is negligible.—EDITOR.]

PARTIAL VIEW OF MILLS AND SHOPS OF HOMESTAKE MINING CO. OPEN CUT IN BACKGROUND

Geological Methods of the Homestake Mining Co., Lead, S. D.

Work Covers Determination of Location and Structure of Major and Minor Folds On Surface and Underground—Colors Used Together With Conventional Signs in Mapping on Co-ordinate System—Complete Records of Diamond Drilling Kept

By Lawrence B. Wright and Joseph O. Hosted

Written for *Engineering and Mining Journal*

IN THE HISTORY of the Homestake operations, the records show that geological work was formerly considered unnecessary; but after spending a large sum in driving prospect crosscuts with no more definite aim than to open up virgin ground, it was decided to make an exhaustive geological study of the mine, so that future prospecting could be carried on in a more intelligent manner.

In June, 1920, the geological department was instituted. It consists of two geologists working in conjunction with the engineers, metallurgists, and chemists. The work, roughly outlined, entails the detailed mapping of about twenty-five square miles of surface area and twenty-two mine levels, with a total of sixty-six miles of drifts and crosscuts besides stopes in various stages of development. Up to the present time about nine square miles of the surface in and around Lead and fourteen mine levels have been mapped in detail and the important features of the structure developed.

Inasmuch as the methods of procuring geological data are somewhat dependent upon the character of the area involved, a rough outline of the conditions encountered without reference to the paragenesis of the ore should be of interest.

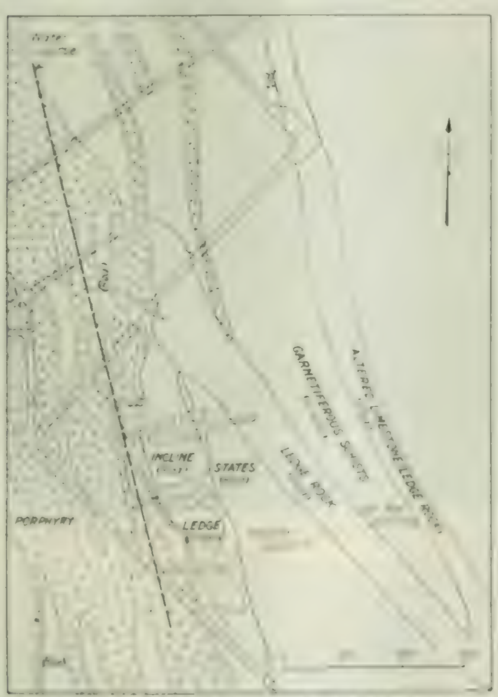
The rocks in the immediate vicinity of Lead may be classed under three broad groups: (1) Tertiary intrusives and extrusives; (2) Cambrian conglomerate, quartzite, and dolomite or "flat formation"; and (3) pre-Cambrian (Huronian) slates, schists, quartzites, limestones, and intrusives. This last group is locally termed the "vertical formation." The pre-Cambrian rocks have been uplifted and dynamically metamorphosed, making the group a series of plunging, tilted folds. The axes of the folds strike N. 60 deg. W. to N. 35 deg. E., and axial planes dip steeply to the east, with few local exceptions. The plunge of the folds is to the southeast. The relation of the other groups to the pre-Cambrian is best shown by the accompanying section.

The ore has been found to be associated with the folding, so that the problem in the district has resolved itself into one of working out the location and exact structure of the major folds and then the location and structure of the minor or drag folds.

The surface geology is transferred from field notes, sketches, and enlarged topographic maps to the permanent surface map made on tracing cloth to a scale of 400 ft. to 1 in. The data are usually sketched in with pencil until rechecked and accurately located before being inked. A 1,000-ft. co-ordinate system is used on both surface and underground maps.

STUDY OF ROCK TYPES

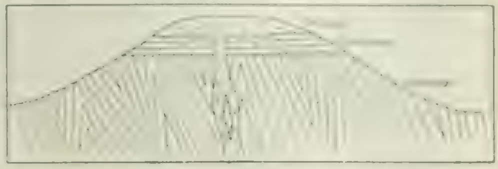
Owing to the intense metamorphism of the pre-Cambrian rocks, a study of the outcrops with a view to their origin has been made. There are many outcrops of green chloritic massive beds that are in some instances derived from a rather basic intrusive and in others from limestone. The whole is schistose, and color, texture, and general appearance are such as to lead one into difficulty unless a study of their origin is made before attempting to work out structure. The Tertiary and Cambrian rocks are easily recognized and classified, for metamorphism has played an unimportant part in their development. The only difficulty encountered in co-relating strata in which the younger series is involved is to be attributed to the similarity of the general appearance of the Cambrian and pre-Cambrian quartzites when they are not found actually in place. However, a study of these rocks has disclosed characteristics that make errors in identification improbable.



A PART OF THE [illegible] LEVEL GEOLOGY MAP SHOWING INTRUSIVE DIKE CUTTING [illegible]

A color system is used in combination with usual conventional signs, giving rise to the following legend: Tertiary: Yellow (conventioned), rhyolite; brown (conventioned), phonolite. Cambrian (undifferentiated): Orange. Pre-Cambrian (Huronian): Blue, slates and phyllites; green, garnetiferous schists and slates; green (conventioned), igneous intrusives; red, limestone; blue with red dots, impure calcareous slates; brown, quartzite, and red with black dots, pay rock.

The general topography being rugged and vegetation plentiful, the best exposures are to be found along the road and railroad cuts, creeks, and on the ridges. In the covered areas there are many prospects that are a great help where exposures are few. After the general classification of rocks and the adoption of a suitable legend, the next step is the mapping of all exposures, careful attention being paid to strike and dip. A regional schistosity was in many cases mistaken for strike by early geologists in this field, and, the planes of schistosity having a uniform northwest trend, the impression was first prevalent that the rocks in this area were simply a series of tilted slates and schists, little thought having been given to the possibility of folding.



RELATION OF GROUPS IN [illegible] DISTRICT

TRACING KEY BEDS

The tracing of certain prominent or key beds has been found the best means of working out structure in conjunction with general exposure mapping. In so doing it has been the rule that their course across country is a devious one, and by carefully locating them on the map the structure is gradually completed. The quartzites serve as the best key beds, and being more resistant than the slates and schists, their outcrops are more prominent. However, due caution is taken, as they are often broken and disconnected along the strike and especially around the noses of folds, not being as amenable to distortion as the softer beds. Where the quartzites are absent, reliance must be placed on the continuation of beds nearest the quartzite horizon. In some formations the sedimentary strata have been cut or displaced by igneous intrusions.

Many of the hill tops are capped by the Cambrian "flat formation," which is in turn capped by the Tertiary rhyolite and quartz porphyries. The structure under this capping can only be deduced by data gathered around the edges or rim. In some instances reliance is placed on the material that has been hoisted from below the Cambrian in old prospect shafts. In areas covered by dense growths, attention is concentrated on float, provided it does not lie on a slope so steep as to render its location unreliable.

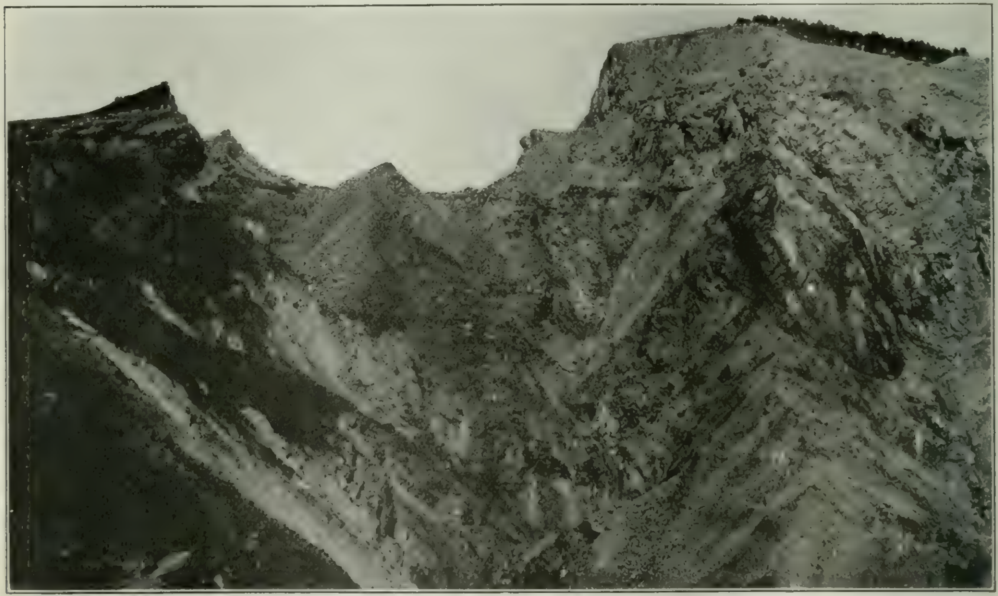
In tracing key beds it is found necessary to keep in mind the alterations that may take place along the strike. These are as follows: Variations in deposition; change in general appearance due to dynamic metamorphism in the more intensely folded areas, and metamorphism due to the proximity of igneous intrusives.

RELATION OF TOPOGRAPHY TO STRUCTURE

In this particular region there is a direct relation between the topography and the structure of the folded strata, and although it is as a rule not advisable to give too much weight to a feature of this nature, there are covered areas where some reliance can be placed in this relationship. In areas where the structure has been definitely proved it has been observed that the southerly sloping ravines are cut in the troughs of southerly plunging synclines, and that the ridges are rounded in accordance with the strike of the beds around the southerly plunging anticlinal noses. The reverse is true of the northern slopes, the ravines being cut northward through the axes of southward-plunging anticlines. Wherever an exception to this relationship occurs, the reason is always quite apparent, in that later intrusives of a resistant nature form the ridges.

UNDERGROUND GEOLOGY METHODS

The mine levels are 100 ft. apart down to the 1,100 level. The lower levels have a vertical interval of 150 ft. The work of mapping the underground geology began on the 200 level, with the 300 and 400 levels following. These upper levels were studied first, owing to the fact that they were for the most part worked out and caving. After finishing these upper levels the lower levels, namely the 2,000, 1,850, 1.700, 1,550, 1,400, 1,250 and 1,100, were mapped in the order named. The middle levels will be studied this winter. The scale of the maps used is 100 ft. to 1 in. and they are also divided into 1,000 ft. co-ordinates. Blueprints and tracing paper maps are used in sketching. The legend is the same as that used on the surface maps, and the same color scheme is carried out.



OPEN CUT AT HOMESTAKE GOLD MINE SHOWING FOLDS

PROCEDURE IN UNDERGROUND MAPPING

The mapping of levels is usually started on the north end and the work carried southward, both geologists working on the same drift or crosscut. This is done as a matter of safety and also as a check on the interpretation of data. On very long drifts, one geologist studies the rocks and keeps notes, the other keeps paces and takes strikes and dips. All rocks, contacts, water courses, and faults are mapped in detail. Many specimens are taken, a part being sent for assay, another preserved for hand specimen, and usually a thin section is made from a representative chip. These are numbered in the order taken, the thin section, hand specimen, and assay sample being given the same number and a note made on the map of the number at the place where the sample was taken. Car sampling and channel sampling of pillars, stopes, and crosscuts are done by three samplers.

My mapping the drifts and crosscuts from north to south in order, the various beds are traced from pillar to pillar and the structure is finally completed. Each day's work is sketched on an office map of the same scale. This map is usually made on tracing paper and is only temporary. The final map is made on tracing cloth, and is not made until the levels above and below have been studied, as many projections of data from above or below are needed for a complete map, owing to the fact that many of the stopes are completed, drawn, and backfilled and the entries boarded up. Some levels have long exploration crosscuts, the geology of which when projected upon the level immediately above or below aids materially in building up the final structure.

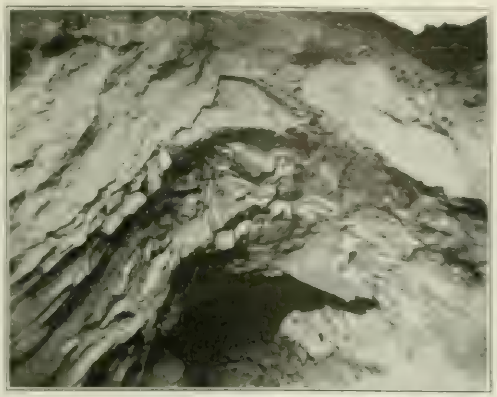
The scale of the cross-sections of the mine are 100 ft. to 1 in. Vertical sections are made at 1,000-ft. intervals along the east-west co-ordinate lines. This method of making the cross-sections on the even co-ordinate distances saves much time, as the data can be projected directly from the level maps. This is made possible by the fact that the east-west co-ordinates cut the ledges at nearly right angles. Taking sections 1,000 ft. apart gives four vertical divisions of the developed orebody. They represent on the average a vertical area 2,350 ft. (depth) by 3,000 ft. (surface). The axes of the folds being at nearly right angles to the sections, it will be seen that the crests of the anticlines and the troughs of the synclines can be accurately traced along the direction of plunge from section to section, showing the length of the limbs of the folds, their height, and the crest of the nose or bottom of the trough at any given point. The porphyry dikes that cut through the Homestake orebody on the hanging wall have picked up, disconnected, and completely inclosed blocks of ore. This condition is nicely brought out in the sections.

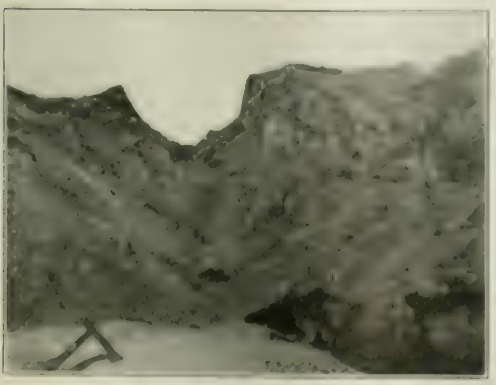
EXPLORATION BY DIAMOND DRILLING

Most of the exploration work is done by diamond drilling. All cores are saved. Cores of ledge matter are split, half being sent for assay and half preserved for geological record. All of the sludge is sent for assay. Five-foot samples are the rule. The geology of the hole is plotted on the map of the level on which the hole is drilled. If the hole is drilled at an angle from the horizontal, correction is made for dip. If the angle is greater than 30 deg., a separate cross-section is made through the course of the hole and the geology mapped in accordance with its relation to that of the adjoining levels.

The holes are surveyed every hundred feet, a compass in gelatine in a glass tube and hydrofluoric acid in a glass tube being used. If the hole deviates greatly from its intended course, it is stopped, as continuance would mean the drilling over the nose of the anticline or under the trough of a syncline, thereby missing the objective. The core is examined upon being brought to the surface, the rock classified, and the angle of the bedding to the hole carefully noted. A complete record of the hole shows the date of drilling level location, description of the hole, distance drilled, kind of rock encountered, sludge assay, and split core assay; also the percentage of core recovery. The sludge assays average about 25 per cent greater value per ton than the core assays. Thin sections of the core are frequently made and labeled according to their location in the hole. Besides the maps of holes, written logs are kept describing the location of hole, the thickness of each formation penetrated, and a detailed description of the various rocks.

Records of petrographic work are kept on forms which include the following data: Specimen number; locality; occurrence; hand specimen description, and microscopic study. Under microscopic study the following are noted: Texture; original structure; secondary structure; percentage and kind of primary; secondary and metamorphic constituents; percentage and kind of accessory minerals; nature of the groundmass, and description of mineralization. From the assembled data the origin of the rock and its classification are deduced.


ANTICLINAL STRUCTURE AT HOMESTAKE


ANOTHER VIEW OF HOMESTAKE OPEN CUT

Whenever practicable, photographs are taken of rock exposures, contacts, and folds. These remain as indisputable evidence of structure after the rock has been mined or caved from its original position. The different formations are colored with water colors according to the legend used.

Iron Ore Resources of the World

A monograph published by the mining and metallurgical section of the East Europe Institute, Breslau, Germany, in the interest of German retention of Upper Silesia, gives some interesting figures on the developed iron-ore resources of the world. From these *The Iron Age* has compiled the subjoined table. Poland's interests have been pooled with those of France in this tabulation, as have those of Austria with Germany, and special emphasis is placed on the large share of control over iron ore now exercised by the French. The tabulation covers the German resources without Upper Silesia and gives to Poland Upper Silesia.

[illegible]

	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		
[illegible]	[illegible]		
[illegible]	11.8		
[illegible]	[illegible]		
[illegible]		[illegible]	[illegible]
[illegible]	[illegible]		
[illegible]	[illegible]		
[illegible]		[illegible]	[illegible]
[illegible]		1,100.0	[illegible]
[illegible]	[illegible]		
[illegible]	[illegible]		
[illegible]	[illegible]		
[illegible]	[illegible]		
[illegible]		[illegible]	[illegible]
[illegible]		[illegible]	[illegible]
[illegible]		[illegible]	[illegible]
[illegible]		[illegible]	[illegible]
[illegible]		[illegible]	[illegible]

To Study Electrothermic Metallurgy of Zinc

Employing cooperative funds furnished by the State of Missouri, an investigation relating to the electrothermic metallurgy of zinc is under way at the Mississippi Valley Experiment Station of the U. S. Bureau of Mines at Rolla, Mo. The physics and chemistry of the condensation of zinc vapor will be accorded especial attention.

Reclaiming 6-Oz. Silver Tailing at the Coniagas Mines

Dragline Excavator Found the Best Means of Collecting The Dry Slime—Cyanidation Reduces Silver Content to 1 Oz. per Ton at a Cost of 35c. per Oz. of Silver Recovered

By H. E. Cawley
Mill Superintendent, Coniagas Mines, Ltd., Cobalt, Ont.

Written for *Engineering and Mining Journal*

A PROBLEM recently before the Coniagas Mines at Cobalt, Ont., was to reclaim and treat an accumulation of 40,000 tons of slime tailing, having an average value of 6 oz. of silver to the ton. By experiment is was found that the slime could be treated to best advantage by the cyanidation process, and so, to carry out the work, the Buffalo cyanide mill was leased from the Mining Corporation of Canada.

The greatest difficulty encountered was in collecting and conveying the slime to the mill. It was decided to reclaim the slime as dry as possible to avoid subsequent settling and filtering, which would have been necessary had a hydraulicking scheme been adopted.

The slime is collected with a Sauerman dragline excavator, dumping into a hopper. About 100 tons per twenty-four hours is handled. A steel mast 45 ft. high is set on a concrete pier, allowing a 35-deg. sweep from hopper edges to the extreme limit of the tailing pond. Another similar hopper, at right angles to the original one, has been constructed to give 15 deg. more sweep without shifting the mast. A double-block tension system is employed at the masthead for raising and lowering track cable. This track cable is 1¼-in. plough-steel rope, anchored to rock which conveniently outcrops along the pond edges. The tension cable is ¾-in. crucible cast-steel rope and the hauling cable is ⅞-in. rope of the same kind.

The excavator bucket was constructed at the mine. It is 4 ft. wide by 2 ft. deep by 2 ft. long, being 6 in. wider at the digging edge than in the rear, to aid in the rapid dumping of the sticky material from the pond bottom. When loaded to capacity with dry slime, the bucket picks up 1,500 lb. Attempts to use a back-dump bucket were not successful.

A 12 x 15 Jenckes double-drum hoist is used to operate dragline and bucket. The weight of the bucket and roller carrier is sufficient to run it back along the track line by gravity to the extreme limit of the pond, a distance of 400 ft. from the collecting tank. A team and scraper is used periodically to drag in slime from parts inaccessible to the bucket.

The hopper is equipped with a grizzly bottom and is placed above a wooden collecting tank 30 ft. in diameter by 10 ft. deep. The tank has an agitator driven by a 10-hp. motor. The agitator shaft revolves at 10 r.p.m.

The slime, which has the nature of clay, falls onto the grid bottom of the hopper and is washed into the tank by the discharge from a 4-in. centrifugal pump, which circulates the pulp already collected. This pump has a speed of 1,100 r.p.m., and is driven by a 40-hp. motor. The circulation of the pump to wash the slime into the hopper has the additional advantage of aërating the cyanide solution and aiding in the treatment. About 50 per cent of the valuable metal is in solution by the time the charge is pumped to the mill.

When starting to collect a charge, a sufficient quantity of barren solution is pumped into the collecting tank to give a pulp dilution of 1 to 1 by the time the tank is filled. Cyanide is then added until the solution has a strength of 0.25 per cent KCN. When the charge is completed, the circulation through the hopper is stopped and the pump is utilized to pump the charge to the cyanide plant, a distance of 1,350 ft. against a head of 60 ft. Charges have been pumped over at a dilution of 0.75 to 1. The daily charge of one hundred tons of dry slime is pumped to the mill in about four hours.

RECLAIMING SLIME FROM TAILING POND

The pulp, arrived at the mill, goes into four Pachuca tanks, each 30 ft. high by 15 ft. in diameter, where it is agitated by air from an Ingersoll-Rand compressor, driven by a 40-hp. motor. Connection is also made with local hydraulic air lines in case of power trouble. The pulp must have at least twenty-four hours' treatment in the Pachuca tanks. The slime gives an alkaline reaction, and the cyanide consumption is three pounds per ton.

The usual Cobalt practice of filtering and washing rules. The tailing, since beginning operation, averages 1 oz. in silver per ton.

The pregnant solution goes from the filter to a 30 x 30 x 10-ft. concrete tank through a 6 x 8-in. Dean vacuum pump. From this tank, the solution is pumped to a small filter and clarified. The clear solution goes through a vacuum pump to a 30 x 10-ft. wooden tank, equipped with an agitator, revolving at 8 r.p.m., driven by a 10-hp. motor. This solution, assaying between five and six ounces silver per ton, is then precipitated by the addition of 0.05 lb. of sodium sulphide, double strength, per troy ounce of silver to be precipitated. When sufficient time has elapsed for precipitation, agitation is stopped and the precipitate allowed to settle. The barren solution is then decanted to a concrete tank, immediately below. Agitation is again started, and precipitate is pumped through a 3-in. Dean Triplex pump to a 24-in. Perrin press. The barren solution from the press runs by gravity back to the barren-solution tank. Precipitates recovered to date contain 23,500 oz. silver per ton, with a moisture content of 42 per cent.

A 2-in. centrifugal pump is used to pump the necessary solution for dilution purposes back to the collecting tank. This pump runs continuously, circulating and aërating the barren solution through open launders.

The mill operates continuously in eight-hour shifts, employing one foreman and three filtermen over the twenty-four-hour period. At the collecting end, two hoistmen operate during daylight hours, with a man day and night on pump and hopper. For all operations, 120 hp. is required. Air power is used for hoisting. The operating time for the year is limited, owing to climatic conditions, extending from about May 15 to Oct. 15. Costs have been approximately 35c. per ounce of silver recovered, during this year's operation.

New Method for Determining Noxious Gas

In Technical Paper 249, "The Determination of Oxides of Nitrogen," by A. C. Allison, W. L. Parker, and G. W. Jones, just issued by the U. S. Bureau of Mines, a new method for the determination of this noxious gas, sometimes formed after blasting in metal mines, is described. The Bureau of Mines, in the course of its work looking toward the minimizing of accidents in mining operations, has occasion to make analyses of gases in determining the ventilation conditions and the hazards that may develop from exposure of the workers to gases liberated in mines. Not only is it important to identify such gases as form explosive mixtures and are at times liberated in large quantities, but, in addition, it is necessary to determine what gases have harmful effects upon miners who are exposed to them while at work. In metal mines where much blasting is done, the shots are often prepared improperly, and oxides of nitrogen may be formed after firing. Moreover, other industries than mining produce exides of nitrogen, which have a deleterious effect on individuals breathing them for any length of time.

Two gases that result from the firing of explosives are, because of their physiological effects, important in mine ventilation. They are carbon monoxide and oxides of nitrogen. Other gases produced at the same time, including carbon dioxide, hydrogen, methane, and nitrogen, are unimportant unless in proportions sufficient to diminish appreciably the oxygen content of the mine air. Carbon monoxide and oxides of nitrogen usually occur together, and are very harmful even when inhaled in small quantities. About 0.01 or 0.02 per cent is the maximum quantity of carbon monoxide allowable continuously in mine air without affecting the workmen harmfully, although as much as 0.04 per cent is harmless for periods of time not exceeding one hour. Not much data are available on the maximum quantity of oxides of nitrogen that may be tolerated in the mine air without danger to the men working therein. The general conclusions are that 0.01 to 0.02 per cent of oxides of nitrogen is dangerous and that under no conditions should 0.05 per cent be reached. Carbon monoxide can be determined to an accuracy of about 0.02 per cent by the usual Haldane analysis, but an accurate method of determining oxides of nitrogen at low concentrations has heretofore been impossible without using a large quantity of gas for a sample.

A method was desired by which small quantities of oxides of nitrogen could be determined from a minimum quantity of gas, for samples of mine gases are taken most conveniently in vacuum bottles of about 250 c.c. capacity. The nitron method used by Gutbier and Busch is difficult to perform and cannot be used at such low concentrations as are present in the usual mine-air samples. To be of value in mine-gas analysis, a method should be accurate to at least 10 parts per million, or 0.001 per cent.

After explosives have been fired, especially in ventilated working faces, the products of the explosion are, of course, diluted with large quantities of air, and the amounts of oxides of nitrogen present will usually be lower than 100 parts per million (0.01 per cent). To determine these small quantities, a method was adapted from the usual procedure for the determination of the oxides of nitrogen in water analysis, applying the diphenyl sulphonic acid method to give the total oxides of nitrogen as nitrogen peroxide or as nitrates. By the use of the method evolved, ten parts of oxides of nitrogen as nitrate could be detected in one million parts of the air oxides of nitrogen mixture with an accuracy of five or six parts per million.

Copies of Technical Paper 249 may be obtained by applying to the Director, Bureau of Mines, Washington, D. C.

Seeking To Utilize More Wisconsin Iron and Zinc

Graduate students in the department of mining and metallurgy of the College of Engineering of the University of Wisconsin are engaged in research into metallurgical processes with a view to discovering means of utilizing large quantities of low-grade ore existing in Wisconsin.

Because of the lack of a commercial process of desulphurization, the enormous tonnage of high-sulphur iron ore of northern Wisconsin has never been worked. Research to evolve a method of desulphurization of such ore in the blast furnace is in progress. At the same time pure science investigations are being conducted to determine the physical properties of blast-furnace slag.

With a view of finding means of utilizing the great tonnage of low-grade zinc in southwestern Wisconsin, experiments in applying selective flotation to these ores are being made. An economic location for an electric furnace foundry somewhere on the Great Lakes is also the subject of investigation.

Formula for Strength of Rope

The Bureau of Standards laboratories in the Department of Commerce have made tests from which it has been possible to deduce a formula that will give the strength of ropes.

Fort three-strand, regular lay manila rope from ¾-in. to 4½-in. in diameter, the following computation will give the breaking load of the rope:

The average breaking load in pounds equals 5,000 multiplied by the diameter of the rope in inches, multiplied by the diameter of the rope increased by one.

This will give, of course, the average maximum weight that the rope will hold, but the working load or the load that a contractor or safe builder may apply with proper safety and precaution would be considerably less than the load given by the formula.

Other data on rope are contained in Technologic Paper of the Bureau of Standards No. 198 by A. H. Stang and L. R. Strickenberg, which has just been issued.

War Problems in Minerals

V—United States Geological Survey, 1914-1918

BY GEORGE OTIS SMITH

THE WORLD WAR put minerals on the map. The discovery that mineral resources are essential in a war was spontaneous and widespread. In Washington, as the hurried development of a war program brought into being one after another new agency, the quickly assembled personnel of each Government organization at once found that most of the raw materials needed in the long-delayed preparedness campaign were of mineral origin. The Railroad Administration learned that coal was both the largest item in its purchases and the largest article of freight; the War Trade Board discovered not only that minerals make up, in value, one-third of the foreign trade of the United States, but that certain imported minerals are almost indispensable to our domestic business; the Food Administration early became concerned as to the adequacy of the supply of mineral fertilizers and mineral insecticides; the Shipping Board at once realized its responsibility in devoting available cargo space to the essential mineral imports and exports; the Fuel Administration necessarily thought in terms of coal and oil; and the War Industries Board soon began its campaign for procuring, at whatever cost, the metals without which our munition plants, new and old, could not serve the cause of humanity.

WAR DEVELOPED ACUTE MINERAL SUPPLY PROBLEM

In considering these absolutely essential fuels and ores the question naturally arose what were our country's available resources, and where and how could they be most quickly developed? Each newly created board sensed these critical problems and set out to solve them. The scholastic atmosphere pervaded Washington, and the spirit of independent research was everywhere, investigators crossed and recrossed each others' trails, and wide-flung questionnaires added to the burdens of the Post Office Department and to the troubles of producers and consumers. The campaign for information was waged with the fervor shown by fresh converts to an idea; the new faith in minerals as large items in the war program was so strong as to tolerate no delay, and co-ordination of effort was therefore impossible, nor was there even time for searching the rapidly accumulating files of the new organization.

The questionnaire habit was easily formed and rarely broken. The first step of a new board was to devise questionnaires which might be working while the program of activity was being formulated. The need for facts was usually keenly realized and sometimes no less apparent to others, as in the case of the two young men who in their investigation of the pyrite situation brought their questionnaire, while still in the dough or at most only half-baked, to a geologist who had specialized on pyrite and sulphur for several years. In the course of the instructive interview, one of the callers caught sight of a glistening object on the geologist's desk and inquired its nature; on being told that this was common pyrite, he remarked that he had never before seen any pyrite—and the discussion of the pyrite questionnaire was resumed on the same plane.

The discovery of the war-mineral subject early in 1917 by so many new Federal agencies raises the pertinent inquiry: Had there been previous to this time of special need no adequate study of this important subject by some Federal bureau? To answer that question in part is the task set for this article.

However well intentioned our historical sense, we are in danger of mixing hindsight and foresight—of unconsciously pre-dating ideas and purposes. It is therefore well for me to limit my review of the war-mineral policy of the U. S. Geological Survey to excerpts from contemporaneous statements.

In an interview in mid-August, 1914, Secretary Lane brought to public attention the new conditions then about to be imposed upon industry by the necessary readjustment in the world's commerce and specifically mentioned the varying effect of these readjustments upon the market demand for the metals and the mineral fuels. He clearly defined the issue of the necessary development of neglected mineral resources in our own country, and the Geological Survey followed up this interview with more detailed press statements on such subjects as manganese, antimony, and potash. In those first weeks the need of information found expression in a considerable volume of correspondence regarding possible new sources of mineral products that had hitherto been imported as well as regarding the expected increase in the demand for other products for export; and on Sept. 4, 1914, the Survey issued a short bulletin on how to make America industrially independent in its mineral supplies. In this bulletin (No. 599) the outstanding deficiencies in domestic supply of mineral raw materials were stated, and the impregnable position of the United States in both its reserves and its current output of the mineral fuels as contrasted with its weakness in two essential mineral fertilizers, nitrates and potash salts, and in three very useful metals, tin, nickel, and platinum.

GEOLOGICAL SURVEY'S IMPORTANT WAR SERVICE

In the wording both of this sketch of the economic situation and of the call for American enterprise to begin at once to investigate and exploit neglected mineral resources, so as to "make our industries safe from the interruptions of war," no important changes would be made even now, after seven long years of experience with the problem of war minerals. The Geological Survey at once realized its duty of acting as an agent in bringing together consumer and producer of mineral raw materials and of pointing out possible domestic sources of minerals to replace imports or to meet new demands for exports, and the performance of this duty made up the largest part of the work of the Federal geologists and statisticians for the four years that followed. The policy of the Geological Survey as an investigative agency outlined in August, 1914, continued to be its policy throughout the war.

As America's entrance into the war gradually became inevitable, the Geological Survey's part in the preparedness program became more clearly defined. At the request of the War and Navy departments, summary reports on water supply and soil drainage were made in advance of the selection of possible cantonment sites, a division of military surveys was formed, a program of topographic work was drawn up by the General Staff of the Army, and the Survey's map-printing plant was devoted largely to confidential and urgent work for military use—all this before April 6, 1917. The product of years of field and office investigation was made available in special reports prepared for the information of the general public or for the immediate use of some commission, committee, or bureau at work on war problems. A relatively large number of members of the Geological Survey entered the military service, a fact that weakened the personnel available for the civilian duties but strengthened the purpose of those remaining for the tasks behind the lines. The mobilization of the Survey members on war work was not spectacular, but it was complete.

GEOLOGISTS' WAR CAMPAIGN

Geologic field work was concentrated on the essential minerals, and an intensive campaign was started in the search for commercial deposits. Every geologist available was at work in some area where increased production might be expected to follow geologic exploration. To meet the increased demand for later information than was contained in the earlier and less complete review of the mineral situation, Bulletin 666, "Our Mineral Supplies," was issued in 1917, first in thirty-three separate chapters, each devoted to a "war mineral," and the first chapter was published one week after the United States entered the war. Twenty geologists contributed to this publication, which had wide circulation, and as the much smaller bulletin (599), "Our Mineral Reserves," had already been issued in several editions, aggregating 21,000, it is evident that this widespread publicity helped to instruct and arouse the public.

Yet the Geological Survey tempered its stimulation activities, even as early as 1917, with advice to those engaged in mineral development not to overlook future conditions. Even with the speeding up already attained, the pace had not yet been reached that the emergency justified; still, to quote further from my administrative report for 1917, I urged that both the consumer and the producer of war minerals should strive to adjust their projects to post-war conditions as well as to the emergency needs, "lest this expansion of productive capacity involve after-the-war losses that will swallow up war profits." A geologist can sometimes forecast the future as well as interpret the past.

SURVEY'S SERVICE TO DOMESTIC INDUSTRY

The policy of the Survey during the war did not include any change in admininstrative machinery or any new appropriations for special war work, but consisted simply in the diversion of every investigative activity into channels that would contribute to the prosecution of the war. Thus the whole geologic branch became a "war minerals" unit; and even the hydraulic engineers of the Survey, in their country-wide study of our power situation, were seeking to save coal by substituting water power for it or by interconnecting steam plants. The increasing demand for facts led the Geological Survey to take the initiative in organizing a joint information board as a clearing house for inter-bureau inquiries regarding mineral products, thus making the Survey's store of information, as well as that of the other bureaus and boards, more quickly and fully available for all the Government organizations, new and old. All the interested official bodies had membership in this co-operative information board, of which a representative of the War Industries Board, Pope Yeatman, was chairman, and a Survey geologist, Dr. E. S. Bastin, was executive secretary.

The need of co-ordination of effort also expressed itself in the organization of the War Minerals Committee, whose valuable activities have been well described by its chairman, Mr. Westervelt. At the outset I could not agree with some of my friends as to the need of this unofficial agency to serve as a catalyzer for the two Government mineral bureaus as well as a link of connection with the outside bodies of mining engineers, but I realized that no one should let his personal opinion block or retard any possible move toward a better functioning of all the agencies that could be hitched up to the war-mineral work. The co-operation of the Geological Survey with the War Minerals Committee was therefore intended to be as complete as possible under the conditions, justly appreciated by Mr. Westervelt in his opening article of this series, and the extra load placed upon the Survey's representative on the committee, David White, and his associated geologists, was justified by results.

CENTRALIZED AUTHORITY ESSENTIAL

The War Minerals Committee in devoting itself later to the movement for the creation of a war minerals administration expressed what was apparent to all those nearest the problem of keeping up the supply of raw materials—that some centralized body or, better some one official with administrative powers equal to his responsibilities, was absolutely essential to stop the drift in policy and the changes in direction of executive acts by boards and committees that were not co-ordinated.

That the Geological Survey did not take to itself a more prominent place on the Washington horizon may have been due to a lack of administrative initiative, but it was not due to any lack of keen realization of the nation's need of information and of a definite policy based on facts. Indeed, it was seen then that an investigative bureau of the Government could find the facts and even decide, to its own satisfaction, upon the policy determined by those facts and yet not be best fitted to put that policy into effect. The thinker and the doer are commonly distinct personalities; they represent two types of minds. This is not a new division of labor; even in pioneer days the pathfinder was not the builder, as Kipling has set forth in his poem, "The Explorer."

Nor was a war needed to teach some of us that the research worker is not the best executive, and, indeed, that an investigative bureau is organized on a plan, possessed of precedents, and manned with a type of personnel that unfit it for work of construction or operation. In these days bureaus, like men, must specialize, and during the war period the part that the Geological Survey was called upon to play was mainly a part behind the scenes. Its fact finding contributed to the action of those who had more prominent parts—those who were to apply the facts to the strenuous operations of the World War.

A mineral administrator was needed to stimulate the production of certain war minerals, but as Mr. Moore has noted in his article, the spokesmen for the industry" opposed the legislation, preferring "relief"

[illegible]

to "administration"—that is, curative to preventive measures. In the absence of a mineral administrator the Geological Survey had continued to do its part in stimulating the production of needed raw materials, and later in the settlement of claims for reimbursement its geologists helped as disinterested witnesses, freely testifying to the dates and circumstances of requested stimulation, but quite as freely protesting against claims later submitted by those on whom it was known that the stimulation had failed "to take."

In the utilization of the Geological Survey and its store of specialized information, two of the newly created agencies with executive powers stand out from all the others as attaining a maximum of results with a minimum of duplication of effort. As Professor Leith has stated, in the second of this series of papers, the Committee of Mineral Imports and Exports knew of the two mineral bureaus in the Interior Department and was content to take the facts at hand there and start with them as the raw material for its own special investigation. Time and effort were thus saved, not to mention the satisfaction felt by the specialists already in service in seeing their work of years utilized to so great advantage. Under those circumstances co-operation was easy and fruitful.

The use made of the Geological Survey by the Fuel Administration was larger, though it included a less variety of subjects. Instead of building up a new organization to handle the many statistical inquiries connected with the all-important subject of coal, the Fuel Administration at once began to utilize the coal statistics of the Geological Survey. Already the Survey had under way a system of weekly reports on coal production, started in July, 1917, and the personnel of the Geological Survey engaged in this and other statistical work under Mr. Lesher became the nucleus of a much larger organization financed by the Fuel Administration but administered by the Geological Survey. Not only was valuable time thus saved, but the resulting investigative service was independent of the executive function of the Fuel Administration, a relation that was later found advantageous in cases of dispute between the Fuel Administration and the Railroad Administration on questions of car shortage. Indeed, the experience of Mr. Lesher in his successful conduct of this large work for the Fuel Administration afforded abundant proof of the inherent difference between fact finding and executive action and of the real advantage of independent control of these two functions.

Lloyd George recently remarked that "man is the most unteachable of animals," yet this chapter in the record of the handling of the war-mineral situation in Washington is not worth publishing unless the bit of history shall carry its lesson. Looking back, like Mr. Spurr, I am "finally thankful it was no worse"; but how could it have been better?

The Geological Survey, with its four decades of study of our country's mineral resources, had the information and experience needed when the country had to prepare for war. This "stock in hand" was of the kind required, and it was, in a sense, available, but the fact stands out that the available knowledge was not utilized to the full extent. As already suggested, I attribute this seeming failure to a condition of organization, and this condition is not local but general. Scientific investigation too often lacks follow-up machinery; facts may be dug out of the ground and eternal truths may be discovered, but their application to life often depends upon chance. Many have noted the unfortunate circumstance that the world has a much larger supply of science than it uses, even though every consideration of economy and efficiency should lead us to apply our science to making the world a better place to live in.

The year 1914 thus found the U. S. Geological Survey, and possibly other scientific bureaus, without adequate "sales management"; there was a good stock of ideas on hand, but no one to push them on the waiting market. The operating part of the works speeded up, and both increased and improved the stock, but the stock did not move as might have been expected or as was hoped.

Without explaining the scientific ideals and standards of an investigative bureau like the Geological Survey, and without making any apologies for its responsible officials, I wish to suggest a controlling condition even more fundamental than this lack of selling ability. The general public, which is well represented in Congress, does not give to the scientific bureau full credence as a source of dependable and useful information, except when its findings agree with ideas and opinion already held or give support to some scheme in which there is some special interest. Disinterested belief that the scientific bureau is more than one of the luxuries of modern civilization is held by so small a majority as to discourage sometimes the most enthusiastic public servant. It is not simply that the scientist is so often lightly referred to as a theorist; there is a widespread and deep-seated lack of faith in experts and specialists. The man of practical affairs is regarded as a better guide; it is not realized that science is nothing but organized practical experience.

It was this same blindness to the value of specialization and the usefulness of specialists that in 1917 led those in high places to put men who had been trained in one line of business into places of responsibility where they had to learn anew everything but the executive habit of prompt action. Thus those men lost opportunities for service in fields for which they were better fitted by being called to serve in fields for which they were unfitted. As an example of this disregard of fitness through training—the success of the Geological Survey in quickly organizing a weekly inventory of the copper, lead, and zinc production and stocks for the use of the Army and Navy buyers of these metals led to the suggestion that the Survey also organize a similar service for hides and mahogany. The obvious reply was that the experience that enabled the geologists who had specialized for years in those metals to render this special service would by the same token unfit these or other Survey members to qualify as experts in leather and wood.

When this incident was afterward related to an assistant secretary of war he expressed surprise that any bureau chief should have failed to appropriate for his bureau any line of activity offered, especially if it was outside his field; and the comment was justified, for not only does the public place too little value upon specialization in science, but the ambitious administrator sometimes forgets his own faith in specialization.

Looking forward to the no less important activities of peace, we may conclude that co-ordination of activity, which presupposes specialization of function, is the goal in an organized scientific and administrative service just as much as in a steel plant.

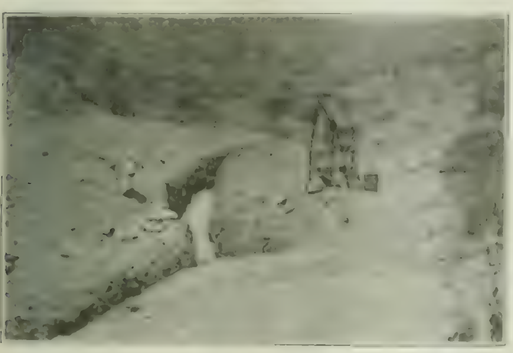
The Placers of the Johnnie District, Nevada

Area Recently Discovered Covers Ten Square Miles—Mexican Air Jig Being Used To Treat Gravel, With Good Results—Source of Gold Near By

BY CHARLES LABBE

Written for Engineering and Mining Journal

IN THE EARLY PART of 1921, placer gold was discovered in the Johnnie mining district in Nevada, and the usual staking rush occurred soon after the first news reached the other mining communities. The district is situated at an altitude of about 3,500 ft. on spurs trending westerly from the Spring Mountain Range close to the border of Clark and Nye counties, Nev., or about twenty miles east from the California boundary line. The nearest supply center is Death Valley Junction, Cal., twenty-five miles distant by wagon road, but the mail route is by way of Shoshone Station and the Pahrump Valley.



PLACER WORKINGS IN MILL CANYON, JOHNNIE MINING DISTRICT, NEVADA

The western slopes of the Spring Mountain Range are low undulating foothills merging at lower levels into the gently sloping surfaces of the Tertiary deposits of the adjacent valleys.

The enormous deposits of facetted boulders occurring at higher levels, principally of the harder rocks of the main range, are evidences of a former glacial period. The remains of a morainic deposit filling the depression of an old valley can be seen on the top of several ridges in the eastern part of the district.

The rocks of the Johnnie district are limestone, shales, schists, quartzites, grits, vein quartz and plutonic quartz, and in few places andesite and rhyolite. The probable geological age of the sedimentary rocks is Paleozoic and possibly as old as Cambrian.

The principal placer diggings are at the bottom of the gulches, below or near gold quartz lodes. The gold in the quartz veins is in a free state. All the placer prospecting formerly done was near the veins, and the results were far from encouraging, as it has been proved since that the bedrock in the channel must be reached, the depth varying from 3 to 25 ft. It can safely be said that in most of the placers the gold has been eroded from the veins now visible, but in Mill gulch and south of the Congress mine placers have been found much higher than the quartz veins. Here the gold may possibly have been derived from rich stringers in the shale or schist. In other places all indications have been obliterated.

The placer ground follows the general trend of the main lode of the district, extending from a point two miles north of the Johnnie mine to four miles south of the Congress mine, a total distance of ten miles and approximately a mile in width.

Nearly half of the proved placer ground is within the quartz properties. A great number of claims have been located, some of which have hardly paid for the location work, but others have opened valuable showings. In general only the prospecting stage has been reached, and few have attempted production.

The pay dirt is found on bedrock distributed rather evenly through a foot of slightly rounded gravels in a soil-like, sometimes clayey matrix, loose boulders being encountered close to bedrock. The conditions are essentially the same in all the gulches, and the thickness of the pay gravel varies little from place to place. The thickest pay streak is 8 ft. thick and is in the Tonopah Syndicate ground, in the main Johnnie gulch at a depth of 25 ft.

The channels are split and reunited, and the width varies greatly. The most satisfactory bedrock is schist or shale so lying as to form natural riffles. Some altered and partly decomposed quartzites and limestones have formed a porous ground, which acted as a good gold catcher. In some places on level bedrock the boulders have acted as riffles and have stopped mostly coarse gold. The gold is fairly and evenly distributed through the pay dirt, and several yard samples from different places have given very close results.

The gold is coarse and angular, with fragments of quartz, showing that the place of its origin is close by, but the gold in the placer is very much coarser than any seen in the ores actually produced even in specimen rock. With every panning a quantity of black sand is obtained, which is composed of pyroxene, titaniferous iron, and iron pyrites. The pyrites occurs in all sizes, from the smallest pieces which can be observed with a strong magnifying glass to fragments half to three-quarters of an inch in size. An assay made of the pyrites of the Mae gulch gave $850 in gold and 38 oz. in silver. In some pyrites coarse free gold can be easily seen.

The climate is arid, and the summer is hot, though the spring and fall are often pleasant. Snow may fall occasionally, but it melts in a day or two. Vegetation is scanty, and if a water level exists it will be found at the level of the water in the Pahrump Valley or of the Amargosa.

In the hills at timber line are numerous springs, most of them three to six miles away and capable of being developed, but it is doubtful if a sufficient volume of water could be obtained for hydraulicking. There are three pipe lines to mine camps and stamp mills, and the supply is ample for milling and domestic purposes. Some of the water could be used for rocking, but since the introduction into the district of the Mexican air jig, very little water is now used for placering.

Either water for rocking has to be brought to the working places or gravel has to be hauled to the water, where sluice boxes are built, but as the pay gravel is very dry and seldom contains any clay, being mostly soil, the dry washer has proved the best. It is a small self-contained machine, inexpensive to build, and can be moved anywhere. It is operated by one man, and the extraction is good.

The air jig or dry washer consists of a screen of ½ to ⅝-in. mesh on which the pay gravel is either dumped or shoveled, the undersize falling into a hopper holding about 150 lb. of gravel, then on a movable frame held in place by tapered wood keys.

The frame is made of wood with 1 x 1-in. riffles placed about 4 in. apart. The bottom is covered with cheesecloth or flour sacking, kept from sagging by a light screen (window screen). The bellows underneath is made of 10 or 12-oz. canvas, the bottom of which is a 1 x 12-in. board, with one end fastened with hinges and the other extending to permit the rope to be tied to the handle. The machine stands on four legs 2 x 4 in.

The operation of the jig is as simple as the construction. With the frame tight in place, the hopper is filled (the bottom plank of the hopper nearly touches the frame) and the gravel runs on the frame, only a few inches being stopped by the first riffle. The bellows is worked rather rapidly, and the air is compressed and acts on the cheesecloth exactly like the water in the regular jig. The gravel is now jumping very smoothly over each riffle. By observing closely at the compression stroke, the air holes can be seen through the gravel bed, and on the return stroke the suction helps to bring the heavy mineral to the bottom. The dust, which one would think must be in quantity, is hardly noticed.

According to the value of the material treated, but usually after three to five hoppers full have been handled, a clean-up is made. The two tapered keys are loosened, the frame is slid out and its contents are dumped on a canvas and panned out in the usual way. The ratio of concentration is 8 to 1 per hopper or 24 to 40 to 1 or more if several hoppers are used. The time required to jig a hopper does not exceed four minutes. It is much faster than panning and cheaper than it is to take the gravel to water. The extraction, which is 75 to 90 per cent, is just as good as can be expected with the rocker.

According to operating figures a cubic yard of pay dirt will yield from $2 to $30 in gold, but no definite figure can be given to show how low a grade of gravel can be made to pay, all this depending on the amount of overburden to be removed, the boulders that may be encountered, the nature of the bedrock, and the facility of handling.

There are on the market dry concentrators that would make just as good a saving and of much larger capacity, but for the prospecting stage the air jig has proved successful.

Value of Compass Exploration

A series of observations is being made in the brown iron ore district of Alabama for the purpose of determining definitely whether the dip compass can be relied upon in the location of ore deposits. A study of the method of mining and handling the ores of this district is also being made by the Southern Experiment Station of the U. S. Bureau of Mines.

Iron-Ore Deposits in Finland and Sweden

Considerable iron-ore deposits have recently been discovered at Kittilä, in Finland. The Finnish Geological Society started investigations there in the summer of 1920, and a report has just been issued giving details of the results attained. It appears that the formation of the ore fields, as well as the properties and appearance of the ores, are quite different from those in the northern Swedish ore districts, with which the Kittilä fields are connected through Norway. On the other hand, the Kittilä ores are stated to closely resemble the Canadian iron ores. If the extent of the Kittilä ore districts are to be determined by a magneto-metric map, the total size would approximate 141,000 square miles and that of the visible part of the field about 104,600 square miles. The ore content of some parts of the latter is stated to be so poor that mining on a revenue-paying basis seems hardly possible. Sites of 4,000 to 8,000 square miles of pure iron deposits have been explored, on the other hand, extending over several hundreds of meters in length and having a width of from forty to sixty meters. The richness of the upper strata of deposits is estimated at 51,400,000 tons and the lower strata are calculated to contain 17,700,000 tons.

Investigations of the Mertainen ore fields (North Sweden), which had been unexplored so far, by the ore commission appointed by the Swedish government, have now come to an end. It was found that the fields contain valuable workable ores rich in iron and poor in phosphorus. An analysis of samples showed an iron content of 65.5 to 68.5 per cent and a phosphorus content of 0.09 per cent. Expert calculations put the total available tonnage at 35,000,000 to 40,000,000. The commission is now engaged on a calculation of mining and operation costs for the exploitation of the deposits, and the railroad authorities are considering the costs of a line connecting Kiruna with the ore fields.

Experiments on Sponge Iron

Results of work done at the Northwest Experiment Station of the U. S. Bureau of Mines in Seattle, Wash., indicate that fine grinding of sponge iron and wet magnetic concentration give a higher recovery of metallic iron than dry magnetic concentration on either coarse or fine material and that dry magnetic concentration is not improved by fine grinding. In melting sponge iron in a direct arc furnace using amorphous carbon as a carburizer, 2½ per cent carbon is readily reached, with a practical limit of 3 per cent. Using graphitized carbon as a carburizer, 3 per cent carbon is readily attained and 4½ per cent is easily possible.

Rapid Determination of Mercury

In making tests for the rapid determination of the percentage of mercury in its ores, according to the *Journal of the Society of Chemical Industries*, a mixture of the ore and quicklime is heated in a tube closed at one end and held almost horizontal. The portion of the tube in which the mercury has sublimed is separated from the remainder, the end sealed, and the mercury dissolved in about 1 c.c. of nitric acid (sp.gr. 1.48—1.50); a few drops of $N/10$ permanganate are added to oxidize mercurous salts, and the solution after neutralization is titrated with $N/20$ potassium thiocyanate.

Mining Men of Note

Eugene Meyer, Jr.

SO FAR, our biographical articles have dealt principally with men of note in the mining world on account of their technical achievements. There is, however, an important class of mining men composed of those who have had the direction of mining policy in a large way. A man may become eminent in the mining field through the direction of technical procedure, of business management, or of finance, and just as it is impossible to draw an exact line between the activities of the mining lawyer and the geologist engaged as an expert in mining litigation, so it is at times hard to frame a distinction among mining men between the technical expert who contributes to the making of mines by his knowledge of metallurgical and mining problems, and the financier skilled in mining problems who makes possible such success by providing the necessary funds. In this class, which we may call men of mining policy as distinct from men of mining technique, are to be found such distinguished names as those of Daniel Guggenheim, John D. Ryan, C. F. Kelly, Adolph Lewisohn, W. B. Thompson, and Eugene Meyer, Jr. Mr. Meyer was born in Los Angeles, Cal., on Oct. 31, 1875, which reminds us that if Ohio is the mother of presidents, California is the mother of mining men. He was educated in the public schools of San Francisco, spent one year in the University of California, and was graduated from Yale University in the class of '95, taking honors in political economy. After graduation he spent a year in the banking business in New York, followed by two years of intimate study of banks and banking houses in Europe, returning to enter the employ of the foreign exchange and banking house of Lazard Frères in New York.

EUGENE MEYER, JR.

In 1901 the firm of Eugene Meyer, Jr., & Co. was formed, which until 1906 was principally known for its activities in connection with placing and marketing railroad issues. Mr. Meyer's interests turned toward copper in 1906, when he became a director and officer of the Boston Consolidated, which was later consolidated with the Utah Copper Co. in 1909. The properties formerly owned by Boston Consolidated have furnished the most important part of the ore mined by Utah. With the development of the silver mines in the Cobalt district, Mr. Meyer became interested in silver as well, and his name appears as a director in Nipissing in 1907 and 1908. Thereafter the firm of Eugene Meyer, Jr., & Co. became one of the best known in the field of copper finance, underwriting and placing the bond issues of such properties as Braden, Inspiration, and Chile. The firm was well known to the engineering profession, many of the principal consulting engineers in the mining field having been called in from time to time by Mr. Meyer for professional advice. It has been said that if you want a thing done well, call on a busy man. It may also be said that if you wish a thing done well and also done promptly, call on a busy mining man. We therefore see Mr. Meyer summoned to Washington soon after the outbreak of war, and taking charge of the Council of National Defense, and later for the War Industries Board, of the nonferrous metals, in which capacity he was succeeded by Pope Yeatman early in the year 1918. With the formation of the War Finance Corporation in 1918 as an emergency banking organization to meet the needs of industries necessary or contributory to the prosecution of the war, and of banks financing such industries, Mr. Meyer was appointed one of its directors, was later elected managing director, and served in that capacity until 1920, when operations of the corporation were suspended. In the spring of 1921 the activities of the War Finance Corporation were revived, and Mr. Meyer was reappointed to the board by President Harding and re-elected Managing Director.

Though the activities of the War Finance Corporation in connection with agricultural relief would appear to be a field large enough to keep any man pretty busy, Mr. Meyer found time to take in the marketing of securities for the Director General of Railroads.

During a recent address to bankers and business men in Los Angeles Mr. Meyer was heard to offer this thought, "Pessimism follows, rather than precedes, the event," an inspiring message to the mining industries.

CONSULTATION

Procedure for Patenting Lode Claims

"Will you kindly inform a prospector what steps are necessary to procure a patent upon two lode claims, the probable cost and how long it ordinarily takes?"

The legal steps required to obtain a patent from the United States Government covering one or more lode or placer claims are fully described in many textbooks and Government publications. A prospector wishing to go through this process will do well to send for a copy of the pamphlet "United States Mining Laws and Regulations Thereunder," published by the General Land Office, Department of the Interior, Washington, D. C., and to inform himself about the law. It is furnished free of cost, and contains all the laws and regulations that directly affect his action. Briefly the necessary steps are as follows:

At his own expense the owner must have a correct Government survey made of his claims. To do this he will have to apply to the surveyor general of his state, specifying what claims he wishes to have surveyed, when the locations were made, and inclosing with his application certified copies of the location certificates. The surveyor general will appoint a mineral surveyor in the owner's district (usually a mineral surveyor whom the claimant proposes) to do the work, upon the receipt of a deposit intended to cover the cost of the clerical work in the surveyor general's office. The mineral surveyor can have nothing further to do with the patenting of the claim after having made the survey and having had it approved by the surveyor general and the Commissioner of the General Land Office. One copy of the approved plat and field notes is retained by the surveyor general, one copy of the plat is given the claimant for posting on his claims, and one copy of the plat and field notes given to the claimant is to be filed with the proper register of the General Land Office. This copy is ultimately transmitted with other necessary papers to the Commissioner of the General Land Office. One plat of the claim is also sent to the register to be filed.

The claimant's plat is to be posted in a conspicuous place upon his claim, and must include a notice of patent application, containing date of posting, name of claimant, name of claim, the number of the mineral survey, mining district and county, and the names of adjoining or conflicting claims, as indicated by the plat. It is next necessary to file with the proper register and receiver a copy of the plat and field notes, accompanied by the affidavit of at least two witnesses that such plat and notices are posted in a conspicuous part of the claims giving the date and place of such posting and a copy of the notice so posted.

Accompanying the field notes must be the sworn statement that the claimant has possessory right to the premises by virtue of a compliance with the mining rules and regulations of the mining district, state, or territory in which the claim lies and with the mining laws of Congress. The affidavit must state the facts constituting such compliance, the origin of his possession, and the basis of his claim for patent. The application should contain a full description of the vein or lode, the kind of mineral, the extent thereof, whether ore has been extracted, amounts and value, and such other facts as will support the claimant's allegation that the claim contains a valuable mineral deposit. This sworn statement must be supported by a copy of each location notice, certified by the legal custodian of the record thereof and also by an abstract of each title certified by the legal custodian of the records of transfer, or by a duly recognized abstractor of titles. The certificate must state that no conveyances affecting or purporting to affect title to the claims appear of record other than those set forth.

Then at the expense of the claimant, the register will publish notice of the application for sixty days in a local newspaper so that public notice is given to anyone holding an adverse claim. After this period, an affidavit of publication must be furnished the register and another of posting upon the claim; also a certificate from the surveyor general testifying to the performance of at least $500 worth of work upon the claim, after which the claimant may pay for the land at the rate of $5 per acre, and if all the papers are found to be regular and in order, a patent will be issued through the General Land Office.

It will be seen that the procedure is both long and intricate, and that many delays can occur in the various steps that are required by law. For this reason it usually takes at least a year from the time an application is made to the surveyor general for a patent survey, until a patent is granted.

Standard forms have been evolved which facilitate the proper execution of each part of the procedure. These forms can be consulted in practically any legal work on mining, such as "Morrison's Mining Rights," published by the Bender-Moss Co., San Francisco, Cal. It is unwise, unless a prospector or claim owner has competent guidance, to undertake to perform the many steps necessary to procure a patent. Governmental regulations are exceedingly strict and punctilious, so that the slightest deviation from a proper and acceptable form is likely to subject claimant to much annoyance and delay in completing his application. The claimant can readily proceed as far as the approval of his mineral survey, but beyond that it is advisable to place his papers in the hands of an experienced attorney.

It is difficult to give an estimate of the cost of procuring a patent to a claim. Usually it is small compared with the value of the land it covers. All expenses must be borne by the claimant, particularly those in which the Government is an interested party. The mineral survey is made at the claimant's expense, the clerical work of the General Land Office in correcting the mineral survey is paid for by the claimant, the advertisements inserted in the local paper and the final payment of $5 an acre are also part of the general expense, to say nothing of the cost of placing the matter in the hands of an attorney. Where the claimant enters into individual negotiations with parties aiding him, the fees he pays are subject to the contracts he makes. Thus the mineral surveyor's charges depend upon the bargain the claimant drives with him. Similarly, attorney's fees.

HANDY KNOWLEDGE

Neighborly Chats With the Foreman

Laying Out a Job

By Duncan MacGregor

Written for Engineering and Mining Journal

Laying out a job depends to a certain extent upon the kind of a job it is. Nevertheless, there is a similarity in all jobs. There is one kind of a job which is carefully planned beforehand and there is the other kind that grows like Topsy, and when finished reminds you of Topsy herself, slightly down at one heel, her hat tilted and chewing gum from ears to eyes and from chin to hat. It's the carefully planned job that generally goes through without those uncomfortable hitches and embarrassments—not to mention accidents.

Take a leaf out of the notebook of the engineer. He first determines exactly what is wanted. He takes plenty of time to do this, for he knows that some people are fickle and need be pinned down in black and white, with pay in advance, before he can tell just what they want. Then he works out plans on paper; builds the whole structure beforehand in those pictures on the brown detail paper. Next he takes off all the quantities he will have to use and decides on the kind of material necessary. He writes these down in the form of specifications and knows pretty well the sort of thing that he is up against.

You can handle your ordinary jobs and some of the exceptional ones in the same way. Get a sheet of paper and make a rough sketch and mark on it the dimensions and kind of material you want. Make out a bill of material. Next think over the tools you will require and make out a tool list. Then figure out the number of men and the time the job will probably take. Lastly, figure on the staging that will be required and make a sketch of it. Take off the material and prepare a bill of material.

The economical way to run your job is to have all the material go first through the shop and then have it delivered along with the special tools close to the job. Now you are ready to turn your men loose. First decide on the order in which things have to be done. Decide what parts of the job can be done simultaneously without the men interfering with one another. Lost time results when one gang has to wait on another to finish up. A little planning ahead of time will prevent these delays.

After completion, when you are satisfied, have one man retrieve all the tools and get them back to the station, and a couple more clean up all superfluous material and get that back to your station. Finally, go over the whole job and see that it comes up to your expectations and is amply strong enough for the purpose.

Then, note in your work book the labor required and any improvements in handling the particular job, so that when you repeat it you can make these improvements. Lastly, compute the total cost. This is essential, for you have to think in terms of cost. If you are going to keep down costs you will find it quite necessary to think dollars and cents on each job and measure your results in units of cost and units of work.

When you go off shift and get your pipe working after supper, run over the whole day's work and criticize your own handling of the work of the day. If you do this from day to day the time will come when you won't miss a single trick and you will get your gray matter so trained that the "super" will stand around and listen pretty respectfully when you have anything to say.

Rail Linings for Ball Mills

By H. W. Hardinge

Written for Engineering and Mining Journal

The article on the subject of "Railroad Rails for Ball-Mill Linings" on page 778 of *Engineering and Mining Journal* of Nov. 12, 1921, by Perry G. Harrison, is certainly interesting, even though the cost which he finally gives for this class of lining, 1c. a ton, I consider rather high.

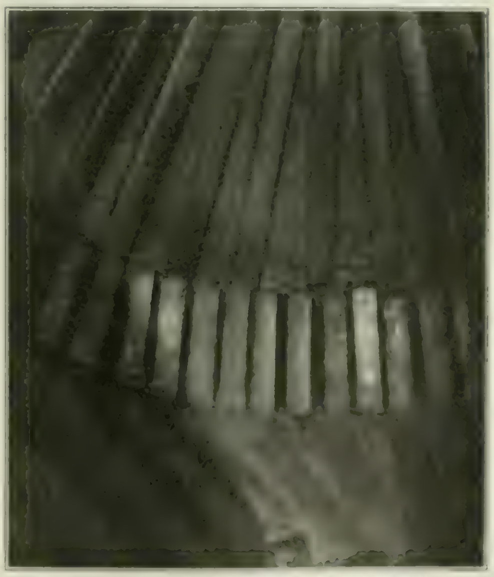


FIG. 1. METHOD OF LINING A HARDINGE MILL WITH RAILS

The new adaptation of old ideas is constantly recurring, and it will be of further interest to your readers in out-of-the-way places to utilize their scrap material as indicated in the inclosed photograph, showing how we tried out this class of lining in conical mills several years ago. In our application of this idea, the rails were held in place by lugs passed through the shell and further held in place by cement. The cement gradually wore away, and its place was automatically filled in with the grinding media and material being ground, which prevented the shifting of the rails. See Fig. 1.

A photograph of another class of lining more particularly used in light ball mills and adopted by the

Hardinge company about ten years ago is also shown. This is formed by cutting off the sections of old rails and imbedding them in cement. The cutting was done with a steel disk revolving at about 2,500 r.p.m. acting as a circular saw, without teeth. It required about three minutes to cut a section of an 80-lb. rail when cold, but when heated in a forge to a cherry-red heat about fifteen seconds sufficed to perform the cutting. Note rail sections in Fig. 2.

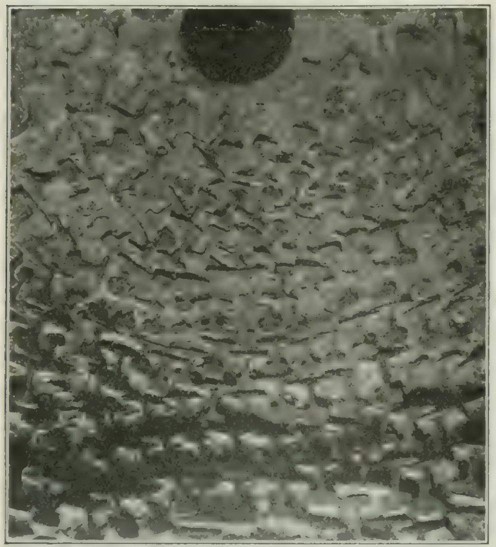


FIG. 2. RAIL AND CEMENT LINING

In connection with Fig. 2 a peculiarity appears which is well worth study and explanation. For instance, looking at this photograph in the position with the discharge trunnion at the top (as shown here), it will be seen that the cement appears to protrude from around the rail sections. If this photograph is turned upside down, one immediately notes that the rails appear to protrude out of the cement— a curious effect that is about as hard to explain as the classification of balls in the Hardinge mill.

The cost in consumption of this class of lining is less than ½c. per ton. It should be used only when small balls (2 in. and less) are the grinding media.

A Water-Tight Underground Dam

By G. C. Bateman

Written for Engineering and Mining Journal

At Cobalt, Ont., on account of so many properties being connected with one another, it is found necessary to build a number of small concrete dams or bulkheads underground in the workings. Usually dams about two feet thick can be used. Some trouble is experienced in keeping these tight, owing to shrinkage from the back and from the sides near the top. To overcome this, when we are building a bulkhead, we leave an opening in the center large enough for a man to get through. The opening is made by putting in a box open at both ends which fits tight to the form, front and back. The top of the box slopes to the back of the dam.

After the form is filled with concrete and has set for a few days, the boards in front of the opening are taken off. Then the boards at the back are knocked off. A man then goes through the opening, takes off the rest of the boards and cuts out a V-shaped section at the sides and top of the bulkhead. This is then made tight by putting in cement and sand with a trowel. To help fill in any small cracks which may later develop, some manure is put in behind the dam. If the water starts coming through, this will help plug up the openings.

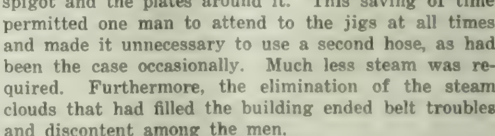
After the concrete has set firmly, the boards, which form the sides, top, and bottom of the opening, are removed and a tight cover is fitted over the back. The opening is then filled with concrete, the slope from the front to the back helping to make a perfect seal. Since we have adopted this method we have had very little trouble from the dams leaking. It is, of course, necessary to put in a pipe through the bottom of the dam of sufficient capacity to carry all the water until all the concrete has set firmly.

Thawing Device for Harz Jigs

By James T. Kemp

Written for Engineering and Mining Journal

A device which greatly simplified the work of keeping Harz jigs thawed out during cold weather is shown in the accompanying illustration. It was devised by the foreman of an eastern concentrator, who had difficulty keeping four cast-iron jigs operating during a severe cold snap when the usual abundant steam supply was cut short. The device consists of a lance of ½-in. pipe about 30 in. long bent up at the end and a T-handled stopcock fitted into the end of a steam hose. The slide of a frozen spigot was first thawed and opened by playing a small jet on the outside. Then the jet was turned on full and shoved up into the spigot opening. It quickly thawed through into the hutch. Each spigot was thawed and the concentrate drawn in less than a minute. It had previously taken three to four minutes' treatment with the open hose to thaw each spigot and the plates around it. This saving of time permitted one man to attend to the jigs at all times and made it unnecessary to use a second hose, as had been the case occasionally. Much less steam was required. Furthermore, the elimination of the steam clouds that had filled the building ended belt troubles and discontent among the men.



STEAM HOSE, FITTINGS, STOPCOCK AND ½-IN. PIPE USED IN THAWING DEVICE

A new method for evaluating zinc dust is given in *Metall u. Erz*, as follows: One gram of dust, ground to 90 mesh, is shaken with 20 c.c. of water until evenly suspended. A mixture of 20 c.c. of 10 per cent sulphuric acid and 25 c.c. of 3 per cent hydrogen peroxide is added. Let stand and stir occasionally. All except a small amount of lead sponge should be dissolved in ten minutes. Add 20 c.c. of 40 per cent sulphuric acid and titrate the excess hydrogen peroxide with permanganate (15 g. per liter) that has been standardized against sodium oxalate.

THE PETROLEUM INDUSTRY

Petroleum Investigations of the U. S. Bureau of Mines

At the petroleum experiment station at Bartlesville, Okla., of the Bureau of Mines, the field investigation on losses of crude oil by evaporation from lease storage tanks has been completed. In one producing district a thorough study of evaporation losses was made; first, under ordinary storage conditions, and, later, with the lease storage tanks equipped with gas-tight roofs. The saving due to the installation of new, up-to-date equipment amounted to from two to four barrels of oil per day for each tank covered. An investigation has been started to determine the loss of crude oil through evaporation at pipe-line measuring stations, and arrangements have been made for a series of tests on a trunk pipe line from the Cushing and Glenn Pool fields to a station at Powderly, Tex.

A field investigation of pumping equipment used in the Mid-Continent field is being made by the Bureau. Tests at the Bartlesville station on low-pressure gas burners used in oil-field boilers have been completed. Eleven low-pressure burners were tested in this investigation. Arrangements have been made to obtain additional field data on steam consumption under different drilling operations.

At the Boulder, Col., field office of the Bureau of Mines the co-operative oil-shale laboratory has been enlarged, and much new equipment has been added preparatory to more extensive work on Colorado shales. Additions to the staff at the laboratory include Douglas A. Fell, a native of New South Wales, whose father is the owner of the only producing oil-shale company in Australia. Important changes have been made in the temperature-measuring apparatus and in the drive mechanism of the horizontal retort at this station. A new location of pyrometers in the retort proper and the retort furnace is expected to indicate more accurately the temperature of the shale in the retort and also make possible more definite control of retorting conditions. During the last two years several attempts have been made to classify oil shales by chemical determinations of various sorts, but these have not been successful.

It has been suggested that the quality of oil to be obtained from a given oil shale will be most influenced by the C:H:O ratio in the organic matter of the shale. Work is now under way seeking to determine this ratio for several representative shales. The plan of work involves (1) the separation of the organic from the inorganic constituents of the shales; (2) the elementary combustion analysis of the recovered organic matter; (3) the retorting of a sample of the same shale in the assay retorts; and (4) a distillation analysis and chemical examination of the oils produced by the assay retorts. This work is now well under way, although at the start considerable difficulty was experienced in making a clean separation between the organic and inorganic parts of the shale. A method for the separation has been developed, however, that appears to be quite satisfactory.

Experiments in refining the oils produced from Colorado oil shales have been started. Various methods of procedure will be tried, and the concentration of the refining reagents changed until the most satisfactory results have been obtained. For the purpose of comparing different oil shales it has been tentatively agreed that the most satisfactory oil is that which yields the highest percentage of crude naphtha containing the lowest percentage of unsaturated hydrocarbons.

A survey of the Mexia oil field, in Texas, will be begun soon by the Dallas office of the Bureau of Mines. It is expected to define the strata in the proved area and to outline the best methods of production and conservation for this particular field.

Montana Fields Increase Production

SPECIAL CORRESPONDENCE

Bringing in a well on the Soap Creek structure, southeast of Billings, Mont., by the Box Co., showing an initial flow of 2,000 bbl., is emphasizing the importance of this new field, in which about a half dozen producers have been found. A well owned by the Western States Co., a subsidiary of the Midwest Refining Co., is reported to have production of 5,000 bbl. A pipe line will be constructed by the Midwest interests. Cat Creek field, in central Montana, continues to report increased output. The Ohio Oil Co. now has attained a depth of about 3,000 ft. in the Big Wall field, with slight oil showings.

Prospecting for Oil in Australia and Papua

SPECIAL CORRESPONDENCE

When the last mail left Australia it seemed not unlikely that the great interest that was being taken in the prospecting for oil in that country would have some practical results. It is recognized that the discovery of petroleum in commercial quantities on this big continent would be of such importance that if the commonwealth government has to pay the £50,000 which it is offering for such a discovery it will prove a remarkably good investment.

Regarding the investigations that have lately been made in the northwestern part of Western Australia, a government geologist (Mr. Blatchford) after inspecting and having analyses taken of samples from an area known as Rough Range, has come to the conclusion that the rock formation is limestone, probably overlying beds of shale and similar rocks, and is of the Carboniferous age; that, owing to earth movements, the limestone has been flexed in the apex of the range, forming a distinct anticline which has been traced along the crest of the range; that geological conditions there are favorable to the storage of mineral oil; and that mineral oil has been found in the bore sunk on the property examined. Extensive areas have been taken up under license in this State as prospecting ground.

Professor David, an Australian geologist, has spoken highly of Mr. Blatchford's work, but recommends more prospecting before expressing a definite opinion as to the value of the discovery from a commercial point of view.

Professor David also has directed attention to the fact that in Papua there exists a continuation eastward of the great oil belt (only perhaps about one-tenth as old as that of the West Australian area), which runs from Burma through Sumatra, Java, Borneo, Timor, to Dutch New Guinea and Papua. There are numerous oil-bearing springs and oil-gas wells in Papua, the strata having been folded into anticlinals and troughs, but the explorations of the geologists of the Anglo-Persian Oilfield Co. show that these arches are mostly intensely disturbed by earthquake cracks or geological faults. This repeated cracking of the rock lid, Professor David says, has allowed the oil gas to escape over large areas.

Geologists are still at work pressing eastward in the direction of the Purari River, and are confidently hoping to be able to trace the oil belt in the more settled country. According to Mr. Blachford's examination, the west Australian region is far more settled than that of Papua, and so may have advantages over the latter.

Petroleum Production Continues Decrease During October

Production of petroleum in the United States, according to the U. S. Geological Survey, continued to decrease during October. The daily average for the month, 1,149,613 bbl., was 70,887 bbl. a day less than the production for September and was the smallest for any month since February, 1920. California, as a result of the strike in the oil fields, dropped to third rank, and decreased daily average production is also reported for all the other states with the exception of Wyoming, Illinois, and Montana, where small gains are recorded. Only 752 producing oil wells are reported to have been completed during October, as compared with 2,086 wells in October a year ago. This falling off in domestic production was offset by an increase in imports of Mexican petroleum, amounting to a daily average of 373,400 bbl. Consumption also increased by 180,352 bbl. a day and was the greatest for any month of the year since January.

There was a net increase of stocks at the end of October, amounting to 884,000 bbl. An increase of 2,029,000 bbl. of Mexican petroleum held in the United States by importers is contrasted with a decrease of stocks of domestic crude oil amounting to 1,145,000 bbl., which marks the first net decrease in pipe-line and tank-farm stocks east of California since April, 1920.

The accompanying figures, compiled from company reports to the Survey, show the quantity of petroleum removed from producing properties. Oil consumed on the leases is not included. This item and net changes in producers' stocks at the beginning and end of the year are obtained by annual convass and are included in the final statistics of production.

Active Developments in Arizona

SPECIAL CORRESPONDENCE

Oil sand, lying beneath 10 ft. of blue shale, is reported to have been found at 372 ft. in a well being drilled by the Colorado Delta Oil Co., near Yuma, in the extreme southwestern corner of Arizona. The company, which is capitalized mainly at home, is sinking deeper.

In the northeastern part of the state, around Holbrook, sinking is being continued on at least two of the wells, which are fully 2,000 ft. deep and which generally have been driven through very hard formations, with occasional strata of shale, with at least one salt bed, though most of the way has been through sandstone and limestone. Dorsey Hager, of Los Angeles, has been making close examination of the ground and has been comparing the logs of several of the wells; this work in the interest of a syndicate, headed by Dr. S. Earl Taylor, that has secured drilling rights on about 250,000 acres in this field. Hager finds resemblances to Illinois and Indiana fields. The Taylor interests have brought in a drilling rig.

The newest exploration field is one that is being leased west and northwest of Douglas, in the southeastern part of the state. The leases have been taken by H. C. Buemler, who is representing a California company.

South of the border, the western parts of the Mexican states of Sonora and Sinaloa are being given geological examination for oil indications by a party led by W. P. Haynes, of New York, with him being R. P. Walters, of Oklahoma; L. Gibson, and Fred Ely.

PETROLEUM PRODUCED IN THE UNITED STATES IN SEPTEMBER, 1921, OCTOBER, 1921, AND OCTOBER, 1920

Barrels of 42 U. S. Gallons

State	September, 1921 (a)		October, 1921		October, 1920	
	Total	Daily Average	Total	Daily Average	Total	Daily Average
Oklahoma	9,790,000	326,333	9,716,000	313,419	9,437,000	304,419
Central and Northern Texas	4,710,000	157,000	4,833,000	155,903	6,659,000	214,806
Coastal Texas	2,796,000	93,200	2,730,000	88,065	2,619,000	84,484
California (b)	7,894,000	263,133	7,065,000	227,903	9,459,000	305,129
Kansas	3,005,000	100,167	2,825,000	91,129	3,269,000	105,452
Northern Louisiana	1,859,000	61,966	1,846,000	59,548	2,511,000	81,000
Coastal Louisiana	128,000	4,267	124,000	4,000	150,000	4,839
Wyoming						
Salt Creek	826,000	27,534	959,000	30,935	987,000	31,839
Big Muddy	136,000	4,533	141,000	4,548	179,000	5,774
Rock Creek	106,000	3,533	110,000	3,548	168,000	5,420
Grass Creek	93,000	3,100	99,000	3,194	164,000	5,290
Elk Basin	47,000	1,567	49,000	1,581	76,000	2,452
Other districts	156,000	5,200	124,000	4,000	102,000	3,290
Total Wyoming	1,364,000	45,467	1,482,000	47,806	1,676,000	54,065
Arkansas	(c) 1,400,000	46,667	(c) 1,300,000	41,936	..	..
Illinois	806,000	26,867	890,000	28,710	872,000	28,129
Kentucky	729,900	24,330	716,400	23,110	759,700	24,506
West Virginia	613,000	20,433	628,000	20,258	673,000	21,710
Pennsylvania	602,000	20,067	580,000	18,710	646,000	20,839
Central and Eastern Ohio	417,000	13,900	405,000	13,064	446,000	14,387
Northwestern Ohio	172,000	5,733	166,000	5,355	182,000	5,871
Montana	137,000	4,567	153,000	4,936	56,000	1,806
Southwestern Indiana	73,000	2,433	70,000	2,258	61,000	1,968
Northeastern Indiana	21,000	700	22,000	710	24,000	774
New York	88,000	2,933	77,000	2,484	82,000	2,645
Colorado	9,000	300	9,000	290	9,000	290
Tennessee	1,100	37	600	19	1,300	42
Totals	36,615,000	1,220,500	35,638,000	1,149,613	39,592,000	1,277,161

(a) Revised. (b) Average of figures reported by Standard Oil Co. and Independent Oil Producers' Agency. (c) Estimated in part.

Technical Papers

Underground Loading—The use of scrapers underground is described in a five-page article by Lucien Eaton in the Nov. 19 issue of the *Mining and Scientific Press*, (San Francisco; price 15c.). Some recent types are illustrated and the field of application is mentioned.

Potash—A description of the alunite deposits of the United States was published in the *Compressed Air Magazine* for October (New York, N. Y.; price 35c.) and in the November issue is a six-page article describing the present condition and the future prospects of the Alsatian mines.

Mining in Tasmania—The annual report of the Acting Secretary for Mines, for 1920, a book of 105 pages, is now available for 1s. 6d. from the Secretary for Mines, Mines Department, Hobart, Tasmania. The principal products were copper and tin. The Mount Lyell Mining & Railway Co., Ltd., produced 4,836 long tons of blister copper.

Round Mountain, Nevada—Bulletin 725-I of the U. S. Geological Survey describes the geology and ore deposits of the Round Mountain district in Nevada. The Round Mountain Mining Co. is the dominant producer of the district. Gold and silver is obtained from both lode and placer deposits, and during the war tungsten ore (huebnerite) was mined, and worked with dry-washing machines.

Phosphates—A monograph on "Phosphates" is the latest to be issued by the Imperial Mineral Resources Bureau. It is a bulletin of seventy-two pages, and may be obtained for 2s. 1½d. from H. M. Stationery Office, Imperial House, Kingsway, London, W.C. 2, England. Data on deposits, production, and consumption, prices and technologic methods throughout the world are given. The United States is by far the largest producer.

New Mexican Tin—"The Taylor Creek Tin Deposits, New Mexico," are described in U. S. Geological Survey Bulletin No. 725-G, thirteen pages, obtainable on application. It is generally considered that the United States has no tin deposits of commercial importance, and there is nothing in this report to make one think otherwise. Stream tin has been found in the gravels of Taylor, Squaw, and Hardcastle creeks, and cassiterite, with specular hematite, occurs in veinlets in soft altered rhyolite at several places in the Taylor Creek district.

Mineral Resources—Recent publications of the U. S. Geological Survey in the "Mineral Resources" series include "Gold, Silver, Copper, and Lead in South Dakota and Wyoming in 1920," nine pages; "Secondary Metals in 1920," fifteen pages; "Cobalt, Molybdenum, Nickel, Tantalum, Titanium, Tungsten, Radium, Uranium, and Vanadium in 1919," sixteen pages; "Gold, Silver, Copper, Lead and Zinc in New Mexico and Texas in 1919," eighteen pages; "Silver, Copper, Lead, and Zinc in the Central States in 1920," forty-one pages; and "Artificial Gas and Byproducts in 1917-18," sixty-one pages. Any of these may be obtained on application to the Survey at Washington, D. C.

Properties of Slate—"Tests of Physical and Electrical Properties of Slate," thirty-four pages, has been published by the Fritz Engineering Laboratory, Lehigh University, Bethlehem, Pa. Details and mean results of physical tests are given in tabular form. Tests of material from the "soft vein" of Pennsylvania indicate that a slate quarried three months has about twice as great resistance in ohms as freshly quarried slate. When slate was tested on a 110-volt line between two metal surfaces of opposite polarity spaced one inch apart, a resistance of 400,000 ohms was found to be a safe working value for switchboard use. The factor of safety for the slate tested was from four to nine, depending upon the length of time it had been quarried.

Mining in Alaska—"The Alaskan Mining Industry in 1920" is the title of Bulletin 722-A, just issued by the U. S. Geological Survey, Washington, D. C., obtainable upon request. This volume, of seventy-four pages, is the seventeenth of a series of annual bulletins summarizing the results achieved during the year in the investigation of the mineral resources of Alaska, and treating especially of the statistics of mineral production. The value of the mineral production in 1920 was $23,303,757, which was slightly more than in 1919 but only about half of the record figures of 1916 and 1917. The increase over the preceding year is to be credited chiefly to the four leading copper mines of the territory. The output of the gold placers decreased, but that of the gold lode mines was maintained.

Superpower Survey—The report of the Superpower Survey for the region between Boston and Washington has been issued by the U. S. Geological Survey as Professional Paper 123. The book is a volume of 261 pages, amply illustrated by maps and charts. It may be obtained on request. The idea behind this project is that the vast amount of electrical energy required in this territory can be better supplied by a few generating stations of extremely large capacity than by the hundreds of small plants now in use. The estimated requirement for energy supplied through the electrical systems for municipal, private, industrial, and railroad purposes in 1930 is [illegible],000,000,000 [illegible]. This energy could be supplied by a co-ordinated power system such as is described in this report at an estimated annual cost of $[illegible],000,000 less than by the system now in use, which is not co-ordinated.

Microscopic Mineral Determination—"The Microscopic Determination of the Nonopaque Minerals," a book of [illegible] pages, has recently been published as Bulletin 679 by the U. S. Geological Survey, Washington, D. C. (obtainable on request from the Survey). Optical methods of determining minerals with the petrographic microscope have long been used and have been carried to a high state of development in studies of the minerals in thin sections of rocks and ores; yet out of about 1,000 mineral species, comparatively few can be identified readily in thin sections. A mineral whose optical properties are known can be accurately and quickly identified, however, by the immersion method, that is, by immersing its powder in liquid media whose indices of refraction are known, and determining its optical constants. In this bulletin the author gives a set of tables for the systematic determination of minerals from their optical constants, describes briefly some methods for the rapid determination of optical constants, gives the results of measurements of the optical constants of more than 500 species for which data were not previously available, and presents statistics on the optical properties of minerals. The methods discussed in this book should prove valuable in other fields than mineralogy. Metallurgists with concentration problems to solve, especially flotation, and those engaged in a study of smelter byproducts will find the book of interest. The use of the microscope should be extended. The author is Esper S. Larsen, and the bulletin shows the result of much painstaking labor. It should find a place in the libraries of all mining engineers interested in experimental work.

Book Reviews

The Mineral Industry During 1920. Edited by G. A. Roush. Cloth; 7 x 9½; pp. 907. McGraw-Hill Book Co., New York. Price, $10.

The latest volume of this well-known book has just been received. To those who are not familiar with it we can do no better than quote from the preface: "The object in the compilation of the annual volumes of 'The Mineral Industry' is to bring together, in as short a time as possible after the close of the year, a review of the progress during the year in the mining and metallurgical industries. While production figures are a necessary part of and record of the industry, they are not the real meat. [illegible] the skeleton around which the discussion of the general conditions in any particular phase of the industry is arranged. [illegible] with such extracts from the current literature as have a bearing on the subject in hand, and [illegible] conditions to show the [illegible] of the industry, [illegible] a well rounded review of general progress."

All the important minerals and metals are covered in the customarily satisfactory manner.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

New York Section of the Mining and Metallurgical Society Discusses Foreign and Domestic Mining Policy

The New York Section of the Mining and Metallurgical Society of America met on the evening of Nov. 22, at the Harvard Club. After the usual dinner, C. M. Weld, the chairman, introduced the subject of the evening, the report of the society's committee on foreign and domestic mineral policy, and called upon J. E. Spurr to present the first discussion. Mr. Spurr's address follows in part:

"The report of this committee is one of maximum importance. We need now, more acutely than ever before in the world's history, to get down to a fundamental basis of hard fact on which to build our policies and actions. We need it for our personal course of action, and for that of our government much more.

"Now, engineers and geologists have some obvious though fundamental truths to sell to the public—and not only to the public, but to the influential men of the world, and even in the first place to all members of this and other geological, engineering and other scientific and technical societies—for the significance is not yet clearly grasped. The first is that the metal and mineral supplies of the world are limited, calculable, and measurable, and, with the recent enormous acceleration of consumption, will be exhausted in a limited lapse of time, susceptible of calculation and prognostication. Moreover, if the curve of consumption increases, that the exhaustion will come about sooner than our present figures, startling though they are, will indicate. That the existing metallic supplies are all that mankind will ever have for all time—unlike wheat, rubber, hides or even lumber, the production, once used, can never be renewed. There is no second crop.

"Now, civilization will either fall at the present crisis, as Mr. Wells apprehends, or it will recover itself, and proceed with its amazing industrial and social progress and evolution. The latter is likely, and when the consumption of metals per capita in some of the more backward countries shall have reached the figure of the consumption in the United States, what about the supplies? I have had many inquiries as to whether I thought that mining would ever be active again, and whether there would ever again be a brisk demand for metals. I think that the owners of ore deposits may safely take heart as to the future of mining. It requires only a common or garden prophet to foresee that the ore mineral crop will be carefully reaped, and that the gleaners will go over the field many, many times in search of the last grains.

"Again, of our major minerals we have had recently a number of quantitative estimates of our petroleum reserves, very valuable and brilliant, and unquestionably accurate enough for practical purposes. These go to show that while we have coal and iron for a century or more, we shall probably exhaust our petroleum in anywhere from ten to thirty years. The cheerful-as-usual optimist (which is as much as to say the cheerful idiot), the bull on the United States, especially the petroleum producer, who wants a tariff on foreign petroleum, assures the public that this is all scientific rubbish, just as the chromite producers of California assured Congress that that state's supplies were inexhaustible. When I consider those people who are unable to comprehend that when we have spent the metals in our subterranean treasury, the treasury will be empty, and that in many departments the treasury is very limited, I should like to take them to the old abandoned chrome mines of Maryland. I should like to remind them of the time—over half a century ago—when Maryland was the chief chrome-producing region of the world; yet during the war various operators tried to revive these mines even at war prices for the ore at the door of the markets—but all in vain."

Dr. H. Foster Bain commended the report of the committee. He spoke of how the United States had been caught napping during the war and the growth of international distrust kept alive by the desire to make each country economically independent. He dwelt upon the necessity that the flow of minerals in international trade should be free—and pointed out the sufficiency of the United States in copper and coal, and of Canada in nickel. Engineers should find the facts, and action should be taken in accordance with these facts.

F. M. Feiker, of the U. S. Department of Commerce, discussed the interdependence of industry, both domestic and international. In his judgment, it has become necessary to think in terms of the merchandising problem. He believes that we do not know enough of collective efficiency and that we spend more time on production than on marketing. He said that we must study sources, quantities, markets and merchandising methods and that as a nation we must stop drifting and evolve a national program.

J. J. Broderick, commercial counselor of the British Embassy at Washington, was the next speaker. Unofficially, Mr. Broderick in a direct and entertaining way discussed the association of the British government with the Anglo-Persian Oil Co., and he said that, in his opinion, this association did not have any special significance to the petroleum business. He asked that the facts be ascertained before conclusions are drawn. He saw much to commend in the work of the committee, and expressed the belief that its report contained the nucleus of a satisfactory method for international understanding.

Dr. A. R. Ledoux discussed the ethical value of the report and pointed out the growing importance of the foreign sources of ore supply in relation to the metal refineries along the Atlantic seaboard.

E. F. Gay, of the *New York Evening Post*, pointed out the importance of the committee's report, and then discussed the potency of international co-operation. He advocated the getting together of the Mining and Metallurgical Society with a similar organization in Great Britain and the frank discussion of international questions in an unofficial way.

J. Morgan Clements, H. H. Knox, A. C. Veatch, Samuel H. Dolbear, H. W. Smith, and Alfred H. Cowles joined in the discussion.

Accidents in Metal Mines During 1920 Show Reduction

Accidents in 1920 at mines producing gold, silver, and miscellaneous metals caused the death of 117 men and the injury of 5,704, according to reports received by the U. S. Bureau of Mines from operating companies throughout the country. Reports from 2,358 mine operators show that 29,933 employees worked 8,354,830 shifts, an average of 279 working days per man. This group of mines includes all metal mines except those producing copper and iron and those in the Mississippi Valley states producing lead and zinc.

The figures show a reduction, as compared with the previous year, of 72 operating companies, 2,197 employees, 222,265 shifts, and 9 fatalities. There was a gain of 12 working days per man, and an increase of 235 in the number of men injured (an injury signifying disability for more than one day). The accident rates for 1920, based upon a standard of 300 working days to the year, were 4.20 killed and 204.82 injured per 1,000 employees, as against 4.41 killed and 191.29 injured in 1919.

States having the highest fatality rates for each thousand employees were New York (22.73), Washington (12.30), Utah (6.29), California (5.83), Colorado (5.35) and Arizona (5.34). Those having the lowest fatality rates were New Mexico (1.34), South Dakota (2.86), Idaho (3.02), Alaska (3.31), Nevada (3.58), and Montana (3.77).

The highest non-fatal injury rates were 316.8 for Utah; 298.0, Idaho; 275.4, California; 266.7, South Dakota; 242.4, New York; 196.6, Montana; 157.7, Colorado; 134.4, Arizona, and 124.0, Nevada. States apparently having the lowest injury rates are not shown, because the abnormally low rates are believed to be due to the absence of state laws compelling mine operators to furnish complete reports to state officials.

Of the 117 fatal accidents, 81 occurred in underground mine work, 19 in shafts, 2 at open-pit workings, and [illegible] at surface shops and yards. The non-fatal injuries were segregated as follows: There were 1,602 underground, 192 in shafts, 75 at open-pit mines, and 835 at surface shops and yards.

The principal causes of non-fatal accidents underground were: Fall of rock from roof or wall, 990; loading at working face, 575; timber or hand tools, 524; haulage, 522; drilling, 474; falling down chute, winze, and other working places, 220; stepping on nails, 151; run of ore from chute or pocket, 115, and explosives, 99. Of the shaft accidents, 59 were caused by cages and skips, 57 by objects falling down shafts, and 18 by persons falling down shafts. Accidents at open pits were due to the following causes: Falls or slides of rock, 13; hand tools, 11; haulage, 9; falls of persons, 6; and by steam shovels, 5. At surface yards and shops the principal causes of accidents were: Hand tools, 131; machinery, 99; mine cars, 98; falls of persons, 95; stepping on nails, 52, and railway cars, 17.

Alta and Cottonwood Districts Outlined at Commercial Club Meeting

At a meeting of the mining committee of the Salt Lake Commercial Club on Nov. 19, J. J. Beeson gave an outline of the geology of the Alta and Cottonwood districts, pointing out that the most important horizons in these districts awaiting development were those in which overthrust contacts existed, which are intensely brecciated zones affording excellent opportunity for replacement by mineralizing solutions. The large orebodies of the Cardiff, the old Columbus Consolidated and the Columbus-Rexall occur along these contacts.

Salt Lake representatives of R. G. Dun & Co. and of the Bradstreet company, George Rust and E. C. Mitchell, explained how reports on mining engineers and mining companies were made by their respective organizations.

Engineers' License Suggested in Utah

The question of licensing and regulating engineers in Utah has been recommended by the Ogden chapter of the American Association of Engineers in a report made by its legislative committee. The report, among other things, says: "Engineers in Utah intend to apply to the state for laws to regulate and protect engineering practice in the state. To a large extent Utah is dependent upon engineering work for development and prosperity, and anything which raises the standard of practice is for the public good. A license and registration law is a means to this end, and endeavors will be made to secure the enactment of such legislation. Twenty-one states now have such laws, and the number will be increased. Action in this matter has been indorsed by the American Association of Engineers, and the question will be submitted to the Engineering Council of Utah."

MEN YOU SHOULD KNOW ABOUT

F. W. Denton was in New York last week.

E. B. Latham, of Los Angeles, was recently in San Francisco.

Frank M. Estes has gone to Honduras to examine mining properties.

John V. Richards, of Portland, Ore., is at Long Beach, Cal., for the winter.

J. B. Tyrrell, of Toronto, has returned from a visit to British Columbia.

Paul A. Gow, general manager of the Tuolumne Copper Mining Co., is in Boston.

Jesse T. Boyd has been appointed consulting engineer to the Silver Mines Co. of America.

Arthur V. Corry is examining mining property near Butte, Mont., for New York clients.

W. W. Avery, geologist of the United Comstock Mines of Gold Hill, Nev., was recently in San Francisco.

Kirby Thomas has returned to New York from Gowganda, Ont., and Quebec, where he has been examining mines.

Thomas B. Crowe has resigned as superintendent of the Portland Mill, at Victor, Col., and will go to California.

John C. Febles has been appointed general superintendent of the Boston & Montana Development Co., at Wise River, Mont.

Charles D. Kaeding, consulting engineer for the Simon Silver Lead Mines Co. and other properties in Nevada, is in Reno on professional business.

Charles Rees is inspecting iron ore deposits twenty miles northwest of the Balsas River, in Michoacan, Mexico, for the Midvale Steel & Ordnance Co.

Captain William Wearne, general superintendent of the iron ore mines of Inland Steel Co., recently left for San Diego, Cal., where he will spend the winter.

F. J. Siebert, formerly with the Goldfield Consolidated Mining Co., succeeded A. L. Chappell on Nov. 20 as manager for the Standard Metals Co. at Peavine, Nev.

Michigan College of Mines has announced the conferring of degrees for the year 1921. Nineteen men received both degrees as Bachelor of Science and Engineer of Mines.

B. L. Johnson, in charge of the foreign minerals section of the U. S. Geological Survey, has been appointed a member of the Federal Interdepartmental Helium Committee.

R. J. Hutchins, assistant manager of the Phelps Dodge Corporation, Burro Mountain Branch, has returned to Tyrone, N. M., to resume his duties after a vacation in California.

Lloyd Ruby, who for the last three years has been manager for the Colorado Mining Co., at Aroroy, Sorsogon, Philippines, is looking over the Lordsburg, N. M., mining district.

E. L. Bruce, professor of the department of mineralogy in Queen's University, Kingston, Ont., has declined the position of Commissioner of Northern Manitoba, offered him by the government of the province.

Captain Frank Kent, vice-president and general manager of the Chandler Mining Co., has returned to Ely, Minn., from a four months' European trip. He will leave about Jan. 1 for his winter home in San Fernando, Cal.

Tate Siebenthal, formerly assistant superintendent of the Gordon Mining Co. at Crosby, Minn., will leave soon for Rio Janeiro, Brazil, where he will have charge of extensive steam-shovel and hydraulic stripping operations for the Schlesinger interests.

Dr. Ernest Fox Nichols has resigned the presidency of the Massachusetts Institute of Technology and his resignation has been accepted by the executive committee of the corporation. His decision resulted from "certain physical limitations, some of them probably permanent," which his physicians said would make it unwise for him to continue. **Dr. Elihu Thomson**, of Swampscott, chief consulting engineer of the General Electric Co., has been appointed to the position. The educational affairs of the institute will continue to be directed by a faculty administrative committee consisting of Acting **Dean Henry P. Talbot** and Professors **Edward F. Miller** and **Edwin B. Wilson**.

Mining and metallurgical engineers visiting New York last week included: **G. A. Swanquist**, Salvador, C. A.; **G. J. Kennedy**, Easton, Pa.; **H. W. Gillett**, Ithaca, N. Y.; **E. B. Holt**, Columbus, Ohio; **C. T. Van Winkle**, Salt Lake City, Utah; **K. H. Donaldson**, Cleveland, Ohio; and **K. Yashizawa**, Tokio, Japan.

SOCIETY MEETINGS ANNOUNCED

The New York Section, A. I. M. E., will hold its regular monthly meeting at the Machinery Club, 50 Church St., on Dec. 7, preceded by the usual informal dinner. C. F. Kelley, president of the Anaconda Mining Co., and Thomas H. Watkins, president of the Pennsylvania Coal & Coke Corporation, will talk on the subject: "What Can Be Done To Revive the Mining Industry?"

OBITUARY

J. F. H[illegible], mining engineer of Asheville, [illegible] on Nov. 11. He was [illegible] interested in the development of [illegible] and other [illegible] in western North Carolina.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

The Day-Smith injunction suit against the Hecla and Bunker Hill & Sullivan companies, involving the Star mine, recently came to trial in Spokane but was adjourned by request until January because of the illness of the trial judge.

Arizona business men have decided to come together this month at Phoenix in what will be the first Arizona Industrial Conference, to discuss the pressing problems confronting the various industries of the state.

The new mill of the Simon Silver-Lead Mines Co., at Simon, Nev., has been started on a test run on low-grade ore.

Further extension of the time for doing assessment work on soldiers' claims will be refused, the Ontario Government has announced.

A smallpox epidemic is feared in the Joplin-Miami district and efforts are being made to avert it. One case has been reported thus far at Picher, Okla.

East Butte has decided to continue its smelting operations on concentrates in storage. Davis Daly remains shut down.

The strike at the coal mines of the Colorado Fuel & Iron Co. is reported to have failed. It is half promised that the reduced wage scale now effective will result in cheaper coal for the metal mining and steel making industries, among others, in the state.

It is reported that Michigan copper producers are not keenly desirous of engaging in the manufacture of copper products.

A new wage scale has become effective in the Grass Valley district of California, where operating conditions are said to be improved.

Two important bills have recently been signed, the Tax Revenue bill and the War Minerals Relief measure. The latter was finally amended so as to make reappropriation of the balance of the War Minerals fund unnecessary.

Arizona's Industrial Problems To Be Discussed

Conference Approved by Hoover To Be Held at Phoenix, Dec. 15-16 —Call Sent Out

Business men of Arizona have decided to get together at Phoenix on Dec. 15 and 16 and talk over the most pressing industrial problems confronting them. A state-wide call for this the first session of the Arizona State Industrial Conference has been indorsed by seventy-two representative men from all branches of industry. The topics for discussion thus far suggested include: water power and reclamation, freight rates, taxation, marketing, encouragement of manufacturing, colonization and economy in government. Mr. Hoover, the Secretary of Commerce, has approved of the proposal.

The idea of the conference was born a few weeks ago at a small meeting of business men, when P. G. Spilsbury, of Phoenix, suggested that possibly coöperation and a study of the problems from the viewpoint that they were problems of the state would be of benefit to all. Mr. Spilsbury was urged to follow the matter to a definite conclusion. Finding the project was widely approved, he got together a committee and worked out the details for the proposed conference.

Among the mining men indorsing the proposal are: Louis D. Ricketts, P. G. Beckett, Grant H. Dowell, John C. Greenway, Julius Kruttschnitt, Jr., Robert E. Tally, R. W. Moore, W. S. Boyd, and Cleve Van Dyke.

French Asked To Exploit Anatolian Mines

By Reuters Agency

Paris, Nov. 2—Youssouf Keman Bey, Foreign Minister of the Angora Government, has addressed a communication to the former French Minister, M. Franklin-Bouillon, the tenor of which is as follows:

The Angora Government has authorized the foreign minister to declare that it is disposed to grant a concession for the iron, chrome and silver mines in the Harchite valley for a period of 99 years to a French group which would be bound to commence the exploitation of the concession within five years from the signing of the agreement through a company formed in accordance with Turkish laws and with the participation of Turkish capital to the extent of 50 per cent.

The government, moreover, is ready to examine other requests which might be made by French groups regarding mining, railway, port and fluvial concessions, on condition that such demands are in accordance with the mutual interests of the two countries.

Turkey also wishes to avail herself of the collaboration of French specialists in her professional schools.

Gogebic Range Mines Increase Working Schedule

The Oliver Iron Mining Co., the iron mining subsidiary of the U. S. Steel Corporation, began Dec. 1 to work six days per week, instead of four days, at its properties on the Gogebic Range in northern Michigan.

Day-Smith Suit Adjourned After Brief Hearing

Illness of Presiding Judge Causes Postponement of Action Over Star Mine

By Hilliard W. Power

The hearing in the injunction suit brought by Eugene R. Day and Mrs. Sarah E. Smith, minority stockholders in the Hecla Mining Co., to prevent the Hecla and the Bunker Hill & Sullivan companies from joining to operate the Star mine, began in the Spokane County Superior Court Nov. 21. President McCarthy, of the Hecla, was on the witness stand for nearly two days and other evidence had been taken when Judge Huenke, presiding, became ill. Defendants thereupon insisted upon postponement rather than to continue under another judge. Postponement to Jan. 16 was agreed upon.

Mining men and engineers were much in evidence in the court on Nov. 21 when the hearing began. A strong array of legal luminaries appeared on both sides, including Post, Russell & Higgins, of Spokane, representing the Bunker Hill; W. H. Plummer, of Spokane, and John W. Wourms, of Wallace, for the plaintiffs. The defendants were represented by John P. Gray and Judge Turner; and the firms of Nuzum & Nuzum and Wakefield & Witherspoon, of Spokane.

Decision as to jurisdiction of Spokane county courts in the case was reached but recently, when it was held by Judge Huenke that service in the case of Bunker Hill could be made upon Frank B. Smith, director of the

Bunker Hill & Sullivan smelter, who resides in and maintains offices in Spokane as smelter director and representative of the Bunker Hill company.

The first witness called was L. E. Hanley, secretary for the Hecla company, who was followed by Carl Landsee, of Milwaukee, a director of the Hecla and a large stockholder. On Nov. 22, President McCarthy, of the Hecla, was on the stand and was subjected to an extended cross-examination by Attorney Plummer.

Attorneys on both sides were warming up to their work in good style by the first part of the week, with promise of brilliant legal repartee, when experts later were summoned to give evidence along more technical lines.

"Even if, as the plaintiffs hold, they had not an opportunity to present their case to the stockholders before the Aug. 18 meeting, yet since that time they have been sending circulars to the stockholders and should have had ample time to gain the proxies for a majority of the stock," was the argument of Attorney Gray in outlining his case. "It looks as though the stockholders had little confidence in the plaintiffs."

Attorney Plummer maintained that the Bunker Hill backed the Star litigation against the Federal Mining & Smelting Co., charging trespass through Morning mine workings, because the Bunker Hill smelter wanted to get the tonnage from the Star. It was further charged that Mr. McCarthy, as president of the Hecla, had obtained control and "elected the directors he wanted." It was held the loss to the Hecla company on the handling of the Star ore would amount to $2 per ton, with a substantial profit to the Bunker Hill smelter, which was anxious to get the tonnage.

New York & Honduras Rosario To Recover Gradually

The New York & Honduras Rosario Mining Co., which recently resumed operations at its mines at San Juancito, Honduras, states that it will probably be the end of the year before its operations reach a normal basis. It will take some time to get the plant ready for active work and to gather the necessary labor, which was scattered at the time operations were discontinued. Work will be continued on the same scale as formerly.

Ontario Refuses Further Time for Soldiers' Assessment Work

The Ontario government has announced that no further time extensions will be granted for the doing of assessment work on soldiers' claims. There have been several postponements of working time on these claims during the war and after the Armistice in order to help the soldier to retain his property. Though this has resulted in helping the soldiers it has also tied up a lot of ground from development, and the government has decided that, to clear the whole situation, no further extensions will be granted.

Simon Silver-Lead Mill Started

Plant Being Tried Out at Part Capacity and on Low-Grade Ore

Electric power was turned on at the Simon Silver-Lead Mines Co.'s mill, at Mina, Nev., on Nov. 15. The mill will operate for the present at part capacity and on low-grade material, to give the entire plant a thorough try-out and eliminate possible mechanical troubles. The mill is designed to have 250 tons' daily capacity, and uses a selective flotation process, making two concentrates, silver-lead and silver-zinc.

The mine is opened by a shaft and tunnel. The shaft is vertical to 230 ft., then an incline on the vein, with levels at the tunnel and at 130, 230, 300, 400, and 600 ft. Ore pockets are used on all main levels. The ore is a carbonate to about 200 ft. and sulphide below. Carefully prepared reports give ore reserve estimates as 600,000 tons, which will yield a net profit of about $7 per ton. Considering the strength and persistence of the outcrop, and of the vein where developed underground, and the comparatively meagre amount of development work done to date, the future of the property as a producer appears good, with some possibility that the mill capacity will soon be increased.

Investigating Bauxite Deposits in Australia

By Special Correspondent

Various deposits of bauxite in Australia are being investigated. The best of these show alumina contents equal to the American standard, but special attention is being devoted to ore from Wingello, near Moss Vale, in New South Wales. This ore carries a recoverable alumina content of about 35 per cent. This is not considered attractive, but if a treatment could be devised for employing the iron oxide in the deposit (about 40 per cent), aluminum manufacture would become a paying proposition. Efforts are being made to interest some of the steel companies in the matter. The quantity of easily accessible ore in sight is set down at about 4,000,000 tons. The only deposit at present being worked is one at Marracan, in Gippsland, Victoria, where the Sulphite Company of Victoria is carrying on operations.

Pump Readily Started After 17 Years' Submergence

In the course of reopening the old silver mines of Hecla, Beaverhead county, Mont. the Cleave shaft is being unwatered. Recently the station pump was reached, cleaned and started after having been submerged for seventeen years.

The pump, a Smith-Vaile, was well greased and protected when suspension took place in 1904 and had been in service for a year up to that time.

When cleaned up and steam turned on it started off without difficulty and is pumping against a 600-ft. head through the incline shaft, using steam at 80 lb. boiler pressure, as though it had been shut down over night only.

Butte & Superior Co. Owes $11,904,913, Minerals Separation Claims

Hearings on Accounting Adjourned in New York—To Be Resumed in February

The opening of the accounting proceedings for the determination of the amount of damages which have accrued through the infringement in the milling operations of the Butte & Superior Mining Co. during those periods in which infringement has been found by the courts to have taken place was held in New York at the rooms of the New York County Lawyers' Association, Nov. 3 to 16.

Minerals Separation accepted without dispute the Butte & Superior company's statement as to these periods of infringement. Then, taking Butte & Superior's account of results, Minerals Separation introduced evidence to show that the only standard of comparison by which to measure the recovery to which Butte & Superior was entitled was water-gravity concentration. Minerals Separation introduced evidence tending to show that this method would have given, at best, a recovery of 65 per cent of the zinc, and a grade of 48 per cent zinc.

Comparing the results upon this basis with those which had been obtained with Minerals Separation process, over the period 1913 to 1919, Minerals Separation presented a claim showing that the profits, gains, and advantages resulting from the infringing operations amounted to $11,904,913.95.

Minerals Separation also introduced evidence to show that the only features contributing to the defendant's results, during this period, were those involved in patents No. 835,120 and the "Soluble Frothing Agent Patent," No. 962,678, and that although both patents contributed to the result, these contributions were so merged as to make it impossible to apportion to the respective patents the share to which each was entitled.

On this basis the plaintiff closed its *prima facie* case, and an adjournment was taken until Feb. 14, 1922, when hearings will be resumed in New York.

On Aug. 12, 1921, Judge [illegible] handed down an opinion bearing upon this question of the standard of comparison (*E. & M. J.*, Aug. 27, page 349), in which he states the law to be that any process in use by the defendant, as a standard of comparison, which was in existence at the time of the infringement. Minerals Separation in the motion upon which this decision was announced had contended that the defendant could be held to a process known at the time of the discovery of the process infringed. Should the results by [illegible] in excess of 1 per cent, which the Supreme Court has declared to be outside the patent, be set up and adopted by the court as the standard of comparison, it is said that there would be due to Minerals Separation only a small fraction of the sum claimed.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Tax Revision Bill Gets Harding's Signature

Receipts Under It During First Fiscal Year To Be $725,000,000 Less Than Under Present Law

Though the tax bill is admitted by its authors to be an imperfect measure, it does provide for a substantial reduction in the tax burden and greatly simplifies the administration of the law. The bill in its final form will require the payment of about $725,000,000 less during the first fiscal year that it is in full operation, than would have been raised had the law it supersedes remained in effect. The reduction will be greater when collections from the excess-profits tax cease altogether. The bill was signed Nov. 23.

The repeal of the transportation and so-called nuisance taxes effects a reduction of $326,630,266 during the fiscal year beginning July 1, 1921. That feature of the bill alone is held by many to justify its enactment. It was stated officially at the White House and by the chairman of the Finance Committee that the bill is intended as a temporary measure only. The great disappointment to business is that the recommendations of the Secretary of the Treasury were not carried into effect in the matter of transferring some of the higher brackets of the income tax to the estate tax title.

In its final form the bill is expected to yield $3,216,100,000 in the fiscal year beginning July 1, 1922, and $2,611,100,000 in the fiscal year beginning July 1, 1923. For the fiscal year of 1922, the bill is expected to raise about $16,000,000 over Government requirements.

The Senate accepted the House rate of 12½ per cent applicable to the corporation income tax. This reduction of 2½ per cent from the rate proposed by the Senate will reduce by $110,000,000 the annual tax burden on business. The lower rate is particularly advantageous to public-utility companies and other corporations now earning small returns on invested capital.

Nothing in Plan To Consolidate Government Science

Through the publication in the *Congressional Record* of a plan by Arthur McDonald, of Washington, to consolidate Government science in the Smithsonian Institution, wide circulation has been given to a scheme which is not taken seriously in Washington and which does not have the indorsement of the Smithsonian Institution. Dr. Charles D. Wolcott, secretary of the Smithsonian Institution, states that the plan was drawn up and circulated without his knowledge. He is opposed to the scheme himself, but sees no reason why publication should not be made of the suggestion, so that those concerned could accept it for what it might be worth.

As a result of the publication of this plan, the various scientific bureaus and the Smithsonian Institution have received a flood of comment.

Part 2 of Commercial Atlas Ready Soon

Second Section of Survey Publication Will Show Distribution of World's Water-Power Resources

Important work is being done by the U. S. Geological Survey in estimating the extent of natural resources of various types. In that connection, Director George Otis Smith has made the following statement to the Washington correspondent of *Engineering and Mining Journal:*

"The Geological Survey will be very much pleased if those interested in the development of American resources give the same welcome to Part 2 of the Commercial Atlas of the World as was accorded to Part 1. Part 2 is on the press and probably will be ready by Jan. 1. This part shows the distribution of both the developed and undeveloped water-power resources of the world.

"At first thought, this type of information may not seem to be connected with mineral resources, but there are two points of direct contact between water power and the mineral industry. First of all, water power has a large stimulating influence in the development of mines the world over. In the second place, water power has been regarded generally as a competitor of the mineral fuels, although most intensive studies of the subject, like the recent super-power investigation, show that water power and steam power can be developed most economically when hitched up together. This graphic presentation of the water-power resources of the world, I believe, will be interesting equally to mining men and to mechanical engineers.

"The present plans of the Geological Survey provide for a Part 3 to be devoted to the reserves of the mineral fuels. This will be followed by another part dealing with the principal metals."

Ferromanganese Men Cleared

Charges of unfair competition against Crocker Bros., Frank Samuel, and C. W. Leavitt & Co., importers of ferromanganese, have been dismissed by the Federal Trade Commission for failure of proof.

War Minerals Relief Bill Signed By President

Last Minute Amendment Makes Reappropriation of Funds To Meet Awards Unnecessary

Without the necessity of a rollcall, the House of Representatives on Nov. 22 agreed to a Senate amendment to the War Minerals Relief bill which removed the necessity of reappropriating the remainder of the War Minerals fund for the payment of additional awards. The bill was signed by the President on the following day, thus becoming a law. This measure is in the nature of an amendment to the original War Minerals Relief Act. It reads as follows:

"Add to the first paragraph of Section 5, the following proviso: 'Provided, That all claimants who in response to any personal, written, or published request, demand, solicitation, or appeal from any of the Government agencies mentioned in said act, in good faith expended money in producing or preparing to produce any of the ores or minerals named therein, and have heretofore mailed or filed their claims or notice in writing thereof within the time and in the manner prescribed by said act, if the proof in support of said claim clearly shows them to be based upon action taken in response to such request, demand, solicitation, or appeal, shall be reimbursed such net losses as they may have incurred and are in justice and equity entitled to from the appropriation in said act.

"'If, in claims passed upon under said act, awards have been denied or made on rulings contrary to the provision of this amendment, or through miscalculation, the Secretary of the Interior may award proper amounts or additional amounts.'"

The measure includes an amendment proposed by Representative Anderson, of Minnesota, which broadens the language so as to allow claims when a written notice of their existence was filed prior to the expiration of the time limit. This amendment is understood to have been intended to admit two Minnesota claims aggregating about $750,000.

The measure, as amended in the Senate, had the approval of Representative Mondell, whose speech indorsing it had much to do with the subsidence of the opposition. An extract from his remarks is as follows:

"The virtue of the Senate amendment is that it strikes out all reference to appropriations and leaves the bill what it was originally intended to be —a measure more clearly stating what was, in my opinion and in the opinion of most of those who have studied the matter, the original intent of the Congress touching these claims. There cannot be a dollar paid or a dollar obligated beyond the sum already available, and in my opinion there will be a comparatively small number of claims added to those already presented in consequence of this amendment. I do not anticipate that the amendment of today will very largely increase the Government expenditure. It will enable a number of claimants of comparatively small means who went to considerable expense, for them, in the endeavor to meet the demand and need of the nation for those war metals, to receive equitable treatment. Under the narrow construction formerly placed on the bill, those people, mostly people of very moderate means — prospectors and small individual operators — were entirely barred from any participation in the relief contemplated. This simply performs an act of justice in behalf of people of small or moderate means who have suffered losses in the production of war material and lays no additional obligation on the Treasury."

Secretary Fall is expected to outline the policy under the new act soon.

NEWS BY MINING DISTRICTS

London Letter

Weardale Lead Co. Passes Dividend—Burma Corporation's Report Out

By W. A. Doman

London, Nov. 15.—For the first time in sixteen years the directors of the Weardale Lead Co. are unable to pay a dividend for the year to Sept. 30. This is the direct result of the heavy fall in the price of lead, which has fluctuated between £36/10/0 and £16/10/0 per ton. Only 1,563 tons of dressed lead ore and 6,870 tons of fluorspar were produced, as compared with 2,774 tons and 9,374 tons, respectively, resulting in a loss of £10,828, in contrast with a profit of £15,702 for the twelve months ended Sept. 30, 1920. The company expects to recover £8,822 in respect of excess-profits duty, which rather more than meets the provision for income tax, leaving a deficiency on the year of £3,287. Electric locomotion has been substituted for horse haulage.

The Burma Corporation report for the calendar year 1920 has just made its appearance. In some respects it is disappointing, for although out of a surplus of £455,516 there is an available balance of £246,770, no dividend is recommended. In August, 1920, an issue of £1,000,000 in debentures was made, and it was thought that this money would have freed the profits for the shareholders. The financial position of the company is remarkably strong, but apparently money will be needed. The surplus is calculated with the rupee at 1/4.

The policy of the company was modified owing to financial stringency. The government of India was unable to contribute anything toward the new works, and the Tata Iron & Steel Co. desired to limit its participation in the business. As a result the construction of the works was stopped. Further, the company was compelled to discontinue the erection of the new lead smelter, and to rely upon the extension and improvement at a much smaller cost of the existing smelter. It was found necessary, too, to suspend all further expenditure on the development of the Namma coal field.

The program now adopted is based on an annual output of 45,000 tons of refined lead and 4,500,000 ounces of silver, requiring a daily output of 700 tons of ore. The problem of a suitable ironstone flux for smelting has been relieved to a large extent by the discovery of a deposit of good ore. This is now being vigorously developed and gives favorable indications. As regards the lead refinery, the capacity has been increased from 1,800 to 3,000 tons monthly; further extensions are in contemplation, and the capacity of the silver refinery is also being enlarged. Results for 1919 and 1920 compare thus:

	1919	1920
[illegible]	105,560	136,450
[illegible]		
[illegible]	28.1	29.57
[illegible]	26.2	26.72
[illegible]	16.1	15.50
[illegible]		
[illegible]	18,135	23,821
[illegible]	2,164,856	2,869,727

The 1920 tonnage included a certain quantity of concentrates. For the first half of the current year operations have been on a larger scale, the tons of refined lead being 15,642 and the number of ounces of fine silver 1,563,083.

Ore reserves are slightly less: On Jan. 1, 1921, there was 4,364,110 tons, assaying 23.3 oz. silver, 25.3 per cent lead, 17.7 per cent zinc, and 1.2 per cent copper.

On Jan. 1, 1920, there was 4,402,218 tons, assaying 23.9 oz. silver, 25.7 per cent lead, 17.9 per cent zinc, and 1.2 per cent copper.

The Great Boulder Proprietary and the Bullfinch company, two West Australian mining companies, are taking a keen interest in mining in West Africa around Jebba, and favorable reports are being circulated as to the properties under examination.

BURMA

Namtu Lead production by the Burma Corporation for October was [illegible] tons gross, refined lead production [illegible] tons, refined silver production approximately [illegible] oz. Refined lead [illegible] [illegible] tons from September production. Refined silver [illegible] [illegible] oz. from previous month's production and general clean up of plant

Johannesburg Letter

Roodepoort United To Close Down—Labor Situation Unsettled

By John Watson

Johannesburg, Oct. 25—The management of the Roodepoort United Main Reef G. M. Co. which belongs to the Albu group, recently placed before their workers a profit-sharing scheme. This has not been accepted and as the mine showed a loss of £1,700 during September the management has now decided to close down the mine.

The shop-workers on the East Rand Proprietary decided to strike last week as one mechanic had resigned from their union. At the finish the strike was averted by this mechanic throwing up his job. There is a considerable feeling of unrest among mine workers and a fresh ballot among a section is to be taken this week-end. During the period of high cost of living, following the war, wages went up. Now the cost of living and also the gold premium are falling, these workers seem inclined to strike rather than accept reasonable reductions.

The Magadi Soda Co., Ltd., incorporated in Great Britain, was registered over ten years ago to work the deposit of natural soda, some 30 square miles in extent, of Lake Magadi, about 50 miles from Nairobi in what is now known as Kenya Colony. The company also has works for the manufacture of caustic soda on the river Hooghly, 17 miles below Calcutta, India. The operations in Kenya Colony, the report states, continued throughout the present year without material interruption. Shipments of soda ash [illegible] in increasing quantities and the reception accorded to them by consumers is said to have been favorable.

AUSTRALIA

Queensland

Mt. Morgan Workers Reject Proposed Wage Cut—Position of State Mining Ventures

Brisbane, October [illegible]—The Queensland Arbitration Court, in a judgment [illegible], granted the claim of the Mount Morgan Co. for a reduction of [illegible] [illegible] wages. Although even with this reduction operations can be carried on only at a loss, the company is prepared to arrange to have work resumed at once, but at a meeting of the Australian Worker's Union today at Mount Morgan the proposed reduction was rejected by the men. There are several different trades involved; the unions affected say that if a reduction is accepted at Mount Morgan the members of the same unions working elsewhere will have to submit to lower wages also, and the leaders urged the men at Mount Morgan, who have been out of their jobs since March 24, to continue out, "on principle." The men working elsewhere, however, are not doing much to help their fellow-unionists at the big mine who they acknowledge have been fighting their battle as well as their own for the past seven months. There is still some talk of a possible compromise.

An official statement lately published showing the financial position of some of the state enterprises connected with mining in Queensland is regarded by the opponents of the government as a severe set-back for their socialistic schemes. In each case a loss is shown. Thus, the state arsenic mine, producing 555 tons of arenic in the year ended June 30 at a cost of £49/1/8 per ton, is in debit for that period to the amount of £4,800; the Bowen coal mine since the inception of the project in 1919 has lost £41,600; the Baralaba coal mne, besides having a loss of £13,000 written off as the cost of a shaft that had to be abandoned, has incurred a further loss of nearly £1,400; and against the Styx River coal mine there is a debit balance of £7,700. In these cases, however, it has to be remembered that the arsenic mine has been supplying arsenic for prickly-pear destruction at a price very much below the market value, that the two coal mines first-named have not long passed the developing stage, and that the Bowen colliery has not yet begun selling coal because the railway to connect the field with the port of Bowen is not yet finished. Two state batteries also show losses, but these were started for the public convenience, and not in the expectation of a profit.

Up to the present a total of £16,286 has been spent on the proposed iron and steel works at Bowen, in addition to £30,000 paid for an iron ore deposit in Western Australia. The work done to date includes the preparation of plans, estimates of cost, and survey of the site of the proposed works. The project is at present hung up for want of funds. The government has recently been fortunate in obtaining a loan of £2,400,000 from New York, and one supposition is that a part of this loan will be devoted to the commencement of the iron and steel works, but no announcement on the subject has yet been made.

The only mine on the once famous goldfield of Charters Towers that is producing any gold worth mentioning has lately been giving some very good returns. The latest is from a crushing of about 17 tons of ore, which gave a value of £1,312, or an average of £6 10 0 per ton. A small crushing from another mine on the field gave a return of £8 per ton.

On the dying, and indeed almost dead, goldfield of Gympie there were last month also several very satisfactory crushings, which show there are still some rich auriferous deposits at this camp. In one case over 41 oz. was obtained from 3 tons of stone; in another 346 oz. from 49 tons; and in a third 176 oz. from 31¾ tons.

Many applications for mineral leases to mine for silver and lead around Brisbane continue to be granted. In most of these cases exemptions from labor conditions for specified terms have been granted and only one holding, the original mine, at Indooroopilly, is actually producing. An output of 131 tons from this mine gave an average return of 70 oz. silver per ton and 42.88 per cent lead, with a small quantity of bismuth. Many of the leases have been taken up on the advice of an electrical "diviner," but, while a good deal of money has been spent in the quest for payable ore on the strength of this advice, so far nothing but disappointment has been the result.

A fresh agreement has been made by the Government with the firm of Rubin Bros., of Paris, for the marketing of the gems of the Anakie sapphire field. This agreement was first submitted to the miners concerned, who approved of it by the narrow majority of 306 to 270. It is for a term of three years, with a provision for an extension.

CANADA

High-Grade Strike Reported at Fish Creek Mine—The Gold Discovery in Whitewater Section

BY ROBERT DUNN

Stewart—It is reported that a strike of some importance has been made on the property of the Fish Creek Mining Co. A raise was started 160 ft. from the portal of No. 1 tunnel to connect with No. 2 tunnel, 180 ft. above, and a shoot of high-grade ore was opened up. This is becoming richer as the raise is continued, and the ore taken therefrom is being sacked for shipment. A considerable amount of ore running from $300 to $400 per ton is ready for transportation.

Latest reports from the Premier mine are to the effect that good progress is being made in the work both at the mine and on the aërial tramway. With regard to the latter, all the towers are completed with the exception of the four at the lower end, and these will be up soon.

Penticton—One of the few silver mines in the province which has continued to operate successfully through the period of silver depression is the Sally mine, at Beaverdell, operated by the Wallace Mines, Ltd. This mine is running steadily with a force of fifteen men. Since having been taken over by the present company, considerable development has been done and a substantial quantity of ore blocked out. In 1920 about $80,000 worth of ore was shipped. The ore mined at present runs between 300 and 400 oz. of silver to the ton, with some lead and a trace of gold.

Vancouver—Further particulars of the gold strike in the Whitewater section of the Lillooet district have been obtained from E. J. Taylor, the original discoverer, who recently came to the coast. He brought with him 60 oz. of gold, which he and another man took out in two weeks' work by means of an arrastre. Mr. Taylor's claims, situated near Iron Creek, run up the mountain side, and so far his operations have been confined to the natural dump brought down from the ore shoot through erosion. He describes the ore as being telluride in a serpentine formation, and his observations lead him to believe that the mineralized zone stretches a distance of twenty-five or thirty miles. It is expected that there will be much interest manifested in this district by prospectors next Summer.

Word has been received that the Kitchner Mines, Ltd., Keithley Creek, will open next season's operations under favorable circumstances. During the open months of this year much work was done in the installation of plant. The company is prepared, as soon as conditions are right, to open up an area of virgin ground. This is an unusual condition in the Cariboo, the placer fields of which have been well worked over since the original discovery in 1860.

The Granby Consolidated Mining, Smelting & Power Co. has entered suit in the Supreme Court against the Attorney General of British Columbia. The company seeks a declaration with regard to its rights and liabilities under the British Columbia Taxation Act. It further seeks a declaration to the effect that taxes for which it is liable are not due until Jan. 2 next and will not be in arrears until Dec. 31, 1922.

Quebec

Black Lake—A long-standing dispute between the Black Lake Asbestos & Chrome Co. and Frank Samuels, of Philadelphia, has been settled out of court by the payment by the company to Samuels of an amount approximating $75,000. The claim was on account of failure to make shipments of chrome during the war.

VENEZUELAN GUIANA

Progress Made in Alluvial Gold Operations—Only One Well-Organized Company

Ciudad Bolivar, Oct. 16—The situation as regards gold quartz mining is little changed, the only two companies working being the New Callao Gold Mining Co. Ltd. and the Goldfields of Venezuela Ltd, both of which continue to crush on a small scale, the latter being chiefly occupied in developing its property.

On the other hand, there has been considerable progress, in regard to the alluvial gold workings, chiefly in the

Cuyuni River district, from which the output has increased up to 2,000 oz. per month. This work in most cases is carried on without any attempt at serious organization or using modern methods. The only exception has been in the case of an American syndicate, which has taken up a property known as Coro Coro, some distance up the Cuyuni River, above the Britsh boundary. Their efforts so far have, however, not been a great success, partly owing to their want of knowledge of the country, and partly to starting work in the wet season, as most of the staff who were newly arrived went down with fever, one of whom unfortunately died.

The place known as Iskiel continues to give good results, most of the gold found being quite coarse, nuggets of several pounds weight being common.

Following the oil boom in the north of the country, large areas of land have been "accused" all over Guiana, but up to now no work has been done to prove indications of oil. A British company has two seaplanes making an aerial survey of the Oronoco delta.

Until the financial situation in Europe improves there is not much chance of obtaining capital for mining prospects from that direction, but in view of the present high value of the dollar and the decreasing output of gold in the world, it is certainly worth the while of American capitalists to take an interest in this region.

In an article on the above district, published in the *Engineering & Mining Journal*, Dec. 4, 1920, there are several errors in names. Calloa should be Callao; Cayuni, Cuyuni; Yuruon, Yuruan; and Yuru, Yuruary. General Juan Fernandez was the discoverer. (apart from the Indians) of the gold placers in the higher Cuyuni River He has since explored the country above its head waters, in the direction of Mt. Roraima, where he also found gold, as well as balata forrests, and big savannah country.

MEXICO

Chihuahua

Erupcion Company Increases Capital Stock

Chihuahua — The sensational suit against the Naica Mining Co., involving the title to the famous Naica property in southern Chihuahua, is to be taken up again by the supreme court of Mexico. This case threatens complications with the United States and Great Britain.

The Erupcion Mining Co., of El Paso, has filed an amendment to its charter, increasing its capital stock from $1,000,000 to $1,500,000. The property of the company is in Chihuahua.

Coahuila

Saltillo—The Mazapil Copper Co. states that it recently blew in two lead furnaces at its Saltillo plant. It reports that prospects do not appear favorable to increasing its operations in the near future.

CALIFORNIA

New Wage Scale in Effect at Grass Valley—Operators More Active in Trinity County

San Francisco—A new wage scale has been mutually arranged between the larger operators and the miners in the Grass Valley district. The agreement is to run to June 30, 1922, and provides for a wage of $4.25 for machinemen and $3.75 per day for shovelers, with extra pay for overtime and Sunday work. This insures stability to mining conditions in the district and as a consequence increased prosperity should result. Conditions at the Empire, North Star, and Idaho-Maryland are excellent. A new hoist and pumping plant are to be installed at the Boundary mine, and a power line has been practically completed. As soon as the new plant is available active developments will be started.

Trinity County is shaking off the lethargy that has pervaded so many gold-mining communities. Many minor operations have been started. It is reported that the Estabrook dredge will be put in operation in the spring, after an idleness of two years. A twenty-stamp mill will be started as soon as power water is available by the Bonanza King mine. A new mill is being erected at the Van Ness mine. The Strode, Gold Hill, Holland, and the Yellow Rose are reported in operation.

Alleghany and Forest, in Sierra County, are active, and the Oro mine, near Downieville, is to be operated on a larger scale. At Sonora, Tuolumne County, a lease and option have been taken on the Magente Mines, near Jamestown, and at Mokelumne Hill, Calaveras County, the Morning Star and Gold Star mines are to be reopened.

NEVADA

Leadville Mines To Shut Down Mill for Winter—Production Normal at Tonopah

Virginia City—At the United Comstock Mines Co. about 500 men are employed on surface and underground. Excavation for the fine- and coarse-grinding units of the crushing plant is completed, and the concrete forms for the former are practically completed. Excavation for the cyanide plant has been started. The Pittsburgh Comstock Mines Co., operating west of the United Comstock, has practically completed opening the tunnel, and actual development on the vein will start soon.

Leadville—The Leadville Mines Co. planned to ship two more cars of concentrates during November, making four cars for the month. The plant is to be shut down for the winter. Work in the mine will be continued, and it is also planned to make a few changes in the mill which will increase its capacity to 50 tons per day.

Divide—The official report of operations of the Tonopah Divide Mining Co. for October shows production of 1,599 tons of ore of an average value per ton of $30.36, and a gross value of $48,518.48. This is practically the same as for the previous month.

Tonopah—Production continues normal in the Tonopah district. The total tonnage mined and milled is about 1,300 per day, with a gross monthly production of approximately $650,000. Bullion shipments reported to date, and covering operations for the first fifteen days of November, are from the West End $57,300, and the Tonopah Extension $46,000. The shipments from the Tonopah Mining, Belmont, and MacNamara should be about as usual. Leasers in the Montana Tonopah, Jim Butler, Midway, and MacNamara are active and regular ore shipments are being made to the Belmont, Tonopah Mining, and MacNamara mills.

Spanish Belt—The fifty-ton mill of the Consolidated Spanish Belt is working satisfactorily and making a good saving. A thorough try out has been made during the last few weeks, and, with minor changes, concentration by both tables and flotation has proved successful. The trial run was made on low-grade dump ore, but higher grade ore from the mine is now being treated. Underground developments are said to be very satisfactory.

UTAH

Chief Consolidated Examines Eureka Lilly

Eureka—Ore shipments from the Tintic district for the week ended Nov. 18 amounted to 167 cars. Shippers were: Tintic Standard, 46 cars; Chief Consolidated, 46; Victoria, 17; Dragon, 14; Iron Blossom, 10; Eagle & Blue Bell, 8; Swansea, 4; Centennial-Eureka, 5; Grand Central, 3; Gemini, 2; Tintic Drain Tunnel, 1; Colorado, 2; Empire Mines, 2; Bullion, 2; Mammoth, 1; Sunbeam, 1; Eureka Mines, 1. At the North Standard drifting to the north is being done on the 1,100 level to reach the No. 2 fissure, which is mineralized with iron at the surface. John Manson is general manager. The work is being done under contract.

The Chief Consolidated has been making an examination of the Eureka Lilly, the control of which has recently passed into the hands of the Chief, in preparation for beginning development work. The present workings extend to a depth of 1,000 ft. and as in other East Tintic properties the lower levels are warm and also gassy, the temperature in this case being a little higher than in the adjoining Tintic Standard. Before extensive work is carried on, it is probable that a ventilating system will be installed and connections made with other workings. In this connection it is of interest that the U. S. Bureau of Mines has made a study of temperatures and gases in the East Tintic mines, and has published a pamphlet in which is described the nature of the gases and their effects.

Park City—Shipments for the week ended Nov. 18 amounted to 2,279 tons, as compared with 1,969 for the week preceding. Shippers were: Judge allied companies, 463 tons; Silver King Coalition, 848, and Ontario, 968 tons.

MONTANA

East Butte To Smelt Concentrates in Storage—Butte & Superior May Resume

By A. B. Keith

Butte—Decision has been reached to continue smelting operations at the Pittsmont smelter of the East Butte Mining Co., ample tonnage of concentrates being in storage to permit this to be done until arrangements can be made to secure a tonnage of custom ores sufficient to replace that which it had been receiving from the Davis-Daly Copper Co. It also is considered possible that the East Butte may be able so to reduce its smelting costs as to induce the Davis-Daly to resume its shipments. The latter has at the present time the largest ore reserves in its history, but in view of the low price copper is commanding it is not regarded as wise to deplete its reserves at present.

The East Butte has been operating only one of its two furnaces for some time, and as its concentrator has been running at a capacity, which had enabled the building up of a considerable tonnage of concentrates, this pile now can be reduced, with the freeing of a large amount of frozen credit, particularly so with a further advance in the price of the copper metal.

East Butte some time ago constructed a battery of four tanks out of slag, which were used for the impounding of its surplus concentrates, to await any improvement in the price of the metal. These tanks have diameter each of 50 ft. and are about 20 ft. deep. One is filled with concentrates and a second partly filled.

Mine tonnage from the East Butte's own properties will not be ample to maintain continuous operation of the mill, it is believed, but production can be speeded up, should the situation justify. However, East Butte mines its ores in a very clean manner, and the advantage to be gained from milling operations is not as great as it would be were the ore poorer in value. The question of freight charges does not enter, as East Butte's mine, mill and smelter are adjacent to each other.

Butte & Superior and the Anaconda people have been in conference in connection with the possible resumption of the treatment of the former's concentrates. Though nothing official is obtainable, it is believed that this meeting possibly foreshadows a resumption of production by the Butte & Superior.

The working forces of the Black Rock mine of the Butte & Superior were increased somewhat last week. At present the principal work is the development of the body of copper ore recently cut on the 2,200 level.

Davis-Daly will continue development operations at the Hibernia mine, where a cross-cut is being driven on the 750 level to reach a point under the 600 level, where ore was discovered, and from which section of the mine the tonnage of silver ore has been mined the past six months.

COLORADO

Coal To Be Cheaper Following Failure of Strike—Colorado & Southern Would Decrease Passenger Service

By Our Special Correspondent

Denver—The Colorado Metal Mining Board will convene early in December to consider the report of the material and supply committee in regard to a plan for procuring cheaper material and supplies; to consider further freight-rate adjustments; a proposition to abandon service on certain branch lines of railroad within the state, and matters in connection with the annual meeting of the Colorado Metal Mining Association to be held in Denver the week of Jan. 16. The board, which is a state commission, will remove its offices from the Tabor Block to the State Capitol on Jan. 1.

With 90 per cent of the normal force of miners at work in the coal mines of the Colorado Fuel & Iron Co. in southern Colorado, the strike called by the United Mine Workers on Nov. 17, against a 30 per cent reduction in wages, appears to have failed. The mines in the Cañon City district operated by this company, where the employees went out on a sympathetic strike, remain closed, the company making no effort to operate.

Officials of the company announce that the new wage schedule will result in approximately $1 per ton reduction in the price for coal, and will bring about a resumption of the Pueblo steel mills, which have been closed since early in the year. The reduced price for coal will also effect a lower cost in smelting and operating costs for the metal-mining industry, and mining men expect a decided increase in mining activity with the coming year.

Alleging that it is operating at a loss, the Colorado & Southern, which is operating the South Park branch of that road, serving the mining counties of Park, Summit, and Lake, has petitioned the Colorado Utilities Commission for permission to modify its daily passenger service to three days per week during eight months of the year. The company proposes to operate daily service four months of the year and to run trains three days per week the remainder. Hearings have been held in the various counties, and beginning Nov. 22 and 23 formal hearings were held at the office of the commission in Denver. Application for permission to modify service on the Clear Creek branch of the road, and abandonment of service on the Romley branch, has also been made by the Colorado & Southern.

The superintendent of the United States Mint at Denver has received orders from Washington to reduce the coinage of silver dollars from 225,000 daily to 75,000, resulting in a reduction of the force in the coinage department of 140 men. Exhaustion of the available supply of silver on hand or procurable, at the various mints, was given as the reason for the reduction. Since the beginning of coinage of silver dollars at the Denver Mint in May, the institution has turned out 17,000,000.

The American Smelting & Refining Co. has announced a ⅜c. increase in the price paid for the silver content of Colorado ores, as it no longer is required to reship its bullion from the seaboard refining plant to the Denver Mint, in order to comply with Government requirements under the Pittman Act.

NEW MEXICO

San Mateo Gold Strike Disappoints—Copper Companies Keeping Skeleton Organizations

By James P. Porteus

Lordsburg—A swing through the mining camps of this section reveals nothing startling in the way of development going on. The copper companies are holding skeleton organizations necessary to the rebuilding of their forces when the time comes. Some of the men are on vacation subject to call and some are working as watchmen. The increased rate of copper consumption is being watched hopefully but no resumption of mining operations in this line is expected before spring. Much needed road work is being done.

Colorado coal mine labor troubles are not expected to affect the New Mexico fields, where the coal industry is showing a slightly more than seasonable activity. In the Raton section most of the camps on the St.L.R.M. & P. railroad will be operating by Dec. 1. The Gallup American Coal Co., owned by the Chino Copper Co. and others, among other improvements is building individual miner's houses that cost $1,500 each. A total of $20,000 will be spent for this purpose.

The San Mateo gold strike is disappointing. The formation which is a Tertiary rhyolite overlying an andesite, carries a sparse showing of thin flakes of gold. There is some silicification and a little iron in places. The deepest hole is 25 ft., showing no values in the bottom. About 100 locations have been made and some nice samples secured, which however do not represent the average nor is there any considerable amount of them.

Silver City—Mining activities in Chloride Flat have been considerably reduced owing to the cancelation of all leases on the Amory Stevens property, on account of an option given by the Stevens heirs to New York parties. The latter expect to begin field work and examinations at an early date. Messrs. Wright, Stauber, Bell and Armstrong are still working on their lease on the Grand Central claim of the Bohemian Mining Co., shipping about two cars of ore weekly. So far the ores shipped have been old fillings which run from 5.75 oz. to 12.5 oz. silver and about 25 per cent lime. As these are desirable for fluxing purposes the smelter has been making a treatment charge of $1 per ton. Regular mining operations will be begun next week on ores that have been exposed during the cleaning up of the old workings.

ARIZONA

Douglas Smelters May Have Legal Trouble Over Fumes—Jackling Not in Power Scheme

By J. H. McClintock

Bisbee—Nearly all the old Copper Queen smelter slag dump has been taken to the new smelter at Douglas, providing excellent fluxing material and with copper returns up to 5 per cent. A few thousand tons of slag still remain, but probably will be sent down as soon as production is resumed.

There is possibility of smoke litigation over the fumes of the two smelters at Douglas. During the last week a conference has been held between representatives of the Copper Queen and Calumet & Arizona companies and owners of ranches in the vicinity of Douglas. It is noted that no degree of acrimony developed in the discussion and that the farmers expressed appreciation of the efforts of the companies to cut down the volume of the smoke. When there was suggestion that the fumes might be transformed into sulphuric acid, Colonel Greenway, of the C. & A., remarked that his smelter alone might furnish all the acid needed in western America. Undoubtedly affecting the local situation is a judgment of $1 lately secured in Prescott by farmers of the Verde valley, who claimed to have been damaged by a defendant smelting corporation. At Douglas, the two companies affected own large and adjoining tracts, flanked on the south by uncultivated acreage in Mexico and on the east by the city.

Colonel John C. Greenway states that the Jackling interests have not joined (as stated heretofore) in the Girand power plans as to the Grand Canyon, but that co-operation is to be given by the Phelps Dodge, Inspiration, Verde Extension and Calumet & Arizona companies. Boring for bedrock is now in progress near the mouth of Diamond Creek, where the black granite is near the stream bed. The plans are relatively modest, with probability that a series of dams will be erected, rather than a great monolith such as planned by the Edison Electric interests. Tentative figuring indicates that a dam 250 ft. in height would supply 100,000 kw. of energy, or enough for the present power needs of central and southern Arizona.

An immense saving in mining costs is expected through operation of the mill of the Apache Powder Co. south of Benson. This is a project that has the backing of the larger mining corporations of the state. The saving mainly is to come in elimination of the major part of the transportation cost, for powder takes a high rate.

Kingman—The C.O.D. property is under the management of Arthur D. Storke, succeeding M. B. Dudley, resigned. The mill will be started again in December, though this will depend on freight rates on concentrates to the smelter.

MICHIGAN

The Copper Country

Producers Not Greatly Interested in Fabrication—To Resume Sinking New Baltic Shaft—Lake Shipments Nearing Close

By M. W. Youngs

Houghton, Mich.—There appears to be a widespread belief here that copper could be fabricated in the Lake district and there has been a marked disposition to look to the mining companies to get into the manufacturing field. But it is apparent the companies are not keen about doing so, and it would appear they would rather continue as they have been doing, mining copper and taking their chances in the open market. Once operations are resumed, however, it is unlikely any great surplus of metal ever will be built up again. A rolling mill, independent of the mining companies and using an average of 1,000,000 lb. of copper per month, has recently been advocated. Such a mill would not enter into competition with any of the larger fabricators of copper; it would be too small for that. But it would provide a start in fabrication apart from the mining companies and perhaps open the way for the establishment of other industries allied with copper, ultimately leading to the consumption of considerable metal.

Arcadian Consolidated will resume sinking in its New Baltic shaft early in December, deepening the shaft from the 942 level to a depth of 1,060 ft., corresponding with the 1,050 level of the New Arcadian shaft which is bottomed at 1,850 ft.

Copper shipments by boat are nearing a close. Shipments have been speeded up to take advantage of the lower rate, and it is believed the total for the month will compare favorably with the high record of October. Export sales are almost negligible, practically all new business having been placed by domestic consumers. Germany has been in the market for little Lake copper as compared to months earlier in the year. Calumet & Hecla still has nearly half of its battery of furnaces in operation, and no reduction is looked for until the middle of December. The electrolytic plant, it is stated, has sufficient material on hand to warrant operations until spring.

Drifting is continuing from the five levels of the Seneca shaft, from the 3rd to the 7th inclusive. There is no change in the appearance of the vein. About 1,500 tons of rock is being shipped to the Baltic mill monthly, this rock being taken out during course of development. The Mineral Range railroad will be extended to the Gratiot shaft, a distance of about two miles, this being necessary to provide direct connections over one railroad to the Point Mills stamp mill, which will be used by Seneca when regular production is begun.

JOPLIN-MIAMI DISTRICT

Efforts Made to Prevent Smallpox Epidemic—Ore Production Affected Somewhat by Winter Weather

By P. R. Coldren

Joplin—Every effort is being made in the Tri-State zinc and lead field to prevent a smallpox epidemic. Recently in Kansas City there have been almost 200 cases, with eighty-nine deaths. The high mortality rate indicates the disease is in a particularly virulent form, and it is feared serious ravages would result should the disease become epidemic among the miners. Only one case has been reported at this writing, a miner living in Picher, Okla., who died after a few day's illness.

The matter was taken up for consideration at the meeting of the Tri-State branch of the American Zinc Institute, held at Picher on Nov. 23, and the city health authorities were urged to burn the small house in which the man resided as the only certain way of preventing spread of the disease from that source. Members of his family have been placed under strict quarantine, and the Institute has proffered both financial and moral support to the health authorities in preventing an epidemic.

At this meeting of the Institute a special treat in the way of reindeer meat, fresh from Nome, Ala., was offered the operators, and the proceeds from the extra assessment for the meal will go toward providing a dinner for the poor children of Picher and their parents, on the day before Christmas.

A touch of winter weather in the last few days has served to handicap production slightly, but not so much as at other times, owing to the fact that most of the production in this field just now is being made by strong companies where weather conditions are not as important a factor as they were with the smaller operators a few years ago. It is believed that production will remain around 5,500 tons per week during the winter.

Little new development is being reported, with the exception that some small operations in lead mining are under way. Recently good lead strikes at shallow depth have been reported on the Sloan land in Newton County, just south of the Jasper County line, south of Joplin, and on the [illegible] land, northwest of Duenweg, Mo. These operations are small, and the lead produced will at best be an inconsequential factor.

F. H. Gaffney has resigned his position as general manager for the Hil[illegible] Mining Co., and on Dec. 1 will assume the management of the Kansas property of the Commerce Mining & Royalty Co. At present these properties are [illegible] being the Webber lead [illegible] of the Blue Mound mine, and a new mill recently erected on a lease directly east of the Vinegar Hill Zinc Co.'s Hat mine, north of Picher. John Neelan will retain his position as manager for the Commerce company's Oklahoma properties.

THE MARKET REPORT

Daily Prices of Metals

Nov.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
24	.....	.....	.....	....	....	.....
25	13.25@13.375	29.50	29.75	4.70	4.35	4.625
26	13.25@13.375	29.50	29.75	4.70	4.35	4.625
28	13.375	29.75	30.00	4.70	4.35	4.60
29	13.375	29.625	29.875	4.70	4.35	4.60@4.65
30	13.375	29.50	29.75	4.70	4.35	4.65@4.70

*These prices correspond to the following quotations for copper delivered: Nov. 25th, 13.50@13.625c.; 26th, 13.50@13.625c.; 28th, 29th, and 30th, 13.625c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
24	66⅝	67¾	75½	160½	162½	25⅛	24½	26¼	26¾
25	66¾	67¾	75½	161½	163½	25½	24¾	26¼	26¾
26	...	...	...	....	....	...	...	..	
28	67⅜	68⅜	75½	163½	165¼	25⅞	25¼	26⅞	27⅜
29	67½	68½	75½	163¼	165	26	25¼	26⅜	26¾
30	67	68	75½	162½	164½	26	25¼	26⅜	26⅞

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver			Nov.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
24	....	...	...	38⅛	28	398⅞	99⅝	67⅝	37¾
25	399	99⅝	66⅞	37⅝	29	398½	99⅝	67¼	37⅝
26	398⅛	99⅝	66¼	37⅜	30	399½	99⅝	67½	37½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Metal Markets

New York, Nov. 30, 1921

The holiday on Thursday (Thanksgiving Day) interfered somewhat with the week's business, but sales have, in general, been of satisfactory volume. Copper continues its firm trend, and lead is also somewhat stronger. Tin and zinc are practically unchanged in price.

Copper

The larger producers have been quoting 13.75c. delivered most of the week, and report satisfactory sales. However, most of this business has been for the first quarter of 1922, or at least for January and February. There was no difficulty in obtaining December and in some cases January copper up to and including Monday for 13.50c. delivered. Copper could be obtained in one direction for second-quarter delivery at 13.75c. delivered, the last two days, though not a great tonnage is available at this price.

Export business has been better than domestic, and satisfactory sales have been made to Germany, England, and France.

Total sales for November, including both domestic and foreign, have been exceedingly satisfactory, and it would not be surprising if the figure would be somewhere between 160,000,000 and 170,000,000 lb. It is likely that a larger proportion than usual, however, has been sold for forward delivery.

Average Metal Prices for November

Copper:

New York Electrolytic	13.035
London Standard	66.614
London Electrolytic	74.386

Lead:

New York	4.683
St. Louis	4.356
London	24.483

Silver:

New York, foreign	68.234
New York, domestic	99.413
London	38.750
Sterling Exchange	396.315

Zinc:

St. Louis	4.665
London	25.949

Tin:

99 per cent	28.592
Straits	28.935
London	158.898

Antimony	4.734
Quicksilver	39.804
Platinum	82.609

Lead

The official contract price of the American Smelting & Refining Co. continues at 4.70c., and this price is also asked by most other interests. Lower quotations have disappeared, and instead there is some talk of 4.75c. Business has been in fair volume. Chemical lead is in free supply in the Middle West at 4.35c. St. Louis, and on desirable business this price might be shaded. Desilverized is somewhat firmer. In Chicago, desilverized lead brought 4.50c. during the week and corroding lead 4.55c.

Lead for export is in great demand, principally for Europe but also for South America and Japan. The Mexican production is not sufficient to fill the orders. Spot lead is quoted at a premium in London, and dealers there are making offers of this premium price for shipment from this side as late as January.

Zinc

Last week the market showed a tendency to decline because of the pressure of metal for sale on an unreceptive market. Prices dropped to 4.60c. East St. Louis, and a small sale at 4.575c. was reliably reported to have been made. Several of the larger producers were unwilling to meet the lower levels, and as the cheaper offerings were soon absorbed, the market has risen to the former level. Inquiries have been generally for prompt shipment, but a few are reported for shipment early next year. Producers are generally not disposed to consider forward deliveries. Business in high-grade continues to be better than for ordinary grades, at a 6c. level, with freight allowed.

Tin

The tin market has quieted down after the rather active sales reported in our last issue. Not a great deal has been on the market, however, and the situation may be characterized as quiet and firm.

Tin for forward delivery has been quoted as follows: Nov. 25th, 30.00c.; 26th, 30.00c.; 28th, 30.25c.; 29th, 30.125c.; and 30th, 30.00c.

Arrivals of tin, in long tons: Nov. 22d, Australia, 25; 25th, London, 25; 28th, Rotterdam, 25; London, 75; Straits, 20.

Gold

Gold in London: Nov. 24th, 102s. 11d.; 25th, 102s. 11d.; 28th, 103s.; 29th, 103s. 2d.; 30th, 102s. 11d.

Foreign Exchange

Foreign exchanges have shown little change. On Tuesday, Nov. 29, francs were 6.98c.; lire, 4.09c.; and marks, 0.3625c. New York funds in Montreal, 9 7/16 per cent premium.

Silver

With the near approach of the time for sailings from San Francisco and Vancouver of the last steamers which can deliver silver in Shanghai in time for the Chinese New Year settlements, the price of spot silver has advanced to a premium of ⅛ to ⅜c. over silver for later deliveries. The Indian bazaars have also been small buyers at times during the last week. The price for silver deliverable on the West Coast within the next few days should therefore be maintained, although the tendency of the general market is uncertain.

Mexican Dollars—Nov. 25th, 50¾; 26th, 50⅞; 28th, 51⅛; 29th, 51⅛; 30th, 51[illegible].

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—List prices have been reduced 5 to 5½c. per lb., but are still above the market for imported aluminum. Reduction was made Nov. 15, and brings prices to 20c. per lb. for 99 per cent, 19c. for 98@99 per cent, and 18c. for 94@98 per cent. Outside market nominal at 17@18c. per lb. for 98@99 per cent virgin grade.

Antimony — Chinese and Japanese brands, 4.50c.; market dull. W.C.C. brand, 5¼@5⅝c. per lb. Cookson's "C" grade, spot, 9c. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at [illegible] per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt — Metal, $3@$3.25 per lb.; black oxide, $2@$2.10 per lb. in bbl.

Iridium—Nominal, $150@$170 per oz.

[1]Molybdenum Metal — In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$70 per troy oz. Nominal. $70, Los Angeles, Cal.

Palladium—Nominal, $55@$60 per oz.

Platinum—$80 per oz. Market dull.

Quicksilver—The market has become stronger. Metal has been sold during the week for $46 per 75-lb. flask. Some dealers quoted $48, but no business is reported on that basis. Improvement is ascribed to better demand from chemical manufacturers. San Francisco wires $41.

[1]Rhodium—$150 per troy oz.

[1]Selenium — Black powdered, amorphous, 99.5 per cent pure, $2@$2.25 per lb.

[1]Thallium Metal—Ingot, 99 per cent pure, $20 per lb.

[1]Tungsten Metal—Wire, $35@$60 per kilogram, according to purity and gage.

Metallic Ores

Chrome Ore—Ore analyzing 40@45 per cent Cr_2O_3, crude, $20@$25 per net ton; ground, $30; analyzing 45@50 per cent Cr_2O_3, $24@$26; ground, $28; f.o.b. Atlantic ports. Quotations are nominal.

Iron Ore—Lake Superior ores, per ton, Lower Lake ports: Old Range bessemer, 55 per cent iron, $6.45; Mesabi bessemer, 55 per cent iron, $6.20; Old Range non-bessemer, 51½ per cent iron, $5.70; Mesabi non-bessemer, 51½ per cent iron, $5.55.

Magnetite Ore—F.o.b. Port Henry, N. Y.: Old bed 21 furnace, $4.85; old bed concentrates, 63 per cent, $5.75; Harmony, cobbed, 63 per cent, $5.75; new bed low phosphorus, 65 per cent, $8.50.

Manganese Ore—$23@$24 per unit, seaport; chemical ore, $55@$60 per gross ton, lump; $75 per net ton, powdered. Nominal.

Molybdenum Ore—85 per cent MoS_2, 45@50c. per lb. of contained sulphide, New York. Quotation purely nominal.

Tantalum Ore—Guaranteed minimum 60 per cent tantalic acid, 50c. per lb. in ton lots.

Titanium Ores—Ilmenite 52 per cent TiO_2, 1½@2c. per lb. for ore. Rutile, 95 per cent TiO_2, 12c. per lb. for ore, with concessions on large lots or contracts.

Tungsten Ore—Scheelite or wolframite, 60 per cent WO_3 and over, per unit of WO_3, $3, f.o.b. Atlantic ports. [illegible], as low as $[illegible].

Uranium Ore (Carnotite)—Ore containing 1½ per cent U_3O_8 and 5 per cent V_2O_5 sells for $1.50 per lb. of U_3O_8 and [illegible] per lb. of V_2O_5; ore containing 2 per cent U_3O_8 and 5 per cent V_2O_5 sells for $[illegible] and [illegible] per lb., respectively; higher U_3O_8 and V_2O_5 content commands proportionately higher prices.

Vanadium Ore—$1 per lb. of V_2O_5 (guaranteed minimum of 18 per cent V_2O_5), New York. Nominal.

Zircon—Zirconium silicate, f.o.b. Pablo, Fla., 4½@13c. per lb.

[1]Zirkite—According to conditions, $70@$90 per ton, carload lots. Pure white oxide, 99 per cent, is quoted at $1.15 per lb. in ton lots.

Zinc and Lead Ore Markets

Joplin, Mo., Nov. 26—Zinc blende per ton, high, $28.30; basis 60 per cent zinc, premium and Prime Western, $25; fines and slimes, $23@$22; average settling price, all grades of blende, $24.73.

Lead, high, $59.15; basis 80 per cent lead, $52.50@$53.50; average settling price, all grades of lead, $56.52 per ton. Shipments for the week: Blende, 8,143; lead, 1,053 tons. Value, all ore the week, $260,950. Shipments for eleven months: Blende, 263,306; calamine, 102; lead, 55,487 tons. Value, all ores eleven months, $9,159,620.

The zinc-ore market weakened from the $26 basis price of last week, but a large tonnage of ore was sold on the lower price. To avoid what is deemed an excessive tax on ore, some Oklahoma producers are cleaning their bins.

A light flurry came into the lead market this week, with the advent of an outside buyer. Purchases were still being made late today, and the regular buyers were unable to ascertain the extent of the demand. The $52.50 basis price of regular buyers was advanced $1 per ton.

Platteville, Wis., Nov. 26—No sales or shipments of ore are reported, except 491 tons of blende sent to separating plants.

Non-Metallic Minerals

Asbestos — Crude No. 1, $1,[illegible]@$1,500; No. 2, $[illegible]@$[illegible]; spinning fibers, $225@$400; magnesia and compressed sheet fibers, $[illegible]@$[illegible]; shingle stock, $[illegible]@$[illegible]; paper stock, $[illegible]@$65; cement stock, $[illegible]@$[illegible]; floats, $7@$10, all per short ton, f.o.b. Thetford, Broughton and Black Lake mines, Quebec, Canada.

Barytes—Crude, $[illegible]@$7 per ton, f.o.b. mines. Ground white, $[illegible], f.o.b. mills. Off color grades, $[illegible]@$17, f.o.b. Southern mills. Foreign barytes, f.o.b. New York, $[illegible] per ton.

Bauxite—[illegible] $10 per [illegible] ton, f.o.b. [illegible] ports. American [illegible] crushed and dried, $[illegible]@$10 per gross ton, f.o.b. [illegible]; [illegible] pulverized and dried, $[illegible]@$16 per gross ton, depending upon grade; calcined [illegible] the [illegible] $[illegible] per gross ton, f.o.b. shipping points.

Borax—Granulated, crystals or powdered in bags carloads, [illegible] per lb.; [illegible].

Chalk—English, extra light, [illegible]; domestic, [illegible]; heavy, 4c. per lb., all f.o.b. New York.

---

[1] Furnished by Foote Mineral Co., Philadelphia, Pa.

China Clay (Kaolin)—Crude, $6.50@$8.50; washed, $9@$10; powdered, $12@$20; bags extra, per net ton, f.o.b. mines, Georgia; powdered clay, $13@$20, f.o.b. Virginia points. Imported lump, $12@$20, f.o.b. American ports; powdered, $25@$40, f.o.b., quoted at New York.

Emery—Turkish emery, 6c. per lb., depending upon fineness. Inferior grades, 3½c., f.o.b., from New England points.

Feldspar—The market is exceedingly dull, and prices are nominal. Consumers reported having offered as low as $4 per ton for No. 1 crude f.o.b. mines. Transactions reported on a $5 basis. No. 1 Canadian, ground, $23 f.o.b. Ohio points.

Fluorspar — Gravel, guaranteed 85 per cent calcium fluoride and not over 6 per cent silica, $20@$22.50 per ton, f.o.b. Illinois and Kentucky mines; acid, glass, and enamel grades, $40@$55; gravel, $15; lump, $12.50, f.o.b. Lordsburg, N. M. Ground, acid grade, 97 per cent CaF_2, $30, New Mexico.

Fuller's Earth—16 to 30 mesh, $21; 30 to 60 mesh, $23; 60 to 100 mesh, $19; 100 plus mesh, $15, f.o.b. plants, Pennsylvania. California grades, $15@$25, f.o.b. mines. Imported, English, $24@$27, f.o.b. Atlantic ports.

Graphite—Ceylon lump, first quality, 6@7c. per lb.; chip, 4½@5c.; dust, 3@4c. No. 1 flake, 5@6c.; amorphous crude, ¾@2½c.

Gypsum—Plaster of paris in carload lots sells for $4.25 per 250-lb. bbl., alongside dock, New York.

Kaolin—See China Clay.

Limestone—Crushed, New York State shipping points, ¾ in. size, $1.40@$1.75 per net ton; 1½ in., $1.35@$1.70. Prices for other sizes practically the same. Agricultural limestone, $2.50@$4.50 per net ton, f.o.b. eastern shipping points, depending upon analysis.

Magnesite, Calcined — Crude, $12@$15 per ton. High-grade caustic calcined, lump form, $30@$40 per ton. Plastic calcined, $45@$50 in barrels, carload lots, f.o.b. California points. Atlantic seaboard, $60.

Dead-Burned — $33 per net ton, Chewelah, Wash.; $58@$64, Chester, Pa. Austrian grade, $53.80 per ton, f.o.b., Chester, Pa. (Magnesite brick—See Refractories.)

Mica — India block mica, slightly stained, per lb.: No. 6, 35c.; No. 5, $1.20; No. 4, $2.50@$3; No. 3, $3.50@$4; No. 2, $4.50@$6; No. 1, $5.50@$6.50. Clear block: No. 6, 50c.; No. 5, $1.75; No. 4, $3.25; No. 3, $5; No. 2, $6.50; No. 1, $8; A1, $6.50@$8.50; extra large, $25; ground, wallpaper grade, $90@$160 per ton (depending upon quantity); ground roofing mica, $25@$70, all f.o.b. New York.

Monazite[1] — Minimum of 6 per cent thorium oxide, $30 per unit, duty paid.

Phosphate Rock—Per long ton, Florida ports: 77 per cent tricalcium phosphate, $11; 75 per cent, $9.50; 75@74 per cent, $9; 70 per cent, $6.25; 68 per cent, $5.75; 68@66 per cent, $5.50.

Pumice Stone — Imported, lump, 3@40c. per lb.; domestic lump, 5c.; ground, 5@6c., all f.o.b. New York.

Pyrites—Spanish fines, per unit, 12c., c.i.f. Atlantic seaport; furnace size, 13c.; Spanish lump, 13@14c.; domestic fines, f.o.b. mines, Georgia, 11@12c.

Silica — Glass sand, $2.25 per ton; sand-blast material, $2.25, both f.o.b. Indiana points. Amorphous or decomposed variety, soft silica, 250 to 500 mesh, $16@$30 per ton. Ganister, crude, $2.50 per ton, f.o.b. Illinois points. Molding sand, building sand, glass sand, $2.25@$3, f.o.b. Pennsylvania points. Market reported dull.

Sulphur—$16@$18 per ton for domestic, f.o.b. Texas and Louisiana mines; $18@$20 for export, f.a.s. New York.

Talc—Paper making, $11@$20 per ton; roofing grades, $8.50@$13; rubber grades, $11@$18; all f.o.b. Vermont. California talc, $16@$35, talcum powder grade. Southern talc, powdered, carload lots, $7.50@$11 per ton; less than carload, $25, f.o.b. cars. Imported, $30@$40; Canadian, $18@$40 per ton.

Mineral Products

Arsenic—7@7½c. per lb.

Copper Sulphate — Large crystals, 5.35c.; small crystals, 5.25c. per lb. f.o.b. New York.

Sodium Nitrate — $2.35@$2.45 per cwt. ex vessel, Atlantic ports.

Sodium Sulphate—For 95 per cent material, $12.50 per ton, f.o.b. in bulk, Western mines, spot and six months' contract; $20@$22 per ton, New York.

Potassium Sulphate — Powder, domestic, $1@$1.10 per unit, basis 90 per cent, f.o.b. New York.

Ferro-Alloys

Ferrotitanium—For 15 to 18 per cent material, $200@$225 per ton, f.o.b. Niagara Falls, N. Y.

Ferrocerium—Per lb., $12@$15.

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 11c. per lb. of chromium contained; 4 to 6 per cent carbon, 11@12c., f.o.b. works.

Ferromanganese—Domestic 76 to 80 per cent, $58@$60, f.o.b. furnace; resale, $90, delivered; English and German, $60@$63, c.i.f. Atlantic seaports. Spiegeleisen, 18@20 per cent, $25@$27 per gross ton, f.o.b. furnace.

Ferromolybdenum—Standard grades, carrying from 50 to 60 per cent molybdenum metal, with low sulphur, phosphorus, and arsenic, $2.25 per lb. of contained metal, f.o.b. works. Imported material, $1.70@$2.

Ferrosilicon—For 10 to 15 per cent, per gross ton, f.o.b. works, $38@$40; 50 per cent, $57@$59; 75 per cent, $120@$125.

Ferrotungsten—Domestic, 70 to 80 per cent W, 40@45c. per lb. of contained tungsten, f.o.b. works. Foreign, 50c., duty paid, f.o.b. Atlantic ports.

Ferro-uranium—35 to 50 per cent U, $6 per lb. of U contained, f.o.b. works.

Ferrovanadium—$4.25@$4.50 per lb. of V contained, according to analyses and quantity.

Metal Products

Copper Sheets—Current New York list price, 21c. per lb.; wire, 14.75@15c.

Lead Sheets—Full lead sheets, 7⅝c.; cut lead sheets, 8c. in quantity, mill lots.

Nickel Silver—29.50c. per lb. for 18 per cent nickel. Grade "A" sheets.

Yellow Metal — Dimension sheets, 17.25c.; sheathing, 16.25c.; rods, ⅝ to 3 in., 14.25c.

Zinc Sheets—$9 per 100 lb., less 8 per cent on carload lots, f.o.b. works.

Refractories

Bauxite Brick—56 per cent alumina, $50 per ton; 76 per cent, $90@$95 f.o.b. works.

Chrome Cement — 40@45 per cent Cr_2O_3, $30@$32 per net ton, and $31 in sacks, carload lots, f.o.b. eastern shipping points.

Chrome Brick—$48 per net ton.

Fire Brick—First quality, 9-in. shapes, $35@$40 per 1,000, Pennsylvania, Ohio and Kentucky. Second quality, $30@$35.

Magnesite Brick—9-in. straights, $55 per net ton, f.o.b. works.

Silica Brick—9-in., per 1,000, $28@$46 in carload lots, f.o.b. shipping points.

The Iron Trade

Pittsburgh, Nov. 29, 1921

The steel market continues decidedly dull, but production is well maintained. The Steel Corporation has averaged above a 50 per cent operation in the last two or three weeks, and most of the large independents have been doing 40 per cent or better.

The withdrawal of prices below 3c. for black sheets and 4c. for galvanized reported a week ago became practically complete by the middle of last week, and on Friday the American Sheet & Tin Plate Co. announced its prices for the first quarter of the new year at 2.25c. for blue annealed, 3c. for black, and 4c. for galvanized. Buying is light except for immediate requirements, but the prices are expected to hold. The $4.75 price on tin plate for the first half is holding well. In bars, shapes, and plates there is a slight sagging tendency, but when, recently, plates struck 1.50c., they seem to have met with resistance. Bars and shapes are done at 1.50c. only in the case of particularly desirable orders.

Demand for oil-country goods is fair. Wire products are in lighter demand.

Pig Iron—The market continues dull, with prices not quotably changed but showing little evidence of strength. Bessemer, $20; basic, $19; foundry, $20.50, Valley.

Coke

Connellsville—Furnace, $3.25@$3.50; foundry, $4.25@$4.50.

---

[1] Foote Mineral Co., Philadelphia, Pa.

METAL STATISTICS

Monthly Average Prices of Metals

Silver

	New York 1920	New York 1921	London 1920	London 1921	Sterling Exchange 1920	Sterling Exchange 1921
January	132 827	65 950	79 846	39 985	367 082	372 650
February	131 295	59 233	85 005	34 745	337 466	385 932
March	125 551	56 023	74 194	32 479	370 870	389 806
April	119 779	59 337	68 848	34 250	392 438	391 784
May	102 585	59 810	60 010	34 165	383 360	396 580
June	90 957	58 510	51 096	34 971	393 663	377 236
July	91.971	60 260	53 736	37.481	385.538	362.565
August	96 168	61 597	59 875	38 096	360 404	364 505
September	93.675	66 160	59 476	40 082	350 370	371 725
October	83 480	70 970	54 197	41 442	346 460	386 315
November	77.734	68.234	50 952	38.750	342 333	396.315
December	64 774	.	41 845		348 101	......
Year	100 900	......	61 590		364 840	......

New York quotations cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York Electrolytic 1920	New York Electrolytic 1921	London Standard 1920	London Standard 1921	London Electrolytic 1920	London Electrolytic 1921
January	18 918	12 597	118 095	70 964	123 238	79 119
February	18 569	12 556	120 188	70 925	126 950	75 925
March	18 331	11 976	109 533	67 565	118 348	71 190
April	18.660	12.438	103 025	69.381	111 500	71 786
May	18.484	12.742	96 750	73 196	109 200	74 298
June	18 065	12 697	87 864	71 852	101 909	75 682
July	18 576	12 170	90 148	71 155	106 455	75 286
August	18.346	11 634	93 935	68 614	111.143	72 705
September	18 144	11 948	96 381	67 977	111 905	72 295
October	15.934	12.673	93 327	67 327	104 905	73.476
November	14.257	13.035	84 807	66.614	94.614	74.386
December	13.188	......	75 702	......	85 905	
Year	17.456	......	97 480	.	108 839	....

New York quotations, cents per lb. London, pounds sterling per long ton.

Lead

	New York 1920	New York 1921	St Louis 1920	St Louis 1921	London 1920	London 1921
January	8 561	4 821	8 300	4 747	47 095	23 387
February	8 814	4 373	8 601	4 228	50 256	20 650
March	9 145	4 084	8 894	4 000	46 054	18 911
April	8 902	4 356	8 618	4 272	39 225	20 589
May	8 576	4 952	8 352	4 784	38 488	23 399
June	8 323	4 485	8 169	4 293	34 330	22 563
July	8 338	4 410	8 283	4 260	34 960	23 399
August	8 687	4 382	8 725	4 217	36 304	23 489
September	8.177	4.600	8 160	4 392	35 452	23 148
October	7.070	4.690	7 018	4.439	35 238	23 679
November	6 159	4 683	6 127	4 356	32 489	24 483
December	4 727	......	4 717		24 089	......
Year	7 957	......	7 830		37 832	......

New York and St Louis quotations, cents per lb London, pounds sterling per long ton

Tin

	New York 99% 1920	New York 99% 1921	New York Straits 1920	New York Straits 1921	London 1920	London 1921
January	61 596	36 000		[illegible]	376 512	190 464
February	58 466	28 534	59 932	32 142	395 750	166 250
March	61 037	27 296	61 926	[illegible]	[illegible]	156 024
April	61 120	28 990	62 115	[illegible]	345 450	163 905
May	53 230	31 431	[illegible]	[illegible]	[illegible]	177 411
June	46 125	28 514	48 327	[illegible]	[illegible]	167 506
July	45 798	26 755	49 154	[illegible]	[illegible]	164 530
August	43 856	25 662	[illegible]	[illegible]	[illegible]	[illegible]
September	41 940	26 280	[illegible]	[illegible]	[illegible]	[illegible]
October	39 310	27 278	[illegible]	[illegible]	258 190	[illegible]
November	35 667	28 592	36 854	[illegible]	241 080	[illegible]
December	31 135	....	[illegible]		212 440	
Year	48 273		49 161		295 866	

New York quotations, cents per lb London, pounds sterling per long ton

Zinc

	St Louis 1920	St Louis 1921	London 1920	London 1921
January	[illegible]	[illegible]	[illegible]	25 262
February	[illegible]	4 938	[illegible]	[illegible]
March	[illegible]	4 737	[illegible]	25 077
April	8 184	[illegible]	47 388	[illegible]
May	[illegible]	[illegible]	45 088	[illegible]
June	[illegible]	[illegible]	[illegible]	[illegible]
July	[illegible]	4 239	41 886	[illegible]
August	[illegible]	4 186	41 220	[illegible]
September	[illegible]	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	[illegible]	[illegible]
November	[illegible]	[illegible]	[illegible]	25 949
December	[illegible]		27 762	
Year	7 671		44 372	

New York and St. Louis quotations, cents per pound London, pounds sterling per long ton.

Antimony, Quicksilver and Platinum

	Antimony (a) New York 1920	Antimony (a) New York 1921	Quicksilver (b) New York 1920	Quicksilver (b) New York 1921	Platinum (c) New York 1920	Platinum (c) New York 1921
January	10.577	5.258	90 192	48 440	154 23	73 400
February	11 588	5 250	84 432	49 545	151 59	70 227
March	11 056	5 282	92 611	46 796	138 56	72 465
April	10.500	5 137	102 192	45 423	127 04	73 404
May	9.655	5 250	89 560	47 000	97 50	73 740
June	8 289	5 087	90 154	46 846	85 19	74 942
July	7 500	4 735	90 333	44 950	83 94	70 440
August	7 177	4 597	83 806	45 028	111 44	73 222
September	7 113	4 564	75 000	[illegible]	115 20	75 968
October	6 723	5 085	67 200	39 840	101 70	81 500
November	6 109	4 734	58 417	39 804	84 75	82 609
December	5 534	.....	49 577	. .	79 62	.....
Year	8.485	......	81.123	. .	110 90	

(a) Antimony quotations in cents per lb for ordinary brands. (b) Quicksilver in dollars per flask. (c) Platinum in dollars per ounce

Pig Iron, Pittsburgh

	Bessemer 1920	Bessemer 1921	Basic 1920	Basic 1921	No. 2 Foundry 1920	No. 2 Foundry 1921
January	$40 47	33 96	$39 88	31 96	$39 86	33 88
February	42 95	28 96	42 61	26 96	43 40	30 25
March	43 40	28 16	42 90	26 46	43 40	27 85
April	43 72	26 96	44 22	24 46	43 90	26 77
May	44 00	26 21	44 88	23 84	45 36	25 56
June	44 89	24 96	45 41	22 66	46 40	24 38
July	47 21	22 84	47 42	20 76	46 56	22.36
August	48 90	21 96	49 88	20 29	49 35	21 53
September	50 46	21 96	50 46	21 21	51 96	22 82
October	49 21	21 96	44 38	20 96	48 58	22 96
November	41.26	......	39 20	.	42 61	.
December	36.96	....	34 90		37 73	
Year	44.45	......	43 85	.	44 93	.

In dollars per long ton

Monthly Crude Copper Production

	1921 July	1921 August	1921 September	1921 October
Alaska shipments	3,019,812	4,407,434	3,709,844	6,160,847
Arizona Copper	(a)	(a)	(a)	[illegible]
Calumet & Arizona	(a)	(a)	(a)	[illegible]
Con. Ariz. Smelting	(a)	(a)	(a)	[illegible]
Inspiration	(a)	(a)	(a)	[illegible]
Magma	(a)	(a)	(a)	[illegible]
Miami	4,112,000	4,281,000	4,268,000	5,084,000
New Cornelia	1,502,927	1,511,964	[illegible]	[illegible]
Old Dominion	(a)	(a)	(a)	[illegible]
Phelps Dodge	(a)	(a)	(a)	[illegible]
Shattuck Arizona	(a)	(a)	(a)	[illegible]
Ray	(a)	(a)	(a)	[illegible]
United Verde	(a)	(a)	(a)	[illegible]
United Verde Extension	(a)	(a)	(a)	[illegible]
Calumet & Hecla	(a)	(a)	(a)	[illegible]
Other Lake Superior	4,250 000	[illegible]	[illegible]	[illegible]
Anaconda	(a)	(a)	(a)	[illegible]
East Butte	1,000,000	[illegible]	[illegible]	[illegible]
Nevada Cons.	(a)	[illegible]	[illegible]	[illegible]
Chino	(a)	[illegible]	[illegible]	[illegible]
Utah Copper	(a)	(a)	[illegible]	[illegible]
Others estimated	8,150,000	[illegible]	[illegible]	[illegible]
Total United States	22,033,739	23,248,398	23,855,317	23,231,572
Imports: Ore and concentrates, matte, etc.	10,924,973	10,888,426	6,268,635	8,445,551
Imports of blister, unrefined	20,749,969	12,574,740	8,614,851	23,360,893
Imports of refined, etc.	595,835	662,885	10,553,792	761,125
Grand total	[illegible]	[illegible]	[illegible]	[illegible]
Granby Cons.	[illegible]	[illegible]	[illegible]	[illegible]
Braden	943,740	[illegible]	[illegible]	[illegible]
Cananea	(a)	[illegible]	[illegible]	[illegible]
Phelps Dodge Mexican	(a)	[illegible]	[illegible]	[illegible]
Cerro de Pasco	[illegible]	[illegible]	[illegible]	[illegible]
Chile	[illegible]	[illegible]	[illegible]	[illegible]
Katanga	[illegible]	[illegible]	[illegible]	[illegible]
Backus & Johnston	[illegible]	[illegible]	[illegible]	[illegible]
Hampden Cloncurry	(a)	[illegible]	[illegible]	[illegible]
Mount Lyell	892,000	940,000	1,204,000	.
Mount Morgan	[illegible]	[illegible]	[illegible]	[illegible]
Cons. M. & S. of Canada	284,000	209,000	261,855	[illegible]
Falcon Mines	[illegible]	[illegible]	[illegible]	[illegible]
Furukawa	2,641,780			
[illegible]		[illegible]	[illegible]	[illegible]

(a) No copper produced during this month.

Comparative Annual Copper Production

	[illegible]	[illegible]	1921
January	[illegible]	[illegible]	[illegible]
February	[illegible]	[illegible]	[illegible]
March	[illegible]	[illegible]	[illegible]
April	[illegible]	[illegible]	[illegible]
May	[illegible]	[illegible]	[illegible]
June	[illegible]	[illegible]	[illegible]
July	[illegible]	[illegible]	[illegible]
August	[illegible]	[illegible]	[illegible]
September	[illegible]	[illegible]	[illegible]
October	[illegible]	[illegible]	23,231,572
November	[illegible]	[illegible]	......
December	[illegible]	[illegible]	......

MINING STOCKS

Week Ended November 26, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Ahmeek	Boston	57⅞	54	57⅞	Sept. '20, Q	$0.50
Alaska-Br. Col. new.	N. Y. Curb	3⅛	2⅞	2¾		
Allouez	Boston	24½	23	24½	Mar. '19	1.00
Anaconda	New York	45⅞	43¾	45⅝	Nov. '20, Q	1.00
Arcadian Consol	Boston	3⅛	3	3⅛		
Ariz. Com'l	Boston	9⅛	9	9⅛	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*31	*28	*28		
Bingham Mines	Boston	13½	13	13½	Sept. '19, Q	.25
Calumet & Arizona	Boston	54½	53¼	53¼	Sept. '21 Q	.50
Calumet & Hecla	Boston	265	255	265	June '20, Q	5.00
Canada Copper	N. Y. Curb	*28	*28	*28		
Centennial	Boston	9	8½	9	Dec. '18, SA	1.00
Cerro de Pasco	New York	34½	32½	34¼	Mar. '21, Q	.50
Chile Copper	New York	12⅞	12⅜	12¾		
Chino	New York	27½	26¼	27⅜	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*14	*14	*14		
Con. Arizona	N. Y. Curb	*18	*3	*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1¼	1	1⅛		
Copper Range	Boston	36½	35¼	36¼	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*41	*39	*41		
Davis-Daly	Boston	6⅞	6½	6⅞	Mar. '20, Q	.25
East Butte	Boston	11	10	10¾	Dec. '19, A	.50
First National	Boston Curb	*80	*60	*80	Feb. '19, SA	.15
Franklin	Boston	1¾	1¾	1¾		
Gadsden Copper	Boston Curb	*50	*45	*45		
Granby Consol	New York	34½	26⅛	30⅛	May '19, Q	1.25
Greene-Cananea	New York	27	24	27	Nov. '20, Q	.50
Hancock	Boston	2½	2	2		
Howe Sound	N. Y. Curb	2¾	2¾	2¾	Jan. '21, Q	.05
Inspiration Consol	New York	38¼	37	38	Oct. '20, Q	1.00
Iron Cap	Boston Curb	†8	†6	7	Sept. '20, K	.25
Isle Royale	Boston	22⅞	20½	22⅞	Sept. '19, SA	.50
Kennecott	New York	24⅞	24	24⅝	Dec. '20, Q	.50
Keweenaw	Boston	1½	1½	1½		
Lake Copper	Boston	3	2⅞	3		
La Salle	Boston	....	....	1½		
Magma Chief	N. Y. Curb	....	....	*8		
Magma Copper	N. Y. Curb	23¼	21	21	Jan. '19, Q	.50
Majestic	Boston Curb	*7	*6	*7		
Mason Valley	Boston	....	....	1½		
Mass Consolidated	Boston	2¼	2	2	Nov. '17, Q	1.00
Miami Copper	New York	25⅞	24¾	25⅞	Nov. '21, Q	.50
Michigan	Boston	2	2	2		
Mohawk	Boston	55½	52	55½	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	5¼	5⅛	5¼		
Nevada Consol	New York	14¼	13½	14⅛	Sept. '20, Q	.25
New Cornelia	Boston	17½	15⅝	17½	Aug. '20, K	.25
North Butte	Boston	13	11½	12¾	Oct. '18, Q	.25
North Lake	Boston			*18		
Ohio Copper	N. Y. Curb	*10	*7	*10		
Old Dominion	Boston	25¼	23½	25⅞	Dec. '18, Q	1.00
Osceola	Boston	31½	31½	31½	June '20, Q	.50
Phelps Dodge	Open Mar.	†185	†175	....	Oct. '21, Q	1.00
Quincy	Boston	43¼	42	42½	Mar. '20, Q	1.00
Ray Consolidated	New York	14½	14½	14½	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*20	*18	*20		
St. Mary's Min. Ld.	Boston	43	41	43	June '20, K	2.00
Seneca Copper	Boston	24½	24½	24½		
Shannon	Boston	1¼	1	1⅛	Nov. '17, Q	.25
Shattuck Arizona	New York	7¼	6⅝	7⅛	Jan. '20, Q	.25
South Lake	Boston	*62	*62	*62		
Superior & Boston	Boston	1¼	1¼	1¼		
Tenn. C. & C. cfs	New York	10⅛	9⅞	10⅛	May '18, I	1.00
Tuolumne	Boston	*42	*40	*40	May '13	.10
United Verde Ex.	Boston Curb	28	27	28	Nov. 21, Q	.25
Utah Consol	Boston	2½	2	2½	Sept. '18,	.25
Utah Copper	New York	59¾	57	58¾	June '21 Q	.50
Utah Metal & T.	Boston	1½	1¼	1¼	Dec. '17,	.30
Victoria	Boston	..		1½		
Winona	Boston	*45	*45	*45		
Wolverine	Boston	11¾	11	11½		
		NICKEL-COPPER				
Internat. Nickel	New York	13	11¾	12¾	Mar. '19,	.50
Internat. Nickel, pf.	New York	67	67	67	Nov. '21, Q	1.50
		LEAD				
National Lead	New York	81½	80⅛	81½	Sept. '21, Q	1.50
National Lead, pfd.	New York	108	105	106¼	Sept. '21 Q	1.75
St. Joseph Lead	New York	14	13½	14	Sept. '21, Q	.25
		QUICKSILVER				
New Idria	Boston	*40	*40	*40		
		ZINC				
Am. Z. L. & S.	New York	11½	10¾	11	May '20,	1.00
Am. Z. L. & S. pfd	New York	36	34¼	35	Nov. '20, Q	1.50
Butte C. & Z.	New York	5½	5¼	5½	June '18,	.50
Butte & Superior	New York	17¾	16¾	17¾	Sept. '20,	1.25
Callahan Z.-L.	New York	7¼	6½	6¾	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb			124¾	Nov. '21 Q	2.00
Success	N. Y. Curb			2	July '16	.03
Yellow Pine	Los Angeles	*40	*40	*40	Sept. '20, Q	.03

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills, Spokane, Pohlman Investment Co., Salt Lake, Stock and Mining Exchange, Los Angeles, Chamber of Commerce and Oil, Colorado Springs The Financial Press N. Y.

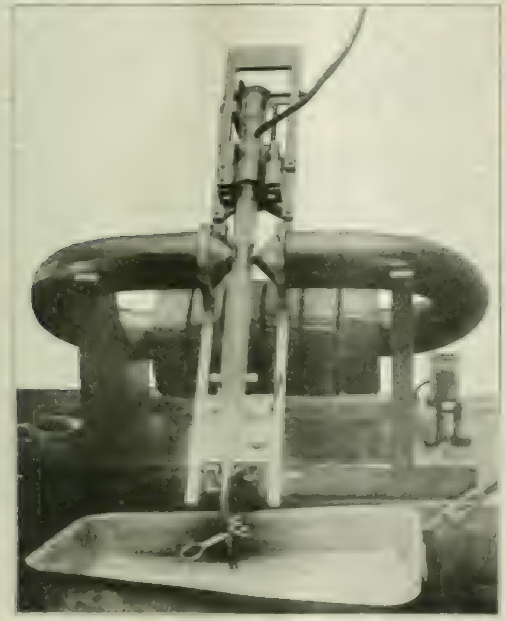
Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	½	⅜	½		
Alaska Juneau	New York	⅞	⅝	¾		
Carson Hill	Boston	15⅛	13¾	15⅛		
Cresson Consol. G.	N. Y. Curb	2⅛	2	2 1/16	June '20, Q	$0.10
Dome Extension	Toronto	*73	*71	*71		
Dome Mines	New York	19½	19	19	Oct. '21, Q	.25
Florence Goldfield	N.Y. Curb	*32	*25	*25		
Golden Cycle	Colo. Springs	*73	*72⅞	*72⅞	June '21, Q	.02
Goldfield Consol.	N. Y. Curb			*4	Dec. '19,	.05
Hollinger Consol.	Toronto	7.90	7.78	7.83	Nov. '21, 4 wks.	.05
Homestake Mining	New York	55	55	55	Nov. '21, M	.25
Kirkland Lake	Toronto	*35	*30	*34		
Lake Shore	Toronto	1.23	1.20	1.23	Nov. '21, K	.02
McIntyre-Porcupine	Toronto	1.98	1.91	1.98	Sept. '21, K	.05
Porcupine Crown	Toronto	*15	*13½	*14½	July '17,	.03
Porcupine V. N. T.	Toronto	*18	*16½	*17		
Portland	Colo. Springs	*33	*33	*33	Oct. '20, Q	.01
Reorgan. Booth	N. Y. Curb	....	....	*4	May '19,	.05
Schumacher	Toronto	*26	*23	*24		
Silver Pick	N. Y. Curb	....	....	*8		
Teck Hughes	Toronto	*17	*15	*14		
Tom Reed	Los Angeles	*40	*38	*38	Dec. '19,	.02
United Eastern	N. Y. Curb	2 7/16	2 5/16	2⅜	Oct. '21, Q	.15
Vindicator Consol	Colo. Springs	*22	*22	*22	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	....	....	*4		
Yukon Gold	N. Y. Curb	1¼	1⅛	1⅛	June '18,	.02½
		SILVER				
Arizona Silver	Boston Curb	....	....	*18	Apr. '20, M	.03
Batopilas Mining	New York	½	½	½	Dec. '07, I	.12½
Beaver Consol	Toronto	*22	*20	*20½	May '20, K	.03
Coniagas	Toronto	1.50	1.15	1.50	May '21, Q	.12½
Crown Reserve	Toronto	*12	*9	*11½	Jan. '17,	.05
Kerr Lake	N. Y. Curb	....	....	3⅞	Oct. '21, Q	.12½
La Rose	Toronto	*33	*31½	*32¾	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*17	*14	*17	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.18	1.03	1.15	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	7	6	6½	Oct. '21, Q	.03
Ontario Silver	New York	4⅞	4¼	4¼	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	....	....	*12	Jan. '12,	.10
Temiskaming	Toronto	*27	*25	*27	Jan. '20, K	.04
Trethewey	Toronto	*12½	*8½	*7¾	Jan. '19,	.05
		GOLD AND SILVER				
Boston & Montana	N. Y. Curb	*95	*81	*83		
Cash Boy	N. Y. Curb	*5	*4	*5		
Consol. Virginia	San Francisco	†66	†65			
Dolores Esperanza	N. Y. Curb	1½	1½	1½		
El Salvador	N. Y. Curb	*11	*9	*10		
Jim Butler	N. Y. Curb	....	....	*7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*3	*3	*3	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	⅛		
MacNamara M.& M.	N. Y. Curb	*12	*11	*12	May '10,	.02½
Tonopah-Belmont	N. Y. Curb	1 5/16	1⅜	1 5/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*68	*66	*66		
Tonopah-Extension	N. Y. Curb	1¾	1⅝	1¾	Oct. '21, Q	.05
Tonopah Mining	N. Y. Curb	1⅞	1¾	1⅞	Oct. '21, SA	.05
West End Consol	N. Y. Curb	*87	*80	*85	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N. Y. Curb	*8	*7	*8	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	*92	*92	*92	Dec. '20,	.15
Chief Consol	Boston Curb	†3⅛	†3	3⅛	Aug. '21, Q	.05
Consol. M. & S.	Montreal	19	18½	18½	Oct. '20, Q	.62½
Daly Mining	Salt Lake	....	†1.00	..	July '20, Q	.10
Daly-West	Boston	1½	1½	1½	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†3	†2½	2½	Apr. '21, K	.05
Electric Point	Spokane	*3	*3	*3	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*35	*25	*26		
Federal M. & S.	New York	10	10	10	Jan. '09,	1.50
Federal M. & S., pfd	New York	35	31½	34¾	Sept. '21, Q	1.00
Florence Silver	Spokane	*11	*10	*11	Apr. '19,	.01¼
Grand Central	Salt Lake	†*40	†*25	...	June '20, K	.03
Hecla Mining	N. Y. Curb	4½	4 7/16	4½	Sept. '21, Q	.10
Iron Blossom Con.	N. Y. Curb	....	....	*17	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	....	†2.00	..	Sept. '20, Q	12½
Marsh Mines	N. Y. Curb	....	....	*3	June '21, I	.02
Prince Consol	Salt Lake	†*7	†*5½	*7	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*1	*1	*1	Feb. '19,	.01
Rex Consol	N. Y. Curb	*9	*8	*8		
South Hecla	Salt Lake	†*50	†*20	.	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*10	*10	*10	Oct. '17,	.05
Stewart Mining	N. Y. Curb	*3	*3	*3	Dec. '15	.05
Tamarack-Custer	Spokane	1.98	1.75	1.95	Jan. '21 K	.04
Tintic Standard	Salt Lake	2.00	1.97½	1.97½	July '21, Q	.05
Utah Apex	Boston	3⅛	2 15/16	3 1/16	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	.	..	*2	Nov. '17,	.01
		VANADIUM				
Vanadium Corp.	New York	32¾	30½	32¾	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp	Montreal	57½	57	57	Oct. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	....	....	79½	Oct. '21, Q	1.75
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	41¾	40¾	41¾	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf	New York	84½	81¾	84	Sept '21, Q	1.75
Am. Sm. pf. A	New York	87	85½	87	Oct. '21, Q	1.50
U. S. Sm. R. & M.	New York	34½	33	33¾	Jan. '21, Q	.50
U. S. Sm. R. & M. pf.	New York	42½	42½	42½	Oct. '21, Q	.87½

NEW MACHINERY AND INVENTIONS

Analyzer for Determining Amount of Magnetic Iron in Concentrate

The Davis Tube Analyzer is a simple device for quickly reducing a sample of ore so that the magnetic iron percentage can be accurately computed. It was developed by the experimental mines station of the University of Minnesota, of which E. W. Davis is the head.

Briefly, its operation is as follows: A sample of ore is placed in the glass tube, shown in the illustration, which has previously been filled with water. The carriage and tube are then automatically rocked, the carriage bearings being placed at the poles of the magnet. A stream of water passes through the tube, washing away the tailings from the concentrate, which is held at the poles. When the washing is completed, the magnetic assay is easily made.



DAVIS TUBE ANALYZER

Accurate results are obtained on strongly magnetic material when crushed to 100 mesh. The machine can be operated on coarser material, but the results obtained may show slight error. The power with which the magnetic coils are supplied should be 100 v., d.c., and the motor which rocks the carriage can be operated on either an alternating or direct current of 110 v. A clean wash water supply should be provided, with light rubber tubes for connections. It may be necessary to distill the water, for if as much as ½ gm. of solids remains after evaporating a liter of the water, the determinations will be inaccurate. A head of 3 ft. of water at the tube is sufficient for operation.

Computation is easiest when exactly 10 gm. of ore, crushed to 100 mesh, are used. The clamp on the rubber hose at the lower end of the glass tube is tightened, and the tube filled with water to within a few inches of the top. The current through the magnets is then turned on, and the tube is placed in an upright position. The 10 gm. of ore are then charged into the tube, the rubber stopper is placed in the top, and the carriage and tube are tipped to an angle of approximately 45 deg. The clamp on the rubber tube is then adjusted to deliver about one gallon in ten minutes into the earthenware evaporating pan below.

The motor is then started and adjusted to drive the carriage at a speed of 60 to 100 strokes per minute. The rocking of the tube and carriage should continue for about ten minutes, when the magnetic concentrate should have collected at the poles of the magnet and should be perfectly clean, all tailings having been washed out into the pan below. If the water in the tube is not perfectly clear at the end of this time, or if the concentrate appears unclean, the operation should be continued for a greater length of time, the tube being tilted to a more nearly vertical position.

When the cleaning has been completed the water supply is stopped. The glass tube is then released from the carriage and is moved upward between the poles, the concentrate moving downward in the glass tube so that it always remains opposite the poles. When the concentrate has reached the lower end of the tube, the rubber stopper is taken out and the rubber tube at the lower end opened, allowing the water to flow out into the pan. When the water level in the tube has reached a point slightly above the concentrate at the magnet, the flow is stopped by the closing of the rubber tube and the glass tube is taken from the magnet.

The concentrate and the remaining water should then be allowed to flow out into a beaker. A little wash water should be passed through the tube completely to remove all particles of concentrate. Most of the water can then be decanted from the concentrate by placing the bottom of the beaker on the magnet and decanting the water into the pan.

The beaker containing the concentrate should be dried over a hot plate and should be carefully weighed; the concentrate is then ready for assay. The evaporating pan containing the tailings and the water should also be dried over a hot plate. As the water nears the boiling point, practically all of the solid matter will settle to the bottom of the pan. The clear water at the top may be siphoned off. The remainder is evaporated to dryness, and the dry tailing is removed from the pan and is analyzed.

A complete computation for magnetic iron may be made when the soluble iron assays of the feed, concentrate and tailing and the weight of the concentrate are known.

The device is now being manufactured commercially by the Dings Magnetic Separator Co., Milwaukee, Wis.

Drilling Operations Shown In the Movies

The U. S. Bureau of Mines is distributing a four-reel educational film entitled "The Story of Rock Drilling," which is of considerable interest to mining men. Pictures of actual drilling operations are shown, in addition to the methods and machines employed for rock drilling of many kinds.

The quarrying scenes were taken at the Westerly, R. I., quarry of the [illegible] Quarry Co. The operation of [illegible] drills and [illegible] hammer drills, as well as of heavy-duty piston drills

SULLIVAN ROTATOR HAMMER DRILL [illegible] THE OTTAWA SHAFT OF THE [illegible] HURLEY, WIS.

mounted on tripods and quarry bars, is interestingly illustrated. [illegible] work, steam drilling, and [illegible] are some of the features.

A Bureau of Mines engineer and the camera man also went to Northern New York, where they photographed scenes at the [illegible] [illegible] drills of various types are used for [illegible] [illegible] and [illegible]

Wis., in the Lake Superior country, other rock-drilling pictures were taken, including shaft-sinking operations, carried on at a depth of over seventeen hundred feet below the surface. The uses of drill sharpening machines and pyrometer-controlled drill-steel heating furnaces were also photographed.

SULLIVAN ROCK DRILLS ON TRIPODS AND SULLIVAN STONE-CHANNELING MACHINE AT NIAGARA FALLS POWER CO. CANAL

Nearly a week was spent at Niagara Falls, in photographing rock excavation methods on the ten-mile canal of the Hydro-Electric Power Commission of Ontario. This canal is about to be opened, and will develop nearly half a million additional horsepower from Niagara Falls. Nearly one hundred heavy-duty rock drills, one hundred or more rotator hammer drills, and twenty stone-channeling machines of the largest size have been used on this work and are shown in the pictures, with all the details of their operation. Some of the largest steam and electric shovels in the country are also illustrated.

The Sullivan Machinery Co. co-operated with the Bureau of Mines in securing these pictures. They may be secured on loan by addressing the U. S. Bureau of Mines Experiment Station, Pittsburgh, Pa., from which place all moving pictures of the Bureau are distributed.

INDUSTRIAL NOTES

Homer W. Scott is in charge of the Cleveland office of the Jeffrey Manufacturing Co., located at 437 Leader-News Bldg., and C. R. Heller is in charge of the Buffalo office, located at 1108 Marine Trust Bldg.

The Austin Machinery Corpn. announces that the Canadian Austin Machinery, Ltd., Woodstock, Ontario, incorporated under the laws of Canada, will henceforth act as sole manufacturers and distributors in Canada of the complete Austin line of earth-moving and concrete-mixing equipment.

Announcement is made of the resignation of A. E. Ratner from the firm of Brile & Ratner, Inc., and of the opening of his own offices at 128 Broadway, New York, where he will continue his activities in the metal and chemical business on a commission and brokerage basis.

The International Ores & Metals Selling Corporation, 280 Broadway, New York, is the exclusive American agent for the Société Miniere et Metallurgique de Penarroya, Corocoro United Copper Mines of Bolivia, the Société de Minerais de Cuivre de Naltagua, Chile, and also specializes in all minerals, ores and metals produced in France and the French colonies. This company, which is under the direction of Abraham Blum, is a subsidiary of Minerais & Metaux, the organization of which is an outgrowth of the consortium that handled practically all of the minerals and metals imported and allocated to the various French industries during the war.

The Combustion Engineering Corporation, 43 Broad St., New York, announces the recent opening of two branch offices, one at 216 Latta Arcade, Charlotte, N. C., in charge of T. E. Nott, and the other at Seattle, Wash., where the company is represented by Fryer-Barker Co., 1133 Henry Building.

The Koppel Industrial Car & Equipment Co., manufacturer of industrial cars, at Koppel, Pa., has opened a new district office at Kansas City, Mo., in the Railway Exchange Building. Harry C. Kraft, formerly with the New York office, has been appointed manager of the Kansas City district.

The W. A. Jones Foundry & Machine Co., announces the appointment of Fred E. Holtz as its Milwaukee district representative. He will assume his new duties immediately, making headquarters in the First National Bank Building.

The Bucyrus Co., announces the removal of its New York office to Suite 728, 30 Church St., with E. G. Lewis in charge as Eastern sales manager, effective Dec. 1. M. J. Woodhull has been appointed central sales manager to succeed Mr. Lewis, in charge of the Chicago office, 622 McCormick Building. E. R. Weber has been appointed northern sales manager, at Minneapolis, 1224 McKnight Building, to succeed J. N. Gawthrop, who will become associated with Mr. Lewis in New York.

The Southwestern Engineering Co. of Los Angeles, Cal., announces that it has recently shipped a complete mill to the Pregones Mining Co., of Iguala, Guerrero, Mexico, consisting of a No. 43 Marcy mill, Dorr Simplex Classifier, two Type A, No. 2610K and K flotation machines, Remco redwood pipe and tank, Southwestern ore feeder, Leffel water wheel, and other equipment. This is a silver-gold property which expects to be operating soon.

The Southwestern Engineering Co. also reports that it has an order for, and will ship within the next few weeks, a complete mill to the Cia Minera Metallurgica Regeneradora de Comanja, Jalisco, Mexico. This latter order includes a Marcy mill, Wheeling Crusher, Dorr Classifier, Hamill ore feeder, two K and K flotation machines, Krogh centrifugal pump and a 10,000-gal. Remco redwood tank.

The Traylor Engineering Co., Allentown, Pa., has recently shipped eighteen 7 x 10 ft. tube mills, one 72 x 30 in. type AA rolls, and four 54 x 24 in. type AA rolls, to the Britannia Mining & Smelting Co., Howe Sound, British Columbia.

TRADE CATALOGS

Pulverized Fuels—Catalog No. 9, "Pulverized Fuels," has been published by the Hardinge Co., 120 Broadway, New York. This bulletin is divided into three main sections, viz., the application of pulverized fuel to various burning problems, the principle of operation of the Hardinge mill, and a discussion of the application of the Hardinge system for pulverizing fuels.

Forge Furnaces—W. S. Rockwell Co., 50 Church St., New York, have issued Bulletin No. 239, which relates to an improved type of forge furnace to meet the demand for equipment which will lower production costs. The novel features of the furnace consist of means for better application of the heat, protection of the operator, and utilization of waste gases to preheat air and fuel for combustion.

Crushing Rolls—Bulletin No. 13, "Buchanan Crushing Rolls," issued by C. G. Buchanan Co., Inc., 90 West St., New York, contains general information on this subject. A brief history of the origin and first introduction of rolls is given, together with data on the large capacity and comparatively small amount of power required to operate the early machines. Limitations with regard to sizes and reductions, tables, capacities, and diagrams relating to present machines are included in the pamphlet.

Platinum—Baker & Co., Inc., Newark, N. J., have issued an 83-page booklet entitled "Data Concerning Platinum." The fourteenth edition of this publication contains, in addition to a full list of the various appliances made by the company, new tables and valuable information that are arranged in convenient form.

Mine Cars—The Lincoln Steel & Forge Co., 5,701 Natural Bridge Ave., St. Louis, Mo., have ready for distribution an interesting pamphlet entitled "Why a Journal Box Mine Car Truck?" The text is supplemented by charts showing the principle of this type of construction. The company will be glad to send the books to executives, mine superintendents, and engineers upon request.

Machine Tools—A new machine tool, known as the No. 4F, horizontal boring, drilling and milling machine, built to drive high-speed tool steels to capacity limits, is completely described in the P. & H. Bulletin No. 4F, recently issued by Pawling & Harnischfeger Co., Milwaukee, Wis.

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor.
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

[illegible]
[illegible]
[illegible]
SIR JAMES [illegible]
[illegible]
J. VOLNEY LEWIS
[illegible]
Consulting Editors

Volume 112 New York, December 10, 1921 Number 23

The Future of Mining

FIFTY YEARS AGO new mining camps were being opened up everywhere through the West. Twenty-five years ago we still had little idea of the limits of our mineral resources, which appeared endless, and so we believed them. Have we grasped what has been going on in the last ten years? Mining has gone on actively; a great reinvigoration of mining activity has been gained by the development of vast low-grade mines, of a tenor previously scorned, especially of copper; and with less success, or with failure, of those of gold. Dredging has made it possible to extract the last few cents of gold from placer gravels previously passed over as unworkable. Meantime, great organizations of capital, served by exploration, geological, and engineering talent, have been systematically sifting the country for new mines of low or high grade wherein to invest the funds they have reaped from the mines they have exhausted or are exhausting. Thousands of mines and prospects are examined, and perhaps one in a thousand or one in five thousand, if the investigators are patient enough, can be made to yield some profit.

It is the gleaners—so soon—going over the field. And there have been many of them, for there are many strong companies whose exploration departments have followed one another from preferred mine to possible prospect. Some of our great companies have quit—abandoned their exploration departments and contented themselves with what they have, giving up the idea of replacement, and perhaps embarking their surplus capital on other lines of business.

Does this mean that mining is on the decline, and that it will disappear? Not so. The world is still fresh for the miner, in many vast areas. It means that our strenuous American mining enterprise must follow the lead of the British, and look upon the globe as its field. It means that our Government must recognize that the sphere of American mining enterprises, which is to feed the demands of our population, is in any and all foreign countries, and is to be followed and protected and fostered there as much as at home. Mining will not die. More and more the world will need the metals. But we shall see world shortages, one after the other, in the ores of many of the metals, *of the grade now exploited*, and consequent necessity of new methods and working lower and lower grades of ore.

In anticipating the great revival of mining which will take place with the restoration of a peaceful growing civilization to the world—and we trust that will soon be brought about—we must look to areas outside of Europe and the United States as better hunting grounds than our old ones have now become: to Arctic America, Latin America, Asia and Africa. And the company that specifies that it will be interested only in mines close to transportation, and where the climate is right, and not too far from New York or London, will be left in the rear of the procession. Transportation was very bad to California, the Comstock, Guanajuato, and the Klondike when they began to be worked. If there are great mines to be opened up yet—and there are—it is because the going has been less good to them than elsewhere.

To the pioneer and the trail breaker belong the future, as the past, of mining.

Decreasing Costs of Production

NO DOUBT many of our readers living in the larger cities have had the pleasure of hearing Mr. B. Seebohm Rowntree speak on the problems of industrial management during the last two months. Mr. Rowntree is at the head of a cocoa works in York, England, employing 7,000 men and women, and which has not suffered from a strike in thirty-one years. He is a most attractive speaker and impresses one with the logic of his arguments. American business men, Mr. Rowntree says, have no equals in their zeal to adopt the most efficient machines and processes, and have no hesitancy in scrapping the most elaborate plant if a saving in cost can be shown. On the other hand, he feels that often much greater savings can be made by securing greater co-operation between plant managers and operators. (We do not like the term "workers"; for the man who sits at a mahogany desk works just as hard and gets just as tired, and does, moreover, just as necessary work, as the man who dons the overalls.)

The success that Mr. Rowntree has had in working out his ideas in England, the amount of study he has given to the subject, and the consultations he has had with men like Lloyd George and Herbert Hoover merit our attention. As to wages, he believes that the minimum wage paid to a married man should be sufficient to house, feed and clothe him and his family comfortably, to take care of normal running expenses, to provide a modest amount for entertainment and savings, and to provide for the education of two or three children. This is the principal feature in which our present system falls down, in Mr. Rowntree's opinion, and he stated that he was not even able to pay such a minimum wage in his own plant. [illegible] hours of work a week should be given for the [illegible] wage. This seems just to us, for normal conditions where the employee is not compelled to waste time at work, or getting to and from his work.

The economic position of the [illegible] on. Unemployment [illegible] big [illegible], and were a man assured of constant employment, he would be willing to accept a lower wage [illegible] than otherwise. Attempts should be made to [illegible] in certain industries. Other work should be substituted where possible and the employees trained to do more than one thing or sent to other districts where conditions are better. The [illegible] law in force in England Mr. Rowntree believes to be a good thing, despite the unfavorable reports of its operation which sometimes reach this side of the water. He pointed out that equally unfavorable reports of our prohibition law are current in England, but since coming here he had found only two prominent business men who were not in favor of it, compared with the loose control of liquor distribution which obtained before the law went into effect.

But we are digressing. About three and one-half per cent of the wage bill in England goes to provide unemployment insurance. However, as Mr. Rowntree said, the amount is variable according to conditions, and it may also be raised in different ways, from the government, employer, or employee. In case of unemployment, fifty per cent of the regular wage is paid to a single man, with, we believe sixty per cent to a married man, and further increases where there are children. He did not think that employees showed much inclination to shirk work to get the insurance. Possibly some scheme could be devised to prevent this, such as an investigation to determine whether an honest effort had been made to obtain work, or if it had been offered and refused.

The status of the worker in the plant was the fourth point of importance. The employee should not, of course, control the work, but he should have something to say about the methods of conducting it, and his advice and co-operation should be invited. Outside representatives of labor unions should not be barred from the right of consultation. Finally, the employee should share in the profits of the enterprise to the extent, so far as practicable, that his increased efforts have contributed to such profits.

Mr. Rowntree's ideas have been embodied more fully in a book which he has written, "Common Sense in Business." Many of his arguments are those of the idealist, and, as he frankly stated, he has not yet found it possible to apply them even in his own plant. But they are the things we should seek gradually to bring about, in order to have the fullest co-operation between the groups known as Capital and Labor, and consequently the most economic methods of production. If Americans are backward in their study and application of these or other modern precepts for the conduct of business and production it is high time we gave them more attention. Perhaps we have been too wont to wave them away with the remark that they are not practicable. Very well, then, make them practicable!

Mechanical Loading Underground

IN THIS ISSUE we are publishing the first of three articles which cover in a complete manner the application of small-type compressed-air hoists to underground loading. In combination with various types of scrapers or "slushers," the use of the small hoist is beginning to play an important part in the operation of "mucking," for not only has it been possible to secure a greater tonnage thereby but a lower cost as well. The subject has been thoroughly studied in copper, lead, zinc, and iron mines, and the application of "scraper" systems to various methods of mining will be detailed.

Increasing costs for labor, supplies, and other expenses contingent to ore removal underground have made necessary the application of such mechanical devices as have been found suitable and economical, and these, together with the adoption of improved mining methods, have made it possible to keep production costs at a figure that will allow a profit to the operator. Formerly, the selection of a mining method was dependent almost entirely on the experience of the mine captain or other official in charge of the work, and the process of mine development proceeded in a fashion which was not always profitable, either from the standpoint of day-to-day production or the ultimate life of the mine. But the old order has changed, and today careful planning and systematic estimation of ways and means are considered essential before the adoption of a mining method.

The removal of ore from stopes, adequate support of workings, transportation of ore, and other considerations must have their place in the flow sheet, and the cost of each held to a reasonable proportion, if the development plan is to be a success.

We believe that the institution of scraper systems underground is a highly important development in the mechanicalization of underground mine work.

The Shyness of the Engineer

THE ENGINEER is notoriously ill at ease, awkward, and inept in public; he shrinks back upon himself and his profession. That stands in the way of his prominence as a leader, and ties him to the chariot of some man with no greater or with less ability, less command of facts, principles, and logic, but of more direct though cruder force, more versatile, fluent, and sympathetic with those moods of men which sway them more than reasons.

Of all the types of engineer, the mining engineer possibly has these characteristics most pronounced. Dinners are a terror to him if he imagines he may be called upon for a few words. His reason works best alone with facts: He thinks in the mine, or over the drafting board—not on his feet or eye to eye. He theorizes about his duty as a citizen, but makes little practical start at coming forward. Realizing his own small share in the universe, he is inclined to stand in awe of men of no heavier caliber than he.

It is a healthful sign of the times that our citizens, great and little, are tending more and more to chip in and do their bit cheerfully, whenever they see a chance to help out. You will note this earnest spirit everywhere—men of business, of affairs, of statesmanship, are democratic in their willingness to serve in small things, to be conferred with, to speak, to write, to fulfill all reasonable and helpful demands so far as they can. In a less measure this is true of engineers; and least of all perhaps of the mining engineers.

On going over a recent appraisal of leading engineers, a prominent technical journal discovered that of the mechanical and electrical engineers rated as the leaders all were occasional contributors to its columns. A survey of the corresponding mining engineers revealed the fact that many of them had never contributed out of their experience any written article to any publication. Their sense of brotherhood, of helpfulness, of service to their fellow-engineer was deficient. It is each man's duty, if he has had special experience, to share that experience, by writing and speaking, when he can—when he is requested, which is a fairly good rule, for he will not be asked unless his help is needed.

We have another example of this quality in the shrinking from publicity, in the refusal to have personal notices, photographs, or intimate sketches published. Those of us who are or have been in this frame of mind—and it is a very common malady with the most of us mining engineers—mistake, or try to pretend to ourselves that we mistake, our failing for a virtue. It is not a virtue: it is the fault of exaggerated self-consciousness. The man who is hungry for publicity, who maneuvers so that he may hear the sound of his own voice raised in public papers, so that he may see his name in print for the pleasure of feeling himself in the limelight, suffers from precisely the same malady—an exaggerated ego.

Your really balanced man—the man we all would like to be—has lost sight of his little self in the contemplation of swirling humanity, of many figures of men whom he respects, of the marvelously great universe around him. He has lost self-consciousness. He is no longer shy. He will speak if asked—or if he has an idea he will out with it without trepidation. It is all one to him whether his picture is published or not—if it will please anybody, ever so little, he is willing to help. If he can help by writing from his experience, or if anybody thinks he can help, well and good: he will write. But if no one wants him to write, if he has no conscious message, it is all one to him whether he never sees his name in print, or whether the newspapers are spotted with his name and doings.

He loves mankind, and is humble, yet is thankful for his ticket to the stage of life; he is determined, yet kindly; he wants to serve, in all things big and little. He does not pride himself on his modesty, nor does he pride himself on his ability to get on. He is not oppressed by his greatness, if he has risen to one of those little great positions which look so large to the man of narrow experience and of short perspective.

When some future city shall be to New York as New York is to Rome, as Rome was to Babylon—where then will be your little eminence? Verily, the future historian, a hundred years hence, shall not be able to locate thee with a fine-toothed comb. That time will come soon enough. Therefore, shed the oppressive robes of sequestered dignity, and get busy, and circulate freely while your little day is still bright. You'll be a long time dead.

Simplification of Manufactured Products

A MOVEMENT that may have far-reaching effects on many of the mineral-product industries had its inception on Nov. 15 in Washington at a conference called to discuss the possibility of reducing the number of varieties of paving brick now on the market. Invitations to the conference were sent out by the Department of Commerce at the request of the National Paving Brick Manufacturers' Association, and included representatives from the manufacturers, engineering and highway associations, and Government bureaus.

Remarkable progress was made, for the conference went on record as recommending that of the sixty-six styles of paving brick now manufactured, fifty-five are to be regarded as superfluous, eleven only being retained as standard. A representative committee of ten members was appointed to initiate any necessary subsequent changes. Highway engineers present expressed a willingness to write new specifications in accordance with the recommendations outlined, and manufacturers are committed to confining production of other than standard sizes to unfinished contracts, repair work and special orders.

It is evident that such a wholesale reduction in the number of varieties will greatly simplify both manufacturing and road paving, and will materially reduce the cost of both operations. The advantages of such a step are so pronounced that the conference is to be congratulated on the result of its deliberations.

The importance of this movement can scarcely be estimated at this time; it may even mark a new era in manufacturing processes, for many other industries are considering similar simplification of products.

The active interest in evidence among various manufacturers tending toward a substantial reduction in the number of varieties of their products has led the Department of Commerce to seek an expert in such simplification of standards, who will act as a liaison officer to bring together all the interested parties in each particular group, to harmonize their various interests, and to assist in working out the desired reductions in sizes or styles.

It is a matter of particular interest that this movement, which may become nation-wide in its scope, had its real beginning in a basic mining industry. There is a wide field for similar adjustments in many other branches of mining, particularly in the non-metallics, where many of the final products are manufactured at the mine or quarry.

The outcome of future conferences of this character will be awaited with interest, and the hope is expressed that many of the leading mining men will follow such events from the conference floor rather than from the gallery.

Maintaining Healthy Miners

SANITATION at metal mines plays an important part in the routine of the operator's duties today. In a consideration of the various factors that go to make up an efficient organization it is recognized that "a contented workman is a good workman," and that every effort must be made to insure, so far as the company is able, a healthy body. Proper toilet facilities, change houses, drinking water, shower baths, and other equipment are responsible in large measure for the prevention of disease at mines; proper ventilation, instruction in hygiene, and the providing of suitable recreation may be mentioned as other means.

Earlier investigations of occupational diseases at mines showed an unusual prevalence of pulmonary tuberculosis, but of late years there has been a gratifying reduction of such cases. The U. S. Bureau of Mines, the National Safety Council, the National Tuberculosis Association, individual mining companies, and others have been making a continuous fight against the disease. But this work must go on.

During December the National Tuberculosis Association and its affiliated agencies are carrying on the fourteenth annual sale of Christmas seals. Briefly summarized, eight elements in the campaign to which the funds so obtained are applied are: Toward increasing the number of hospitals and sanatoriums; for establishing nearly 600 clinics and dispensaries; in securing at least 3,000 public health nurses who instruct in the home, mothers and their families; toward research work; for statistical study; for publicity in distributing during the last sixteen years approximately 1,000,000 pieces of printed matter; for the Modern Health Crusade, which has enrolled nearly 6,000,000 school children who are learning daily health habits; and toward securing over 1,000 open-air schools

WHAT OTHERS THINK

Side-Charging of Reverberatory Furnaces

The interesting editorial study of the "History of Side-Charging of Reverberatory Furnaces" in *Engineering and Mining Journal* of Nov. 26 calls to mind interesting phases in the development of Western smelting practice. One should bear in mind that the problems of fettling and charging were entirely separate, at least as far as practice was concerned, until the men at the Canadian Copper Co. discovered that a banked charge constituted a self-renewable fettling.

I can speak of my own knowledge of the changes in furnace design instituted by engineers with the Anaconda Copper Mining Co. Notwithstanding the fact that calcine tracks lie parallel with the furnace, charging was done through hoppers set across the Anaconda furnaces near the firing end. This method of charging was thought to be ideal, so the layout at Tooele—a smelter designed in 1909 by Charles H. Repath, mechanical superintendent of the Washoe plant—was for parallel tracks for coal and calcine, running overhead through the building at right angles to the furnaces. A similar track layout in the reverberatory plant was adopted by Messrs. Repath and McGregor in other Southwestern smelters designed by them from 1910 to 1914. No fettling holes were provided through the skewback in the original furnaces built at Tooele (1909-1910).

Having in view the possibilities of fettling through charge-holes, successfully practiced for many years at Cananea, I proposed a return to the Anaconda layout—double tracks over the furnace from end to end—in the preliminary design for the smelter reconstruction at Great Falls (1911). The very difficult topography of the site, and the desire to use standard-gage equipment and easy curves, forced a return to the then "standard" layout. In order to fettle through the arch, however, a narrow-gage track was laid on top of the brickwork of the furnace side walls, and a small hopper car transferred fettling matter from hoppers hung under the calcine tracks to the various drop-holes. This scheme was possible on the reverberatories designed under the direction of J. H. Klepinger, superintendent, and Peter Thill, master mechanic, and built there in 1912-1913, as these furnaces were cased in steel plate, and the arch thrust carried into a heavy slag foundation by inclined struts, thus wholly eliminating tie rods.

During the winter of 1913-14, experiments on pulverized-coal firing and side-charging were made at Anaconda, and were highly successful. By the summer time, at least one of the Anaconda furnaces was steadily smelting at a then unheard-of and extraordinary rate, with fine charge banked up on either side clear to the roof. Tiny rivulets of molten ore seemed to spring from the hot slopes. Hoppers were kept loaded, and charging was continuous. Necessity for fettling had gone, for the sides of the furnace were a bank of ore, constantly renewed. This was the logical extension of the idea which the Anaconda men freely attributed to the Canadians.

You should mention an interesting variation of the side-charging scheme as developed by James Heggie, then general superintendent of the El Paso plant of the American Smelting & Refining Co., and applied to reverberatories at that plant and at Hayden, Ariz. Originally built in 1912 as copies of the successful old Garfield long reverberatories, with a multitude of small buckstays, the Hayden furnaces were rebuilt to allow side charging through mangers some time previous to 1916. This involved piercing the side walls with broad, arched openings, requiring a buckstay spacing of about 9 ft. An inclined plate sloped outward and upward from the sill, forming the outer support of a heap of ore, converter slag and flux which entirely closed the opening. This cold material was always heaped high, and it rolled down into the furnace as the lower portions were smelted.

E. E. THUM,
Formerly Engineer, Great Falls
Reduction Department,
Anaconda Copper Mining Co.
New York.

The Horn of the Hunter

Prompted by your very praiseworthy effort to reduce the retail selling price of manufactured brass and copper articles to a level commensurate with the present wholesale price of copper metal, I wish to call your attention to the present exorbitant retail prices of shot-gun shells and rifle cartridges, in the manufacture of which copper and lead play the most important parts.

Shot-gun shells that sold at 70c. and 75c. per box of 25 in 1914 today cost the sportsman \$1.30 to \$1.40 per box, and cartridge prices show a proportionate if not greater increase.

Copper, as well as lead, for more than six months has sold below its 1914 pre-war price, and powder and mercury, I am told, cost no more at wholesale than previous to the World War.

Repeated requests made of our local dealers in ammunition for an explanation of these illogical prices have brought only the unsatisfactory reply, "We are not to blame for the prices."

Now, Mr. Editor, if you will make clear the reason for these high prices of ammunition, despite the low cost of those things that enter into its manufacture, and place the blame where it properly belongs, you will, I am quite sure, receive the thanks of a host of sportsmen all over the country.

COLORADO SPORTSMAN.
Denver, Col.

Danger in Entering Old Workings[*]

In every abandoned shaft or pit, or in fact, any old working where the air has been stagnant for a considerable time, there is always danger of oxygen deficiency, as the oxygen which originally comprised one-fifth of the atmosphere may be appreciably replaced by gases that do not support life, usually by carbon dioxide (black damp) or methane (fire damp).

Generally, there is no physiological warning of oxygen deficiency in the air, the first decided feeling is one of extreme weakness, accompanied by dizziness, better described as partial paralysis, and the victim collapses practically without warning. To guard against this danger, a man should not enter old workings without having a rope tied around his body and at least two men on the top. The rope should be kept taut. Then if a distress signal is given, the explorer will not only be prevented from falling, but can be quickly pulled to fresh air and his life saved.

---

[*] Abstract of an article by B. O. Pickard. *Reports of Investigations*, U. S. Bureau of Mines.

Scraping and Loading in Mines With Small Compressed-Air Hoists—I

Use of Slushers in Underground Loading Applicable to Various Mining Methods Direct Haulage to Chute Is Preferable System Secures Greater Tonnage Per Man per Day and Combines Simplicity, Low First Cost, and Flexibility

BY WARD ROYCE

Written for Engineering and Mining Journal

DURING THE LAST FEW YEARS mining operators have been devoting considerable time to the solution of ore-handling problems. Previously advancement in the art of mining was mainly in the improvement in ore-breaking and rock-drilling machines, transportation and allied operations, but the "No. 2" shovel in the hands of a husky mucker has been the means of handling and loading most of the material broken in underground workings.

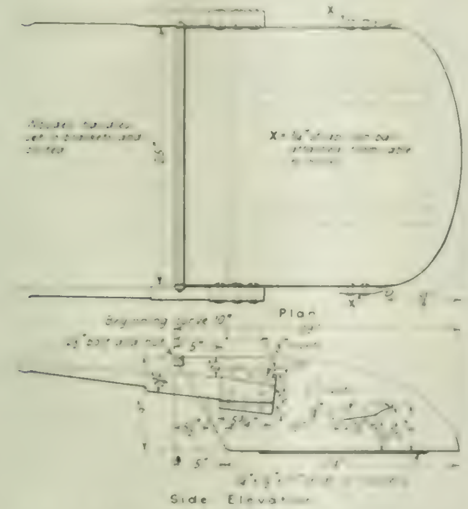


FIG. 1. OLIVER IRON MINING CO.'S [illegible] SCRAPER

The obvious inefficiency in the use of the shovel and the increasing scarcity of the class of laborers required for the work have led to the development of a number of loading and shoveling machines, many of which are successful in the class of work for which they are designed and adapted. Machines of this class now on the market are practically all large and heavy, and of high capacity, and they require the services of operators of a higher grade of intelligence than is common among ordinary mine labor, and, in addition to first high costs, entail considerable expense incident to upkeep and repairs. Furthermore, their size, weight, and capacity limit their adaptability to utilization in the larger openings and most accessible places.

ECONOMICAL CONSIDERATIONS IN ORE LOADING

Time studies from various underground mining operations indicate that in the removal of ore by the old hand methods, mucking comprises from 25 to 50 per cent of the total shift's time. As there are only two men, as a rule, working in the average opening, this is sufficient evidence to show that the average working place does not produce enough material to allow economical operation of a machine of high first cost and large capacity, owing to the necessarily large proportion of idle time. Unless such a machine is sufficiently portable or flexible to permit of its being moved from place to place, and thus kept continually at work, or the time element and not cost is the first consideration, there can be no great advantage in its use in the average working place.

An excellent solution to the problem lies in the use of the scraper. The motive power for this type of ore-handling machine consists of a winding engine operated by air or electricity. The advantages in the underground use of an air-operated machine are too numerous to require detailed mention, the most obvious being the fact that in nearly all underground workings the power supply is already installed and available in the air lines upon which the machine drills depend. This type of

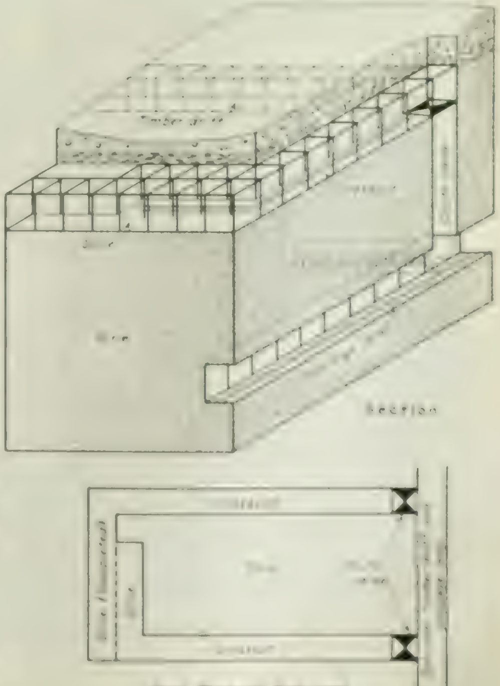


FIG. 2. TOP-SLICING METHOD OF MINING

machine has the further advantage of a design which in no way interferes with its variation in power, size, and portability with a corresponding variation in first cost and adaptability for other purposes, such as hoisting, hauling cars, and similar work.

The use of scrapers in mining merely involves the application of the several arrangements that have long been widely used in surface operations, varying from the horse-drawn slip scraper or "slusher" seen on every small grading job to the various drag-line scrapers and graders used in ditching, grading, and other large excavation work.

In applying the scraper to mining the simplest method comprises the combination of a small edition of the slip scraper or "slusher," such as is shown in Fig. 1, with a 1H "Little Tugger," or other type of small compressed-air hoist. This arrangement has been in use for some time in the "soft-ore" iron mines on the Mesabi Range of Minnesota.

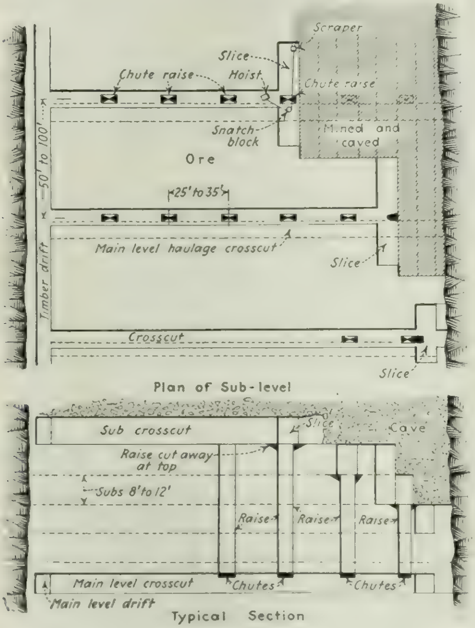


FIG. 3. TOP-SLICING METHOD ARRANGED FOR SLUSHING

TOP-SLICING SYSTEM ASSURES CLEAN MINING

The "top-slicing" method (Fig. 2) of mining is the standard practice at these mines. This consists of removing the ore in horizontal slices 8 ft. to 14 ft. thick, beginning at the top of the orebody. As the horizontal slices are developed they are called "subs" (sublevels). Usually on the sublevels the ore is divided by crosscuts into pillars 50 ft. in width, and by working at right angles from the crosscuts the pillars are removed in short slices in retreating from the boundary. Timber is used to support the overburden, or capping, and as the ends of the pillars are sliced off the timbers are blasted down, allowing the burden to cave to the floor of the sublevel, which has previously been boarded over to prevent mixing waste with the ore below. As the work progresses sublevels are opened from raises in the solid pillars, and removal of ore is carried on under the caved ground resting on the floor of the next higher sublevel. Eventually a mat is formed of the old timbers, which assists greatly in preventing runs of sand and other waste material. The ore is practically scraped off the floor boards laid in mining the sublevel above, and this results in remarkably clean mining.

The usual method of working with shovel and tram car called for only one raise to each pillar or working place, the raise being at the intersection of the sublevel crosscut with the haulage level drift below. This necessitated quite a long tram at the start of operations on the pillar, as the haulage drifts are usually on the boundary, or occasionally in the center, of the orebody. The more modern arrangement is to construct the chute raises at closer intervals along the sublevel crosscuts, connecting them with crosscuts on the haulage level parallel to and almost directly under the crosscuts on the sublevels.

The layout as arranged in the mines where slushing is employed is ideal (Fig. 3). Here the raises are located in such a way that each raise takes care of the ore mined from three slices. The ore from the center slice is pulled directly into the raise, and by blasting off a corner of the pillar the ore from the two outside slices is carried to the raise with little difficulty.

DISTRIBUTION OF CONTRACT CHARGES

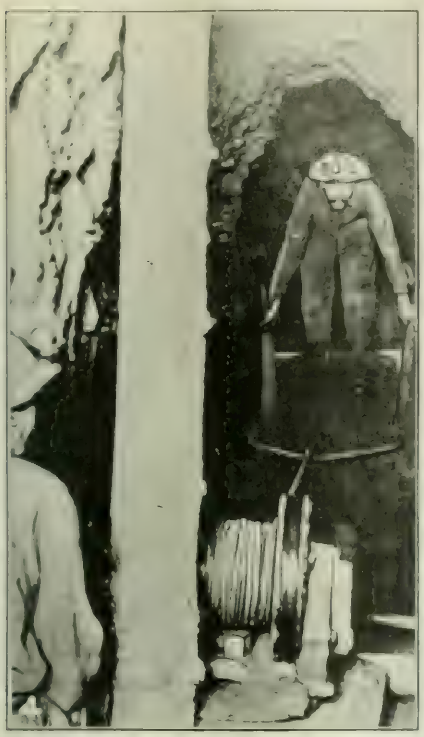
Miners work in contract gangs of four, two men on each shift, doing all the work connected with drilling, blasting, mucking, and timbering. Ordinarily, one gang is assigned to each crosscut and works both ways to the center of the adjoining pillars. The hoist and scraper are furnished to each gang, together with the drilling machine, steel, hose, and other permanent equipment. The men are charged only with shovels, saws, axes, and blasting supplies, the cost of this material being a charge against the contract, which is based on the number of cars loaded from the working place.

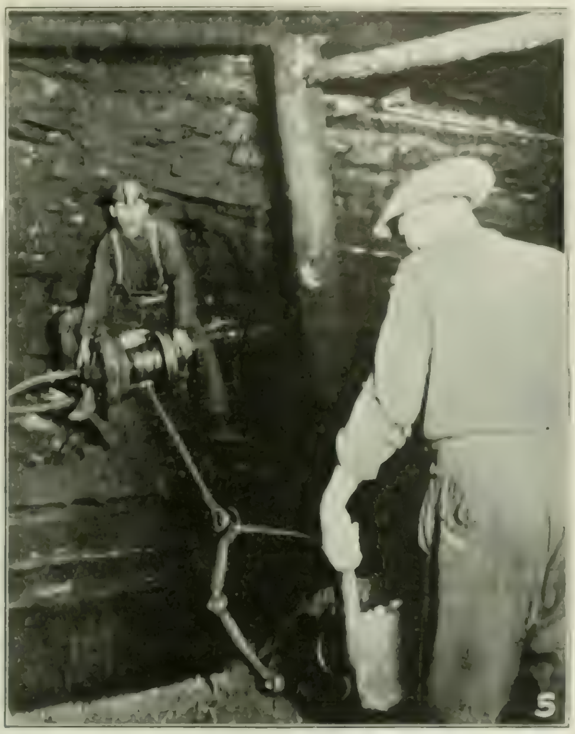
The "Little Tugger" hoist is usually mounted on a turntable which is made fast to a timber skid or a truck, the whole set being placed behind one of the chute raises and blocked down. One of the men operates the hoist; the other handles the scraper, carries it to the pile of broken ore, holds it by the handles at the proper angle as it is pulled into the pile by the hoist, and then follows the load as the scraper is hauled to the chute. Dumping the scraper at the chute (Figs. 4 and 5) is done in much the same manner as the horse-drawn scraper is handled on surface.

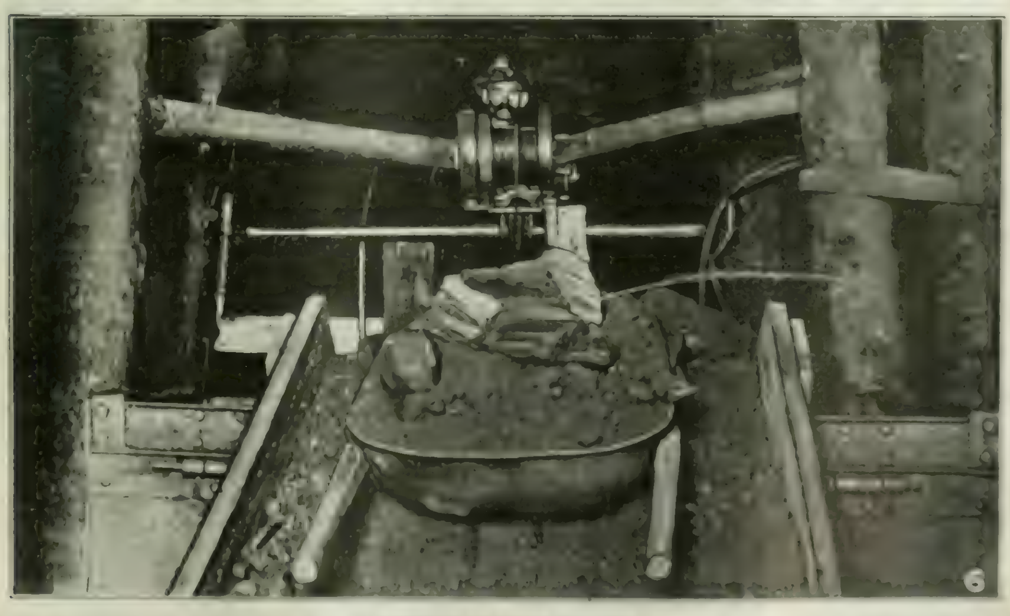
Although the labor of handling the scraper is fatiguing, the men change places at frequent intervals and have increased their production and earnings so that they are well satisfied with the method. When the scraper was first introduced there was considerable objection on the part of the miners, but since its advantages have been demonstrated the men request the equipment as soon as working conditions permit.

SNATCH BLOCK USED IN INDIRECT HAULAGE

As a rule the workings are so laid out that the bulk of the ore is handled directly to the chute in a straight haul. If it becomes necessary to make a slight turn, the scraper is steered around the obstruction by the man who loads and follows it; where the turn is too abrupt it is customary to lead the rope through a snatch block at the turn. The scraper is then hauled to the turn,


4


5


6

METHODS OF USING SCRAPER

Fig. 4. Pulling scraper toward chute. Fig. 5. Dumping scraper at chute. Fig. 6. Loading [illegible] [illegible] and [illegible] sills

the rope removed from the block, and the haul continued to the chute. Similarly, a snatch block is used to direct the scraper to the chute when it is not convenient to set the hoist in line.

In certain sections of the mines where chutes are not accessible, cars are loaded directly with the scraper in much the same manner, the scraper being hauled up to the car over an inclined slide made of planks. This method (Fig. 6) is obviously a little slower than the other, but it gives satisfactory results.

The scraper now in use on the Mesabi Range holds approximately 3 cu.ft., and in handling the finer ore will carry and push along a total load of from 4 cu.ft. to 5 cu.ft. In hard chunky ore the efficiency is greatly lowered because of the difficulty of holding the scraper while it is being pulled into the pile.

A statement furnished by one of the iron-mining companies on the Mesabi Range and covering the production of about 40,000 tons of ore shows that twenty-four contract gangs using shovels and tram cars averaged 10.09 tons per man per day, whereas fourteen gangs using "Little Tuggers" and scrapers averaged 12.43 tons per man per day—an increase in production of 23.19 per cent. This covered all places where the scrapers were used. The most efficient operation is in performing work where direct hauls are possible and the scraper is dumped into a chute opening at the floor level. In 1921 conditions were greatly improved by modifying the layout in some of the new workings better to accommodate the scrapers. With these improvements the figures show more nearly fifteen tons per man per day.

CONTRACT EARNINGS HIGHER WHERE HOISTS ARE USED

At the time these figures were compiled no great difference was made in contract prices to cover the cost of operating the hoists, the purpose being to promote the use of scrapers by allowing the men to make more money with them than they could by hand shoveling. The average difference in the contract price was about 5c. a ton, depending on conditions. Prices were lower in workings where the hoists were used, and the men in these stopes averaged about a dollar a day more than the men using shovels.

Two men using a scraper in the above-described manner should handle from 4 cu.yd. to 6 cu.yd. per hour of the soft, heavy ore, depending on the length of haul. The "Little Tugger" will haul the load at a rate of 80 ft. or more per minute, depending on the air pressure. Length of haul in these operations will probably average about 35 ft., the maximum distance being 50 ft., or slightly more under advantageous circumstances.

Considering the figures noted and assuming a wage of $5 per day, the labor cost per ton of ore is reduced approximately 10c., all of which has been saved out of the mucking time. The expense of operating a "Little Tugger," the power cost being as at the property from which the figures were obtained, should be about 75c. for handling the shift's output of twenty-five tons. The use of the scraper eliminates cars and track in the working places, with the labor involved in handling and rehandling track material. As the track has to be removed and relaid every time a slice is completed and blasted in, this becomes a considerable item. In addition, there is to be considered the reduction in final costs resulting from spreading the fixed overhead charges over an increased tonnage.

The efficiency of this method of handling ore with scrapers depends on several factors. The capacity of the scraper is limited to the size and weight of scraper that can be handled by one man without involving too much exertion. Length of haul is limited by the same factor, practice showing that efficiency is sharply reduced after the length of haul is increased beyond 40 ft. After this distance is reached the best results are obtained by using the scraper for car loading.

ADVANTAGES OF SCRAPER METHOD

The principal advantages of the method are simplicity, low first cost, and flexibility. No rigging is required, operations start immediately after blasting, and the man carries the scraper directly to the most advantageous point. The clean-up is made without loss of time. The outfit is light and portable, and may be moved from place to place without much effort.

The principal disadvantage lies in the fact that it has increased the efficiency of the men without lightening their labor to a marked extent. Lightweights will accomplish little more with this type of scraper than they will do with a shovel, and in rough material they will probably do less. The method therefore has not disposed of the real problem of furnishing an outfit that anyone can use successfully.

TROLLEY ARRANGEMENT EFFECTIVE BUT INFLEXIBLE

An ingenious arrangement devised to cut down the labor involved in the single-rope method of slushing is found in the trolley shown in Fig. 7. An I-beam carrying a small-type hoist at one end is mounted on a frame set up in the opening so that the end at the breast is higher than the other which carries the hoist. A pulley is mounted at the breast end of the trolley, and the rope runs from the hoist through the pulley, and then through another pulley carried in a traveler running on the beam. As the rope is wound on the drum of the "Little Tugger," the scraper is forced against the foot of the pile and loaded; then hoisted until the bail of the

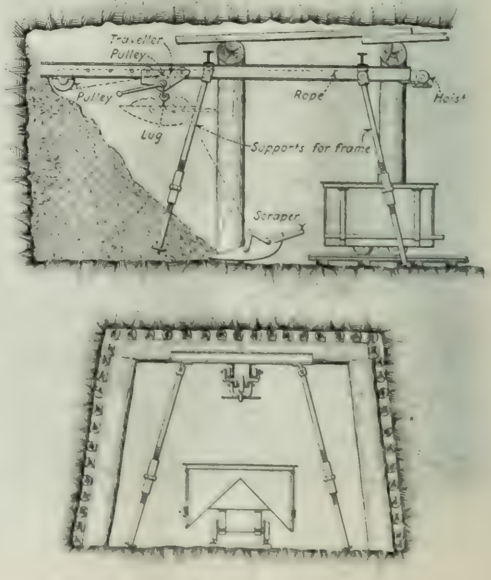


FIG. 7. TROLLEY ARRANGEMENT LOADER

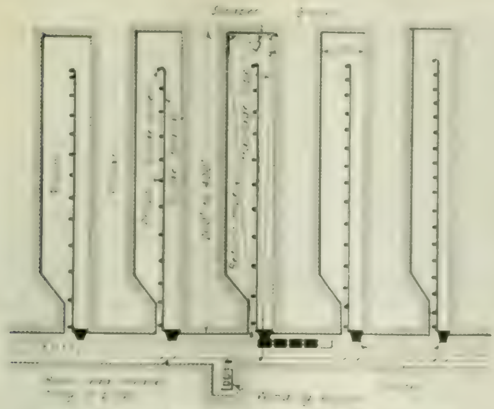


FIG. 8. EVANS SCRAPER SYSTEM IN A COAL MINE

scraper can be hooked to a lug on the traveler, when the rope is run slack and the traveler runs back down the inclined trolley, carrying the scraper to the point over the mine cars where it is dumped by tipping the handles. Two men operate the device, which has eliminated the labor involved in carrying the empty scraper. This is an improvement over the other method, but the inflexibility of the arrangement and the time and labor involved in extending the trolley as the opening advances, rigging and tearing down and other necessary work, have prevented its general adoption.

To increase the efficiency of the scrapers and further to reduce the labor involved, developments have been made which follow more nearly the practice covered by the surface drag-line outfit. This requires the use of a double-drum winding engine, so that the scraper is hauled by power during the complete trip, an arrangement for holding a pulley or snatch block through which the return rope may run, and the use of a scraper that is more nearly automatic in operation—i.e., self-filling and self-dumping.

Probably the first instance of the use of an arrangement of this type was in the coal mines of Pennsylvania. Here the Evans-Goodman scraper system has been employed for some time with considerable success.

TRUE SCRAPER SYSTEM PUSHES LOAD

The winding engine used with the Evans scraper is a motor-driven, tandem-drum machine of about 25 hp., made by the Goodman Machinery Co., of Chicago. The drums have a capacity of 500 ft. of rope, and the rope speed is about 400 ft. per minute. The machine is 6 x 3 ft. and weighs from two to three tons. The scraper is a V-shaped device, 42 in. wide across the opening, 18 in. high and 36 in. long, made simply of a bent plate with a stiffener bar across the opening and carrying a piece of 3-in. angle part way around the bottom, which slips under the coal and provides a face for the scraper to ride on. This is a true scraper, as it pushes the load in front of itself instead of carrying the load, as is done by the slip scraper.

In practice the winding engine is set centrally to handle coal from a panel of four or five rooms. The ropes are led from the machine to a pair of guide pulleys mounted on a semi-permanent frame directly in front of the machine, and from them through such snatch blocks as are required to lead the ropes to the working faces.

The rooms are ordinarily carried 25 ft. wide on 50-ft. centers and from 300 ft. to 500 ft. long, connecting one entry with another. A line of props is set along one side of the room, and to these planks, which serve as a guide for the scraper, are spiked. A snatch block is set at each side of the face and a vertical guide roller is mounted at the end of the line of guiding plank.

The scraper travels across the face of the chamber at the foot of the pile of broken coal. When the scraper approaches the side of the chamber the haulage rope is released from the near snatch block and the scraper is hauled along the line of guiding plank to the opening with the tail rope riding against the vertical roller. When the scraper is returned empty the haulage rope is again run through the near snatch block, so that the scraper again travels in a path parallel with the face. A removable chute apron of steel plate is provided at the mouth of the chamber to bridge the gap between the opening and the side of the mine car (Fig. 8).

In mining the narrow beds it is necessary to remove either floor or roof rock in the entries to permit the passage of the mine cars. This requires that the chute apron be inclined to elevate the scraper to the car, where the roof rock is taken down and usually requires the removal of roof at the mouth of the chamber to provide head room for the scraper.

EVANS SYSTEM IN ANTHRACITE FIELD

I saw one of these scrapers at work in one of the mines in the Scranton anthracite field, working in a vein about 30 in. thick. The contractor in charge had a gang of nine men, who handled all the work in a panel of several rooms, using a Jeffry undercutter in breaking the coal. Drilling was done entirely with hand augers; all blasting, setting props, loading, and other work was on the one contract. The [illegible] was

[illegible]

[illegible]

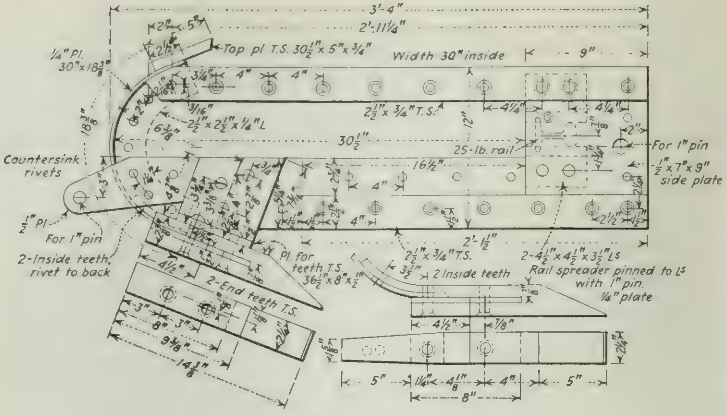


FIG. 12. QUINCY SCRAPER

made that the average daily production was about fifty tons of coal—roughly five tons per man. Low production may have been due to some extent to the fact that the men were working in such thin coal. However, the rooms were being carried over 300 ft. long, and it is probable that efficiency decreased because the men had to travel such long distances in transporting tools, timber, and other material, on hands and knees in very constricted quarters.

Several years ago conditions in the workings of one of the Lake Superior copper mines reached the point where it became necessary to devise mechanical means of removing broken ore from the stopes. The lodes outcrop at this property at a dip of about 50 deg., and for years the broken material would run freely on the foot wall. The lodes have gradually flattened out with depth, until the present openings are running on a foot wall with an average dip of about 35 deg., so flat that the broken material will not run. The ore, or "copper rock," is a fairly hard amygdaloid carrying native copper in shot, sheet, and mass form. The ore broken in the stopes is now hauled by scrapers to chutes at the drift level, where it is loaded into the mine cars.

SCRAPING AS ADAPTED TO ROOM-AND-PILLAR SYSTEM

The stoping is laid out on a room-and-pillar system, advancing from the hoisting shaft to the boundary limits, the pillars being removed in retreat from the boundary. The haulage levels are driven at 200-ft. intervals on the dip of the lode, the stopes connecting level to level. In working out these flat stopes enough of the broken material is removed from time to time to permit the passage of the miners, and when the stoping is completed the remaining material is cleaned out.

Experiments were made at this property with various modifications of the Bagley grader and other similar power scrapers. These are box-shaped, bottomless scrapers of several yards' capacity,, used extensively in the West on grading and excavating jobs. (Fig. 9.) Such scrapers were found to be entirely too large for underground use, and a number of smaller machines of similar design were tried before the present scraper was adopted. (Note Figs. 10, 11 and 12). Patentable features of these scrapers, which had no application in underground work, were entirely eliminated.

The Quincy scraper is a bottomless box device of about 8 cu.ft. capacity, weighing about 500 lb., and made reversible with teeth on one side and a straight lip on the other to fit it for handling either coarse or fine material.

Winding engines in use are geared, double-acting, double-drum machines of about 20 hp., weighing from 2,500 to 3,500 lb., such as are made by the Lidgerwood Manufacturing Co. and other manufacturers. Several machines now in use were designed specially for this work by the Lake Shore Engine Works, of Marquette, Mich. The drums have a capacity for 300 to 500 ft. of ½-in. rope, and a rope speed of 200 ft. per minute. (Figs. 13, 14, 15.) All these machines are air operated.

THE USE OF SNATCH BLOCKS

In opening the stopes the entire lode is cut away to a height of 15 ft. to 20 ft. above the floor of the drifts. Stulls are then placed skin to skin along the foot-wall

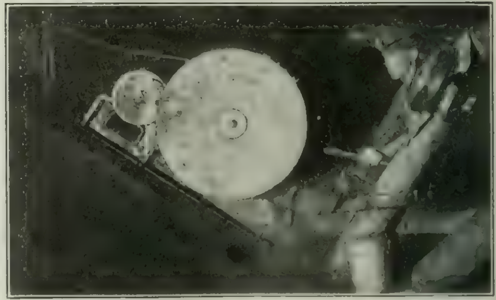


FIG. 13. SCRAPER ENGINE IN MICHIGAN COPPER STOPE

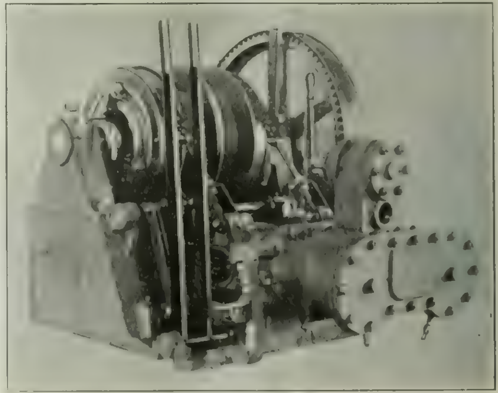


FIG. 14. LAKE SHORE ENGINE WORKS AIR-DRIVEN SCRAPER HOIST

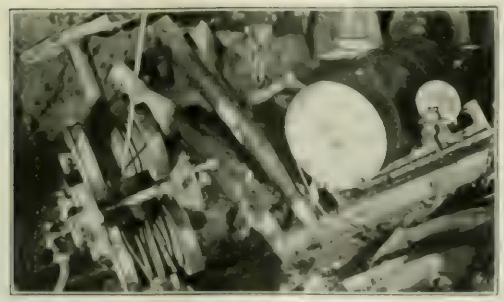


FIG. 15. THE "LITTLE TUGGER" SCRAPER HOIST

side of the drift, leaving openings at regular intervals for the chutes. (Fig. 16.) The winding engine is set up on the foot wall above the stull timbers, at the foot of one of the pillars between the stopes. The ropes are handled much the same as in the Evans coal-scraping system.

One set-up handles the material broken in two or three stopes on each side of the machine. The snatch blocks are suspended from drill columns jacked in between foot and hanging, or from hooks set into holes drilled into the hanging wall. The ropes are usually led around a pair of guide pulleys set directly in front of the engine and from them to the place where the scraper is to work; one snatch block is hung at the top of the stope and another on the timber just above the chute, and the scraper operates between them. By changing these two blocks from one chute to another and from one point to another at the top of the stope, practically all the foot wall is covered and little or no shoveling is necessary to finish the clean-up. (Figs. 16 and 17.)

The scraper crew consists of four men—one handling the engine, two men who work along the path of the scraper, moving the large pieces of ore, shifting rigging, and performing other necessary work, and one man who acts as signal man and is stationed at or near the dumping point of the scraper where he can oversee all the operations.

CONDITIONS GOVERN OUTPUT

Under favorable conditions four men will handle in this manner approximately 150 tons of the broken rock as an average day's work; they have handled as much as 275 tons in an eight-hour shift and as little as 75 tons. Quantity depends entirely on conditions. The day's run in the clean-ups is usually low. Under the old arrangement it would take many more men to handle this material by shoveling it down the foot wall from one man to another. In fact, the mine captain once remarked that he could not crowd men enough into one of the stopes to get out as much as the scraper crew would handle.

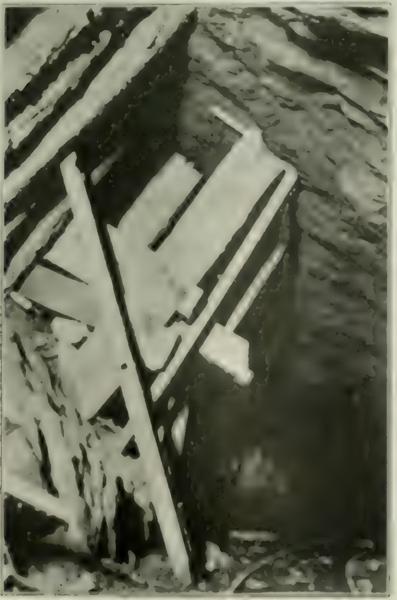
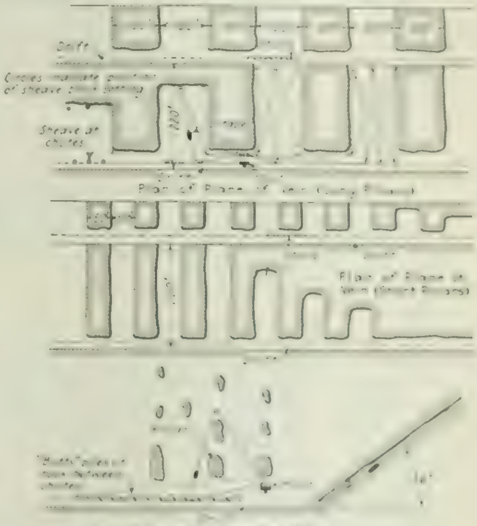


FIG. 16. CHUTE TIMBERING IN A COPPER MINE



Drift
Circles indicate position of sheave block setting
Sheave at chutes
120'
Plan of Stope in Vein (Long Pillars)
Plan of Stope in Vein (Short Pillars)
Typical Setup in Scraping Stope

FIG. 17. SCRAPER SYSTEM ARRANGED FOR ROOM-AND-PILLAR METHOD OF MINING

To be continued

Bureau of Mines Releases Two New Films

The U. S. Bureau of Mines has recently added two new motion pictures to the list which it releases for educational purposes. One is "The Story of Heavy Excavating Machinery" in which are depicted the various types of steam, gasoline and electric shovels and other apparatus of a similar nature used in mining operations. Scenes are shown in the iron mines of northern Michigan and the quarries of New England, as well as coal-stripping operations in Ohio. The picture was prepared in cooperation with the Bucyrus Co.

The other film is entitled "Mexico and Its Oil" and was produced with the aid of the Sinclair Consolidated Oil Corporation. Scenes in the Mexican oil fields and at Tampico are shown. Applications for the loan of these pictures should be made to the Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa.

Recent Advance in Design of Gold-Dredge Bucket Lips

Inside-Outside Type, Lately Developed, Possesses Several Advantages—Re-riveting Unnecessary During Life of Lips—Improved Reiling Lip Marks Return to Double Flange—Casting Teeth on Inside of Lip

BY GEORGE J. YOUNG
Western Editor, Engineering and Mining Journal

GOLD-DREDGE buckets and bucket parts have not been standardized, but each dredging company modifies bucket shape and parts to accord with the exigencies of its practice. The larger companies have two or three styles of bucket, all of which are interchangeable on the same boat. The weight of buckets is approximately 200 lb. per cu.ft. of capacity, the following table indicating approximate weights of buckets and lips:

APPROXIMATE WEIGHT OF DREDGE BUCKETS AND BUCKET LIPS

Bucket Size, Cu Ft.	Weight Bucket Without Lip, Lb.	Weight of Lip, Lb.
6	1,095	195
7	1,400	260
9	2,100 .	450
15-20	3,000 to 3,900	570-750

Practically all buckets are now made of manganese steel and are of the two-piece pattern, the bucket base, with the eyes and the hood, being cast as one piece of manganese steel. The bucket lip is cast separately and riveted on. When gold dredges were first built, the bucket speed was 50 ft. per minute, but it is now, upon most dredges, 70 ft. per minute. Consequently, both buckets and bucket lips have to withstand more severe conditions. A manganese-steel bucket will last about three years, an 18-cu.ft. bucket handling in that time approximately 200,000 cu.yd. of gravel. Bucket lips last from six to twelve months, and in some instances up to eighteen months. Bucket pins have an average life of six to twelve months, but are more uncertain in length of life than other parts of the bucket line. Bushings of manganese steel last six to nine months. Bucket pins have been constructed of manganese steel, but these often have been uncertain in length of service. Properly cast and heat-treated, the manganese-steel bucket pin gives excellent service, but, owing to breakages, the nickel-chrome steel pin has been principally usd. Recently, however, better results than formerly have been obtained with the manganese-steel pins.

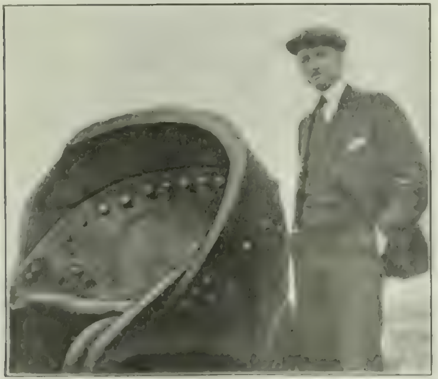


FIG. 1. ORDINARY OUTSIDE DREDGE BUCKET LIP
[illegible] bucket without lip [illegible] Bucket [illegible] and [illegible]

Bucket lips are subjected to the greatest wear and tear of all parts of the dredge bucket. The ordinary lip of the outside type is shown in Fig. 1. The lip shown takes up outside wear. The Reiling lip, shown in Fig. 2, which was first used by the French Gulch Mining Co., of Colorado, is known as the inside lip. The riveting flange of the lip is inside the bucket hole, where it forms a projecting ledge. This arrangement takes up inside side wear and provides a clearance that makes the bucket discharge more freely than one of the outside-lip type, in which the contents sometimes packs tightly, particularly where heavy clay accompanies the gravel.

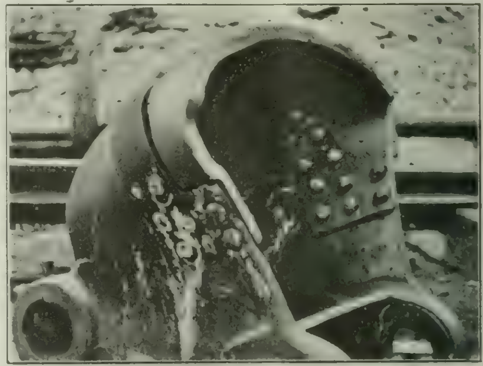


FIG. 2. REILING INSIDE DREDGE BUCKET LIP

Other minor improvements also have been made, such as the casting of one or more ribs upon the bucket hood to take the thrust upon the riveting flange of the outside lip, or the casting of a small projection on the bucket hood for the same purpose. To get greater freedom of discharge, in some instances the back part of the bucket lip abutting against the edge of the hood has been thickened, meeting the cutting edge in a sweeping curve.

THE "INSIDE-OUTSIDE" LIP DEVELOPED

Following the invention of the Reiling lip, a double-flanged bucket lip was developed. This lip had complete inside and outside riveting flanges. In principle it was an improvement over the various modifications, but it was difficult to get an accurately fitting casting. The inside lip was next changed by placing one-third of the inside flange on the outside, making a lip riveted by a flange in part inside and in part outside. This was easier to fit. In the lip as finally designed, shown in Fig. 3 (1), the middle part is riveted on the outside and the ends are riveted on the inside. This type of lip is called the inside-outside lip.

The advantages which have developed in the use of the inside-outside lip over the old type outside lip are more pronounced in difficult digging, as when in cemented gravel and in material where boulders and clay are encountered. In loose material, however, the advantages are sufficient to warrant the use of this type of lip. It is not necessary to make any change in the design of existing buckets, as these lips can be used by changing the lip pattern to fit any bucket of the present type. In fact, the advantages of this new type of lip show up more quickly on a partly worn-out bucket.

RE-RIVETING OF BUCKET LIPS ELIMINATED

The necessity of re-riveting during the life of the lips is eliminated in the use of the inside-outside lip. It was necessary, with the old style lip, when working under conditions similar to those in some of the dredging fields in California, to re-rivet the lips every four or five months. This is an expensive operation, necessitating, as it does, the shutting down of the dredge to change the buckets. The chief cause of the rivets working loose is the pressure at the top or center of the lips as they are forced into the bank while passing under the lower tumbler. This, in addition to the pull that comes on the ends, or corner, of the lip as the dredge is swung sideways, tends to make the ends spread. This puts the rivets in tension and causes them to loosen rapidly, the rivet holes in the hoods of the buckets wearing larger each time the lips are re-riveted. With the inside-outside lip, however, the tension on the rivets is taken care of by the flanges. At the center of the lip the flange is on the outside, which takes the pressure when the bucket is forced into the bank under the lower tumbler. The flanges at the ends of the lip are on the inside, which prevents them from spreading out from the pressure at the center and the side pull on the corner at the same time. Consequently, the rivets do not come into tension, which fact prevents them working loose as quickly as they did with the old type. The rivets will not stay tight under all operating conditions, but the lips will not come off even when the rivets are loose.

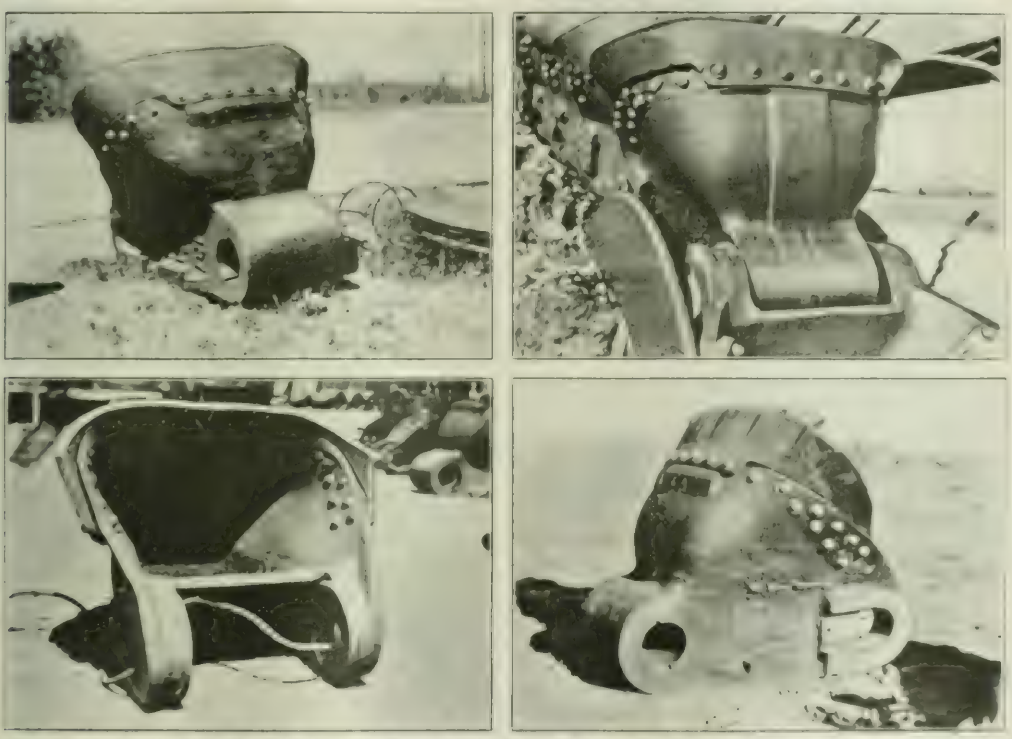


FIG. 3. (1) INSIDE-OUTSIDE LIP [illegible]. (2) CLOSE-UP VIEW OF BUCKET [illegible] INSIDE-OUTSIDE LIP ON. (3) OUTSIDE LIP, ENDS OF [illegible] PULLED AWAY FROM HOOD AT SIDE OF BUCKET. (4) SIDE VIEW OF BUCKET [illegible] WITH [illegible]

The inside-outside lip prevents the hood of the bucket from wearing out, as the flange protects that portion on the inside where the most wear comes on the hood. According to L. D. [illegible], the new lip was first tried out and used to salvage buckets which had worn on the inside at the side or circular part of the hood shown in Fig. 3 (2). The flange of the lip at this place was put inside of the bucket and serves as a patch for the hood. It developed that these lips did

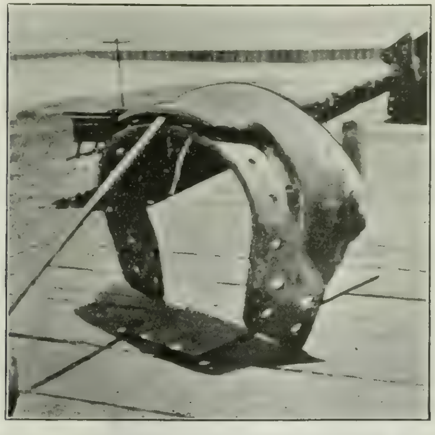


FIG. 4. IMPROVED REILING DREDGE BUCKET LIP

not get loose as readily as those of the old type, on account of less wear in the holes of the hood. Experience showed that the second set of outside lips became loose in less time than the first set. This trouble increases with each succeeding set, because the rivet holes become larger and irregular in shape, so that it is harder to fill the holes properly with the new rivets. This trouble is practically eliminated by the inside-outside lip.

It was necessary to discard the lips of the outside type, shown in Fig. 3 (3), sooner than those of the inside-outside type. On the dredge on which the first inside-outside lips were tried out, one-half of the lips were of the old outside type. The buckets were of 15-cu.ft. capacity and were digging very hard cemented gravel. It was necessary to re-rivet the outside type twice during their life, but the inside-outside lips were not re-riveted. At the end of eleven months' wear, it was found that the outside lips were so loose that it would be necessary to re-rivet them again, as they were being pulled off of the buckets. There was about one month's wear still left, but it was not considered worth while to re-rivet them again, so they were discarded. The inside-outside lips, however, gave this additional wear, which amounted to practically 10 per cent of the life of the lips, without any further trouble. As the inside-outside lips are placed on the buckets from the front, they are much easier to put on and it is possible to get a much better fit.

With this type of lip, Mr. Hopfield also states, there is less spill back into the well hole at the main hopper. When the bucket dumps its load on the back of the preceding bucket, some of the material, as it slides along the back and over the sides of the bucket, is sufficiently deflected when it hits the projection of the outside lip, to cause the material to fall back into the well hole. The inside-outside type is flush with the surface of the bucket hood along the sides and allows the material to fall into the hopper and pass through the screen, resulting, no doubt, in quite a saving of gold during a year's operation.

It was first thought that the inside flanges of the new-type lip would interfere with the proper discharge of the material, if it were of a sticky nature. This, however, has proved not to be the case. When digging clay, the material enters into the bucket along the cutting edge of the lip, and is pushed along the inside surface of the lip and then to the inside of the hood. The inside flange of the new-type lip, being on the inside of the hood, provides an interruption which prevents the clay from coming into close contact with the hood as it passes the lip, and allows soft or loose material to lodge between the clay and the hood, which facilitates dumping, instead of retarding the material.

CASTING TEETH ON INSIDE OF LIPS

The inside-outside lip has opened the way for trying out an experiment of casting teeth on the inside of the lips, which, up to date, is working out satisfactorily. Some lips with the teeth cast on, as shown in Fig. 3 (4), are being tried out and have been in service about five months. Mr. Hopfield states that they show an improvement when digging clay and cemented gravel.

The inside-outside lip is patented and is manufactured by both the Columbia Steel Co., of San Francisco, and the Taylor-Wharton Iron & Steel Co., of High Bridge, N. J.

A return to the double-flanged lip is shown in Fig. 4 in a modified form. This is known as the improved Reiling lip, which was recently turned out by the American Manganese Steel Co. This has a complete riveting inside flange and an outside flange at the top portion of the bucket. It is easy to make a casting that will fit the bucket. Lips of this pattern are in use at Dayton, Nev., on the dredge of the Gold Canyon Dredging Co. The lip is flared in such a way as to take the side cutting wear upon the lip rather than upon the side portion of the hood. In the center portion of the lip, the rivets are in double shear.

Fig. 5 is a photograph of one of the Natomas boats digging hardpan with the ladder in a high position. It illustrates excellently the severe service given to bucket lips. The scraping action of the bucket lip of the first (1) bucket coming into action is particularly noticeable. The lower angle of incidence of the bucket (2), immediately preceding, shows how the excavated material is crowded into the bucket hood. The third (3) bucket, with the ladder in a lower position, would also be in a digging position. For the ladder in a lower position the relative position of the buckets would be approximately the same. The bucket lips shown are inside-outside lips.

Acknowledgment is made of the courtesy of Corey C. Brayton and L. D. Hopfield, both of whom contributed the illustrations for this article and discussed the development of the various designs with me.

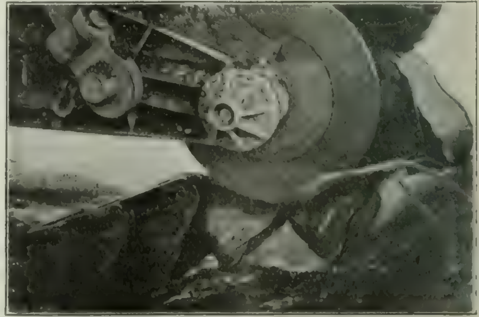


FIG. 5. DIGGING HARDPAN WITH LADDER IN HIGH POSITION

BY THE WAY

A Thrill

Broadway engineers got a thrill the other day when "Her Salary Man," a comedy in three acts by Forrest Rutherford, made its first appearance at one of the local theaters. It fairly warmed the cockles of the heart, whatever they may be, to see how the engineer was able to snatch a few moments from his professional work to write a play that would prove acceptable. Some, no doubt, began to feel that perhaps they too would try their hand at this sort of thing. There was money and distinction in it. Feeling thus ourselves, we called Mr. Forest Rutherford up at his office at 120 Broadway to ask him to recommend a textbook on the subject. But our Mr. Rutherford said he has been getting quite a bit of credit for this other man's work for a long time. So we rang off disappointed.

Excelsior

Necessity is the mother of invention. The results of testing man's ingenuity abound, and by them we measure progress. Great strides are being made in the development of mining machinery, especially in devices designed to help in discovering new deposits of ore. It is to be noted as the year 1921 draws to a close, and it is reason for complimenting the designing engineers, that the pick and shovel and the diamond drill are gradually displacing the divining rod and witching stick for prospecting purposes. Success and the spectacle of others' success fire the imagination, and it leaps ahead to the time when those using the latter implements will be open to criticism for their conservative ideas.

A Hunting Story

Cap'n Dick was in a capricious mood as he watched the unloading of a truck load of powder. Skillfully the men lifted the boxes one by one and carried them into the magazine, where they were carefully shelved to await the time when they would be lowered in the "bal" for use underground. "'An'some chap, that there 'Ercules, isn't un," said Cap'n Dick, pointing to a picture of the mythical superhuman imprinted on the side of one of the boxes. "Who was he, Cap?" asked one of the men. "M'son," said Cap'n Dick, "'Ercules wuz a 'aughty 'unter 'oo 'unted 'ares in tha 'Ampshire 'ills, an' w'en 'e 'ad em 'e 'it em h'on tha 'ead with a 'eavy 'ammer an' they 'owled 'orribly. Dam-me, after that there I mus' be gettin' on. Don't forget to lock tha bloody door after thee."

Value Versus Profits

"We mine anything of value," the Creede General Mines Co., of Creede, Col., states on its letterhead. This is all right, so far as it goes: it makes employment for the unemployed, business for the supply companies, and tonnage for the railroads. But can they sell what they mine?

That is the question. Many things of value have long been more or less unsalable in the mining industry. Though conditions are improving, there are millions, hundreds of millions, of tons of low-grade ores that show value on the assay certificate but which would yield only a goose egg in net returns, or even a loss, if smelted or otherwise reduced. We are interested in this because we are working on a new process by which we hope to be able to treat practically anything and get 100 per cent recovery at a cost of practically nothing per ton. This is very promising. We shall be generous when we have this perfected and shall let all of our friends in on the ground floor.

Our Gold Threatened

A Londoner, H. Bond by name, claims he has discovered how to extract gold from mercury. Many an amalgamator knows how to do this, too, and therefore lets his finger nails grow long. Mr. Bond is an honest man we infer from the information given of him in the *Times* dispatch, and what he claims to do is to convert mercury at fifty-odd cents a pound into gold at $20.67 an ounce, which is certainly some conversion but not necessarily impossible. Once in a while Mr. Bond hurries too much or perhaps he works more carefully, with the result that he turns part of the mercury into radium instead of gold. But he can find abundant use for such impurities. The whole scheme, Mr. Bond says, is simply colossal, a Teutonicism surprising in the mouth of a Britisher. Some day, no doubt, the transmutation of the baser metals into gold will be an accomplished fact, and we frankly think it unwise to laugh too loudly at Mr. Bond until we have all the facts in the case. We are all the more on guard when we remember that 40 per cent of the world's gold is in this country. It would be just like some double-dashed furrin scientist to try something like this under the circumstances.

The Opal Superstition

The South Australian government last year appointed a commissioner to enquire in Europe as to the possibilities of securing a market for the white opal which is found in that state. Learning that on the Continent the old superstition that the opal is unlucky not only still lives, but is so strong that people will not buy the gem, the commissioner, Mr. Schlank, possibly remembering the axiom that a "rose by any other name would smell as sweet," thought that an opal by some other name might sell much better. He therefore suggested that this gem should be renamed. Dr. Herbert Smith, of the Kensington Museum, who was consulted, considered the idea a good one, and suggested as the new name the Greek word *irodos*, which being interpreted means rainbow. Several versions of the origin of the opal superstition have been given, and Mr. Schlank mentions one, which is probably the earliest, that dates back five hundred years—another instance of how hard some things die. It seems that in the long ago there were several large stage coaches running in France that were named after precious stones, such as ruby, sapphire, diamond, and opal. It so happened that the coach named "Opal" suffered numerous mishaps, and that several notables, including Napoleon in later years, who traveled by the unlucky vehicle, suffered grievous hurt. Mr. Schlank says that though the superstition is strongly prevalent on the Continent of Europe, it does not greatly worry the more sophisticated American or Britisher.

Entirely Personal

George Graham Rice has turned up at Rocky Bar, Idaho, where he is reported to have interested New York capital in an option on a local property. The *Police Gazette* please copy.

CONSULTATION

Non-Metallics and Enameled Ware

"I understand that considerable quantities of non-metallic minerals are used in the manufacture of enameled ware, but I do not know exactly how they are used in that trade. Can you give me a little light?"

Many non-metallic minerals are used in the manufacture of enameled ware. The most important are sand, borax, feldspar, ground quartz, clay, soda ash, fluorspar, and whiting. In addition, the metallic pigments, zinc oxide and tin oxide, are essential in some processes. The enamel as applied to kitchen ware, bathtubs, jewelry, and other articles is a glass to which color is given by means of metallic oxides. The ordinary enameled kitchen utensils use a base of iron or steel for the coating; sinks and bathtubs, cast iron.

The enamel used in coating cast-iron sanitary ware is compounded of several of the various minerals mentioned above and is applied in two coats, a primary gray coat and a finishing coat of white. Manufacturers are careful to use an enamel that expands at the same rate as cast iron when heated; otherwise the enamel would crack and give an unsatisfactory product. The exact mixtures used depend largely upon the purity of the ingredients of the enamel, the metal used as a base, methods of manufacture, and much experimentation.

A mixture that has been successfully used as a ground coating by one manufacturer and reported by the U. S. Tariff Commission consisted of 44 lb. of sand, 18 lb. of borax, and 14 oz. of borax fused in a furnace. The molten mass is run into cold water and ground with an addition of 9 per cent by weight of quartz and 12 per cent by weight of clay. The enamel for this first coat, after grinding, is one-third part water and is called "soup." A skilled workman sprays this material over the article to be enameled, which is then heated in a high-temperature furnace to fuse the enamel and to make a smooth coat.

The finishing coat consists of a mixture of 37 lb. of feldspar, 31 lb. of borax, 31 lb. of sand, 24 lb. of soda ash, 9 lb. of fluorspar, 4 lb. 9 oz. of whiting, and 6 lb. of zinc oxide, which is mixed, fused, and ground with 14 per cent by weight of tin oxide, 7 per cent of zinc oxide, and 7 per cent of clay. The tin oxide is the most expensive ingredient of the enamel, and imparts the lustrous opaque white finish to the common enameled sanitary ware. The white coat is applied to the article to be enameled after it has been heated to a red heat.

Before the war Germany and Austria-Hungary were strong competitors of the United States in the manufacture of enameled ware, but the war eliminated this competition. Domestic production grew, and large quantities of enameled ware were exported to countries formerly relying upon Germany for their supplies.

The United States is in a splendid position as regards raw materials for this industry, practically all of them being produced in this country. At present the industry is feeling the drop in trade noted in other industries, but it is an important factor in the consumption of a great many non-metallic minerals.

The Use of Taper Ropes for Hoisting

"Will you kindly tell me whether round taper ropes are being used at the present time for hoisting purposes in mines in the United States and the world. Are they a recent development in the industry and how is their use generally regarded by mining engineers?"

So far as *Engineering and Mining Journal* is aware, no round taper wire ropes are being used at present for hoisting purposes in American mines. They have been used in South African gold mines, according to Peele's "Mining Engineers' Handbook," although no definite reference is given as to the mine employing them. Behr, in a paper entitled "Winding Plants for Great Depths," issued by the South African Institution of Engineers, states that round taper ropes were tried at some of the Comstock mines as early as 1875. One of the ropes was used to operate a 37 deg. incline 1,400 ft. long, through a shaft 1,400 ft. deep, from a hoist engine on the surface. The rope was in use from 1875 to 1884 and was 2 in. in diameter at the top and 1¾ in. at the lower end. The load at the end of the rope was ten to twelve tons. Behr states that considering the conditions under which this rope operated the use of a taper would not be warranted.

At the mines of Przibram, Austria, taper ropes were used in the 80's for mines with a vertical depth of 3,900 ft. They were built of crucible steel wire having an ultimate strength of 120,000 lb. and were made with a regular taper, starting from the small end. One wire was was cut about every 16 ft. and a larger one brazed on. Each rope consisted of seven strands around a hemp core, each strand consisting of six wires around a similar core. The initial factor of safety due to static load condition alone, and without considering the effect of bending, was about 7, and the ropes lasted from three to four years. Five shafts used the taper ropes, and two of them were over 4,000 ft. deep. Other examples of mines using taper ropes are the Ronchamp collieries, in France, and the Preussen shaft No. 2, in Westphalia.

Two varieties of taper ropes have been designed. In one, the same number of wires are used throughout its length, the taper being obtained by reducing the individual sizes of the wire; in the other form the taper is obtained by decreasing the number of strands.

Although taper ropes possess theoretical advantages, one of the objections to their use has been the necessity of designing the taper rope for each depth of mine, and that straight ropes can be had to hoist a reasonable load from a 5,000-ft. depth. It is worthy of note that in the new shaft of the City Deep mine, in the Transvaal, which is to be 7,000 ft. in vertical depth, a 2-in. flattened strand rope will be used. A flattened strand rope is essentially a round rope.

Behr contends that taper ropes are as reliable as those of uniform section and would cost less for deep shafts than ropes of uniform section and of equal effective strength; also that taper ropes made, as they should be, with a long lower portion of uniform section, had a greater margin of safety at the most dangerous section than ropes of uniform section with tail rope for the same factor of safety.

HANDY KNOWLEDGE

Neighborly Chats With the Foreman

Selecting Men

BY DUNCAN MACGREGOR

Written for Engineering and Mining Journal

You're wrong, Jim, about the employment manager. You just said that it would take away your control over the men. Well, maybe it does take away a certain kind of control. This hiring and firing idea is well enough in its way, but perhaps it has had its day. There's another kind of control which may be in the long run best for every one. If I were you, I would get in line with that employment manager and first find out what he is planning to do and give it a chance. You and the employment manager pulling together will be worth while to you both. He's going to take a share in the responsibility, and you are going to be able to give more direct attention to your men. You are still the man at the front, and you have to handle the men. You've still to get the work out and keep the men out of trouble. In that sense you have the same job, and it's a man's-size job. Using your gray matter will make it a pleasant job, too, and you will have your men with you.

You ask how to size up men. It strikes me, Jim, that you have more troubles than a lady suffragette. You've put a tough question up to me. There's a good many kinds of men, Jim. There are slouchy men and neat men, know-it-alls, Handy Andys and men who can do one thing well; men who are careful and conscientious; men that are careless and heedless of the safety of others; men that deliver the goods, and others that are disappointments; men who are loyal; men that are sweet and sour and men that are just plain agitators. You have men with good gray matter who use their eyes and ears and men who always get in a hole. You have green men who are pure gold and some that are just plain dubs; some that are clean and some that are of the smutty-story type. Jim, there are as many different kinds of men as keys on a grand piano.

I know you want to ask: How about machine men, timber men, shovelers, and the others? That's all right from one point of view, but from another angle you have got to look deeper than that. You've got to look at the real man and size him up, and then you'll know what really makes a good timber man or a good machine man. You've got to be a bit of a psychologist—that's what I think they call it. Then you have to parcel your jobs out in accordance with what you know intimately about them. Put a man who has lots of gray matter and can keep himself out of trouble on your difficult and dangerous jobs and put the other kind where they can't hurt themselves. Put your green men on your clean-up gang where they can get around and know the mine and you can get a line on them. Have one of your best men in charge of this gang and get him to tell you how the new men stack up. Then shove them along, first on shoveling and next as helpers on the timber gang, and then try them out on a machine. Make a study of each one until you can place him to his and the mine's advantage. Of course you can size up a man's hands and his feet and the way he handles himself, but these are superficial alongside of getting really acquainted. You can find the man for the job if you do it.

One additional thing you can tuck away and think about. Be sympathetic with your new man and let him know that you have faith in him. This belief in a man is a wonderful way to get a grip on him.

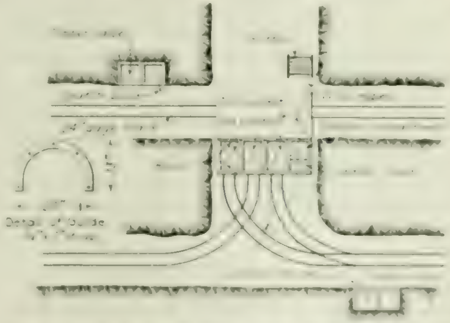
Handling Ore and Timber in Removing a Shaft Pillar

BY BYRON G. BEST

Written for Engineering and Mining Journal

Some years ago, in removing the pillar which had been left around an abandoned shaft in one of the Michigan iron mines, the following method of handling ore and timber was used:

The block of ore to be recovered was about 75 ft. high and lay on a dike about 80 ft. above the highest operating level and 1,000 ft. from the operating shaft. To remove the pillar with a minimum amount of rock work, a drift on the existing level was extended to the old shaft. Between the level and the bottom of the ore the old shaft timber was removed and replaced with cribbing, converting the shaft into a five-compartment raise, this including three ore chutes, one timber compartment, and one ladderway.



LAYOUT OF STATION ON NEW LEVEL OPENED AT BOTTOM OF OREBODY, 80 FT. ABOVE OPERATING LEVEL

A new level was opened at the top of the raise and raises were put up and sublevels started for the removal of ore. To furnish an additional outlet in the case of accident, a second raise was put up, connecting the two levels. The old shaft, however, was used in hoisting all of the timber and in transferring most of the ore to the lower level.

The timber compartment was lined with plank, and an air hoist, or puffer, was installed at the top of the raise as shown in the accompanying sketch. Timber was hoisted to the top of the raise by the puffer, and carried by hand to one of the two timber raises leading to the sublevels and situated on opposite sides of the shaft. Each of these raises was equipped with a wire rope running over a sheave wheel at the top of the raise and around two snatch blocks on the level, where either rope could be connected to the rope on the drum and the timber hoisted to the sublevels by the puffer. The ropes were connected by passing a small clevis through loops in the end of each rope.

The ore was trammed to the transfer raise in one-ton, end-dump cars. On the south side of the raise the ore from the east side of the pillar could be dumped into either of two compartments, and the ore from the west side into only one compartment. The tracks ran to the edge of the raise, where a rail laid across the tracks stopped the cars and made dumping easier. On the north side of the raise a turn-sheet was installed, and ore from any part of the pillar could be dumped in any compartment.

At the center of each ore compartment a semicircular guide of ¾ x 2-in. strap iron was fastened to the turn-sheet. The outside width of the guide at the open end was 1 ft. 8 in., a little less than the distance between the inside faces of the wheels. The guides brought the cars in the proper position for dumping, and a rail similar to the one on the opposite side of the raise stopped the cars and assisted in dumping.

Spillage and Dust Losses

By George J. Young

Written for *Engineering and Mining Journal*

So far as is known no comprehensive study of spillage and dust losses in handling ores in metal mining has been made. It is undoubtedly negligible in many instances, but often it must amount to an appreciable item in a year's time, particularly where high- and medium-grade ores are handled. Spillage losses take place at ore chutes due to careless loading or inefficient gates. Overabundant loading results in top spillage. Chute and top spillage can be retrieved in part. Bottom spillage which takes place by fine dust sifting through holes in the bottom of cars, trucks, or wagons or through the cracks and openings about the doors or gates is seldom retrieved. By the use of tight bottoms and a type of car which can be dumped by the revolving tipple, bottom spillage can be reduced to a minimum. A special design of auto-truck gate that is tight is feasible, although no special attempt appears to be made to supply trucks equipped with such gates.

Dust losses on conveyor belts are due to fines and sticky material adhering to the belt and deposited by it upon the conveyor framing and floor. These losses are sometimes retrieved in part by regularly cleaning up, but as tight floors are not often conspicuous a certain loss is undoubtedly permanent. In one instance a mining company installed a bristle brush on the under side of the conveyor head pulley and retrieved some of the loss. The discharge of the brush was received in a small bin. Undoubtedly a thorough working out of the design of a cleaning brush would prove to be advantageous.

Dust losses due to wind are undoubtedly large at certain periods or seasons and when ore cars or trucks are unprotected. With ore piles exposed to winds there are undoubtedly heavy losses where much fine ore is present and it is dumped upon the ore piles from any height. At one large smelter the ore beds are protected by a tight fence surrounding the ore piles. This is an excellent safeguard. Windage protection should be provided in the design of all ore-handling plants, particularly in those where it is customary to treat fine dry ores.

At a small concentrating plant in which gold and silver ores were handled an attempt was made at drying the concentrates in a small yard contiguous to the plant, but the windage loss was so conspicuous that a drying furnace was installed in the mill and further loss thus prevented.

Another loss analogous to spillage losses is encountered in wet stopes. Excessive water flow carries off fines. These may be trapped in sumps and later retrieved, or they may be allowed to go to waste as is often the case.

It is evident that a careful survey of spillage, windage, and flowage losses is essential in every mining operation and particularly in long-continued operations where relatively large tonnages are handled. In the aggregate they may be worth preventing, though the cost may sometimes be in excess of the value of the material that is saved.

A Safety Device for Hoisting

Written for *Engineering and Mining Journal*

One of the simplest ways to prevent overwinding in hoisting is by the use of beveled guides just below the sheave wheel. If the ordinary guides in use are 4 x 6 in., the safety guide is made from a 6 x 8-in. timber. The lower end of the guide is framed 4 x 6 in. and made to connect with the standard guide. The guide is then gradually tapered to a size 6 x 8 in. at the upper end. Two of these guides of equal length are put in. The 6 x 8-in. end is just below the sheave wheel. The length of the beveled guide depends upon the head room available above the cage.

In case of overwinding either of two things usually happens. The cage is generally drawn up into the sheave wheel with such violence that the wheel is often broken, but sometimes, if the speed is sufficiently great when the cage strikes the sheave wheel, the rope is broken, and if the safety dogs refuse to hold the cage it drops back into the shaft.

When safety guides are used it is practically impossible to draw the cage up into the sheave wheel, and if the rope should break, the cage is held so tightly in these guides that it cannot fall back into the shaft. These guides hold the cage in two ways. They spread the shoes and they bind against the cage. The pressure exerted against the hoist is sufficiently great to bring it to a stop.

Safety guides of this type have been used for many years in the Southwest, most extensively at Cananea, and have proved to be very satisfactory. It has been found when there has been an overwind that the cage is caught so tightly in them that it is quite a job to get it out.

This type of overwinding device is simple, efficient, inexpensive and when properly installed requires no care or watching. It is not as satisfactory for high-speed, high-powered hoists as for the more common type of hoist. Its use is not nearly as general as it should be. Where used it has given great satisfaction, and it is no longer an experiment. The hoisting engineer always has the knowledge that the beveled guides are going to stop the advance of the cage into the sheave wheel. The worst that can happen is for him to run the cage up into the guides and get it stuck there, but he need have no fear of being the cause of a serious or fatal accident from overwinding if these guides are properly installed.

THE PETROLEUM INDUSTRY

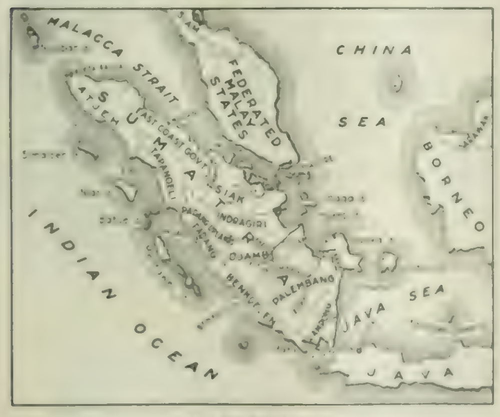
The Djambi Oil Field of Sumatra

BY ARTHUR H. REDFIELD*

Written for Engineering and Mining Journal

CONSIDERABLE INTEREST has been aroused in recent months over the disposition of the Djambi oil field of Sumatra, Dutch East Indies. The subject has been the occasion for extended diplomatic correspondence between the governments of the United States and The Netherlands, and has attracted widespread attention in the daily press, as well as in the journals devoted to the oil and gas industry. In view of the comparative dearth in the United States of published data on the geology, occurrence, and character of the Djambi oil, a résumé is given in this paper of the known facts of the petroleum geology of Djambi.

The geology of the Djambi oil field is a part of the geology of Sumatra as a whole, and cannot well be made a subject of unrelated study. The Residency of Djambi, extending as it does nearly across the island, represents almost a complete topographic and geologic cross section of Sumatra. The oil-bearing strata of Djambi are intimately related to those of the producing oil fields of Palembang. The structure of the Djambi oil field is due to the same tectonic forces which produced the anticlines of Atjeh, Perlak, and Palembang, in Sumatra, and even of Java and Borneo. A brief discussion of the stratigraphic and structural geology of Sumatra is accordingly given as an introduction to the geology of the Djambi field.



MAP OF SUMATRA

A cordillera, the Barisan Highland, extends lengthwise through Sumatra from northwest to southeast parallel to the west coast and separated from it by a narrow coastal plain which nowhere exceeds nineteen miles in width. The Barisan Highland consists of parallel ranges, separated by upland valleys, which broaden in places to plains and which elsewhere are broken by volcanic peaks. On the east slope of the cordillera spurs of the mountain chain extend toward the coast, especially in the northern end of the island, and in places broaden to plateaus. The western slopes of the cordillera descend steeply to the narrow coastal plain which borders the Indian Ocean; and consequently the watercourses of the western slope are comparatively short.

On the eastern side of the cordillera the foothills of the Barisan Highland are succeeded by a broad, flat plain, which is crossed by innumerable streams and rivers, sprinkled with numberless lakes, great and small. The level of the plain is broken by many hills largely of igneous origin, known by the Malay name of *boekit*.[1]

CRYSTALLINE ROCKS OUTCROP FREQUENTLY

The oldest rocks in Sumatra are gneisses, schists, and quartzites of indeterminable age. The origin may be referred in part to the pre-Cambrian and in part to the early Paleozoic. They probably belong to several geologic periods, but all were folded and denuded before the Permo-Carboniferous beds were deposited. These crystalline rocks form the backbone of the island, and crop out at numerous places in the Barisan Highland. They are penetrated here and there by pre-Carboniferous intrusions of granite.

The oldest sediments in Sumatra that can be determined by fossils are Permian (or Permo-Carboniferous?). Limestones of Permian (or Permo-Carboniferous?) age occur in several zones extending lengthwise through the Barisan Highland and in the Goemai Mountains, which form the easternmost range of the Barisan Highland in southern Palembang.

For years it was supposed that Mesozoic formations were lacking in Sumatra. However, fossils of Upper Triassic age have been found in the upper basin in Kwaloe River, in East Sumatra, and of Jurassic and Cretaceous age in isolated areas in the mountains of Upper Djambi. The "old slates" ([illegible]), which crop out in zones throughout the Barisan Highland and surround Tigapoeloe and Doeablas Mountains, are considered by Tobler to be Jurassic.

The Tertiary oil-bearing system of Sumatra is of principal interest in this discussion. Tertiary deposits are widely spread over the plains and low-lying country of Sumatra. The lowlands of the east coast, which attain a breadth of 130 miles in Palembang, are underlain beneath the Quaternary surface deposits by Tertiary sediments, which are cut in places by volcanic intrusions. The coastal plain of the west coast, nineteen miles wide near Benkoelen, is also composed chiefly of Tertiary sediments.

---

*Published by permission of the Director of the U. S. Geological Survey.

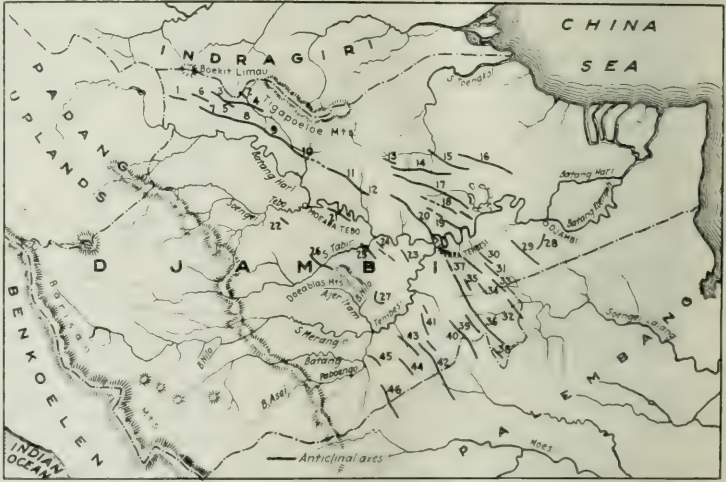
[1] Pronounced "boekit." The Dutch orthography has been followed in this paper in spelling Malay words and place names.

Igneous rocks are found in their greatest development in the Barisan Highland, where eruptives form a broad zone twenty to thirty miles wide in places. Intrusions of igneous rocks in the Tertiary lowlands to the northeast of the mountains form hills or *boekit*.

STRUCTURE OF PETROLEUM AREAS

The petroleum fields of Atjeh, Perlak, Djambi, and Palembang all form subordinate basins of a great geosyncline, which may be traced from Burma throughout the length of Sumatra as far as eastern Java. This geosyncline is bounded on the west by the Outer Malay Geanticlinal Arc, which extends from the Arakan Yoma Range of Burma through the Andaman and Nicobar Islands, the Barisan cordillera of Sumatra to the crystalline massifs of Tji-Letoe, Lohoeloh, and Diivo on Java, and on the east by the Inner Malay Geanticlinal Arc, which extends from the East Burman ranges through the Malay peninsula, the islands of Banka and Billiton to the Karimoen-Djawa Islands, lying north of Java. From Burma to southern Sumatra the tectonic lines bear generally north-northwest — south-southeast. At the Strait of Sunda, the tectonic lines turn sharply in an east-west direction. The geosyncline is filled with folded Tertiary strata. The bearing of the axes of folding is parallel to those of the inclosing geanticlines.

The existence of the Outer Malay Geanticlinal Arc is evidenced in the southwestern or mountainous half of Sumatra by a series of pre-Tertiary *coulisses* due to folding. By *coulisse* is meant one of a series of ridges *en échelon* on the earth's surface, like the wings (French, *coulisse*) of the stage in a theatre. Such features are formed by folding of the stratified rocks and the intrusion of masses of igneous rocks, followed by erosion. The Sumatra *coulisses* are apparently part of a system of *écheloned* ridges that may be traced up the Malay Peninsula to the central highland of Asia, and that continue to the east and northeast through many of the other islands comprising the Dutch East Indies.



MAP OF DJAMBI OIL FIELD

Key to Anticlines of Djambi Field. (Roman numerals after name indicate the "order" of the anticline)

1. Pemerian (III)
2. Sentano (IV)
3. Tjimpegan (III)
4. Gloempang Besar (III)
5. Soeroet (II)
6. Djenking (III)
7. Karang (II, III)
8. Oeloe Inoem (III)
9. Melawah (II)
10. Soemal (III)
11. Rengas-Kilis (III)
12. Loeboek Kepajang (III)
13. Loeboek Lesoeng (IV)
14. Soeban Tiang Djilan (III)
15. Pematang Lantih (IV, III)
16. Toeba Obi (III)
17. Benano-Singoan (III)
18. Sangkilan (III)
19. Kahidoerian (III)
20. Singkati-Sanggalan (III)
21. Serian-Selangli (II)
22. Aboeran-Koempih (II)
23. Mersam (II)
24. Geger (III)
25. Inoem-Bandoeng (III)
26. Rantau-Limau-Manis (III, IV)
27. Batang Nilo (IV)
28. Kenali-Assam (III)
29. Kempino (III)
30. Kehilangan-Badjoebang (II)
31. Rambel-Betoeng-Semblo (III)
32. Boeajan-Boeloeh (III)
33. Pajo Ngalega-Temidai-Mengkanding (III)
34. Meroeo-Senami (III)
35. Iboel (III)
36. Pendjarokan-Soengei Boengin-Moeara Badak (III)
37. Djangga (III)
38. Kapas Oost (III)
39. Ketidoeran-Boetang (III)
40. Ketalo-Manggoel (III)
41. Tanah Abang-Pemoesiran (III)
42. Telisa (IV)
43. Sekamis (III)
44. Plajang Semoet-Djelalt (III)
45. Ajer-Meroewap (II)
46. Djelapang (III)

The West Sumatra *coulisse* extends with many interruptions from the extreme point of Atjeh lengthwise through the island to Cape Bata, in the District of Lampong. Numerous parts of this *coulisse* are still unknown or hidden from the eye by Tertiary and later volcanic deposits. A series of longitudinal valleys separates the West Sumatra *coulisse* from a series of eight eastern *coulisses*. These structures are of varying length, but follow a trend generally parallel to that of the West Sumatra *coulisse*. They reach their greatest width in the highlands of western Djambi and the Padang uplands.

Van Es suggests the existence of an outlying *coulisse* extending from Cape Perbaben to the Strait of Banka. The existence of this *coulisse* in the south of the Island of Banka has been demonstrated.

Tertiary anticlines paralleling for the most part the trend of the main tectonic lines of the island abound in the geosynclinal basins of the east coast of Sumatra. They are particularly numerous in central Palembang and Djambi, as well as in eastern Atjeh. The geology of central Sumatra is not sufficiently well worked out to permit statements as to the tectonic phenomena of its eastern lowland.

Three sets of lines of volcanic activity occur—longitudinal, transverse, and oblique. These series of volcanic lines are confined to the southwestern or mountainous portion of Sumatra. The longitudinal lines trend northwest to southeast, parallel to the main tectonic lines of the island. The transverse lines are normal to the longitudinal lines. Diagonal lines, bearing roughly north and south, occur in a few places.

A number of fault lines also have been observed in Sumatra. These lines have the same direction as have been noted in the volcanic lines, longitudinal, transverse, and diagonal. Faulting is confined, with one noteworthy exception, to the southwestern or mountainous half of the island. The exception is a fault traced by Van Es across the east coast of Sumatra from the mouth of River Rokan to Lucipara Point.

A fault with a marked overthrust is believed by Van Es to run from Koeta Radja to Atjeh to Semangka Bay, in Lampong. The existence of this fault, as of other faults in the same area, is difficult to establish because of the thick flows of eruptive rocks.

PETROLEUM GEOLOGY OF DJAMBI

The topography of the Residency of Djambi is characteristic of both the Sumatran cordillera and the east coast lowlands. From the sea and from the Tigapoeloe Mountains, which constitute an outlier of the Barisan Highland, a relatively flat plain extends over three-fourths of the area of the residency, its surface broken only between Tabir and Merangin rivers by the Doeablas Mountains, which are a smaller outlier of the Barisan Highland. Toward the southwest the plain rises to meet the foothills of the Barisan Highland, which occupies the remaining portion of the residency.

The Tigapoeloe Mountains consist of an intruded massif of pre-Carboniferous granite, about which a belt of the "old slates" (Jurassic?) crop out. The Doeablas Mountains are a similar structure.

The plain of central Djambi consists chiefly of Tertiary sediments. Tertiary rocks ranging from the Eocene to the Pliocene are exposed in strips due to the folding of the strata throughout southeast Djambi and around the Tigapoeloe and Doeablas Mountains. To the northeast and southeast the Tertiary beds dip under the Quaternary and Recent alluvial deposits.

The mountains of Djambi begin on the northeast with a granite massif, and are succeeded by a zone of Permian or Permo-Carboniferous (?) rocks and a zone of the "old slates" (Jurassic?). The Barisan Mountains proper, which form the boundary between the residencies of Djambi and Benkoelen, consist of late Tertiary and Quaternary eruptives.

Cretaceous fossils have been found in Upper Djambi in isolated areas on the left bank of Batang' Asei and near Tapoeatan.

OLDEST SEDIMENTARIES PRINCIPALLY LIMESTONES

The oldest sediments that can be determined by fossils, in Djambi as in Sumatra, are Permian (or Permo-Carboniferous?). These consist prevailingly of massive limestones. Associated with the Permian or Permo-Carboniferous limestones in Djambi are shales, sandstones, conglomerates, graywackes, diabase—and porphyrite—tuffs, and marls. Unconformably overlying the Permian are the "old slates," ascribed by Tobler to the Jurassic. These consist of slates, quartzites, phyllites, and conglomeratic graywackes. The isolated occurrences of the Cretaceous which occur in Djambi consist of limestone and of shales with intercalated limestone beds.

The Eocene of southern and central Sumatra is represented by a lower or "breccia stage" of conglomerates, breccias, sandstones and marly shales, and by an upper or "sandstone stage" of shales, clays, and coal-bearing sandstones. The lowest member of the Tertiary, however, which appears in the Residency of Djambi is the "basal conglomerate" (Eocene?), which occurs in isolated outcrops surrounding Tigapoeloe and Doeablas Mountains.

The Telisa beds, which in central Djambi overlie the "basal conglomerate" unconformably, form the equivalent of the Goemai beds (Lower Miocene) of Palembang. Their thickness is estimated at about 3,280 ft. The Telisa beds consist of well-bedded, hard, generally chocolate-brown and gray shales and clays, in places containing typical concretions. Locally beds of limestone occur. The shales are sufficiently compact to form in places steep perpendicular cliffs.

The Telisa beds are conformably overlain by the Lower Palembang beds (Upper Miocene). These are purely marine in origin, and consist of more or less well-bedded green-blue clays and sandstones, and less important beds of sandy shale. Coralline and glauconitic limestones crop out in only one or two places. There are few lignite beds. Tuffaceous sediments also occur. In Djambi the Lower Palembang consists of about 6,600 ft. of more or less well-bedded greenish-blue marine clays and sandstones, as well as sandy shales. The Lower Palembang beds, it may be remarked in passing, contain the principal petroleum horizons of North Sumatra.

MIDDLE PALEMBANG CONTAIN PRINCIPAL OIL HORIZONS

The Middle Palembang stage (Lower Pliocene) contains the principal oil horizons of the Residency of Palembang. A typical development of this stage is found in the Kampong Minjak and Minjak Itam oil fields, east of Moeara Enim, in Palembang. Its lowest member consists of lignite measures about 130 ft. thick. The "lower clays," which overlie the lignites, consist of about 295 ft. of sandy and pure shaly clays, and are overlain by shaly sandstones 410 ft. thick. The "upper lignite measures," which form the highest member of the stage, total about 410 ft. in thickness.

The Middle Palembang beds evidently do not attain the thickness in Djambi that they do in Palembang. In Djambi they vary in thickness between 400 and 2,000 ft., and consist chiefly of sandy clay-shale, without marine fossils. Only a few interbedded lignite seams occur, none of which exceed 10 ft. in thickness.

The Upper Palembang stage (Upper Pliocene) consists of tuffs which vary from white and gray to azure blue, but whose color above the ground-water level, however, is in most cases pink to red. A few isolated lignite seams occur locally. The lower part of the Upper Palembang stage shows distinct stratification; this is not the case, however, with the upper beds, which are difficult to distinguish in many places from the overlying Quaternary tuffs.

The Upper Palembang beds (Upper Pliocene) consist of azure-blue soapy tuffs, which weather to a greenish yellow. They are with difficulty distinguished from the overlying Quaternary tuffs, which may be regarded as a denudation product of the Upper Palembang beds. The thickness of the Upper Palembang stage exceeds 2,000 ft.

Quaternary deposits of [illegible] clays and more or less sandy tuffs occur in horizontal beds in the upper reaches of Batang Hari and Batang [illegible]. Alluvial terraces of [illegible] clay occur also in these valleys.

Granite massifs form a considerable part of the Barisan Highland. Late Mesozoic granites constitute the cores of Tigapoeloe and Doeablas Mountains in Djambi.

Diabase rocks form [illegible] areas both in the granite massifs of the Barisan Highland and of the massif of Oeloe Rawas. Porphyrites and keratophyres occur in the mountains as well as at places on [illegible] River.

Andesites, dacites, [illegible], quartz porphyries, am-

[illegible]

phibole porphyrites, and other igneous rocks, chiefly basic, are found in the *boekits* that project from the plain.

The petroleum fields of Djambi lie within the Upper Tertiary peneplain province of South Sumatra. This extends from Tigapoeloe Mountains as far as the southeastern portion of the Residency of Palembang, where the peneplain disappears under the relatively horizontal layers of Quaternary tuffs. It cuts across Tertiary sediments, folded into a series of elongated anticlines and synclines.

In the southwest the oil fields of Djambi border upon the Sub-Barisan Plain, a relatively narrow strip of unfolded late Tertiary tuffs, which separate the Barisan Highland. To the northeast the petroleum fields border on the extensive, low and geologically unexplored coastal marshes.

The anticlines of South Sumatra have been classified by Tobler as anticlines of the first, second, third, fourth, or fifth order, according as the Upper or Lower Pliocene, Upper or Lower Miocene, or older formations have been exposed by erosion on their domes.

A continuous anticline, designated by three or four names of subordinate parts, lies to the north of Batang Hari and extends in a general northwest-southeast direction. The dips of the limbs of the anticline vary in places from 20 to 30 deg. Both Lower Palembang and Middle Palembang beds are exposed on its crest.

A group of minor anticlines, roughly parallel to the main anticline, occur in northwest Djambi between Batang Hari and Tigapoeloe Mountains. These are chiefly of the third order.

East of the Tigapoeloe Mountains several important anticlines, chiefly of the third order, begin, and continue southeastward to Batang Hari.

West and northwest of Soengei[3] Tebo the Tertiary strata between Batang Hari and the mountains are relatively flat-lying. A small anticline of the second order occurs south of Soengei Tebo. A long anticline of the third and fourth orders, whose major axis bears northwest-southeast, crosses Soengei Tabir, extending to Doeablas Mountains, and a small, somewhat curved anticline of the fourth order occurs to the east of the mountains.

A series of short anticlines of the second and third orders, whose major axes have the general northwest-southeast trend, occur for a limited distance south of Batang Hari and west of Batang Tembesi.

The portion of the Residency of Djambi lying south of Batang Hari and south and east of Batang Tembesi contains no less than nineteen anticlines, of which the majority are of the third order. The major axes of the anticlines trend generally northwest-southeast. The most intensive folding occurs in the southwest part of the anticlinal group.

The presence of petroleum in the Tertiary formations of Djambi is suggested by numerous seepages of oil, with or without natural gas, as well as emanations of methane, carbon dioxide, and hydrogen sulphide. Salt springs, known by the Malay name of *soeban*, also occur. These indications occur for the most part on the flanks of the recognized anticlines.

Possibilities of Petroleum in Central Djambi

The possibilities of obtaining petroleum in commercial quantities from central Djambi, such as may be forecast on the basis of the known geology, are decidedly good. The strata show numerous indications of petroleum in the form of active seepage. The anticlines and synclines of the Palembang peneplain are continued in Djambi, and probably indeed on the other side of Boekit Limau through Indragiri, Siak, and the northern east coast to Atjeh, where the existence of a folded structure has been established. The geology of central Sumatra has not been sufficiently worked out, however, to affirm this positively.

From all appearances, however, petroleum will be found in Djambi at different geologic horizons than in Palembang. The Middle Palembang stage, which contains the principal oil horizons of Palembang, does not attain the thickness in Djambi that it has in Palembang. Moreover, sandy shales are the predominating formation in Djambi, with fewer and thinner lignite seams. Oil and gas seepages are almost entirely absent from the outcrops of the Middle Palembang of Djambi.

However, the Lower Palembang stage, which comprises the productive oil horizons of Atjeh, is well represented in Djambi. It contains, moreover, a proper succession of porous and impervious beds, suitable for the accumulation of commercial deposits of petroleum. It is significant that by far the great majority of the oil seeps, gas emanations, and *soebans* in Djambi occur in outcrops of the Lower Palembang beds. A few issue from the Telisa beds, and few or none from the Middle Palembang.

Occurrence Resembles That of Neighboring Fields

The occurrence of petroleum in Djambi in the Lower Palembang stage is in accordance with experience in the neighboring fields. In Palembang the oil-bearing horizons have been found in progressively lower geologic levels in a line from southeast to northwest. At Moeara Enim oil is obtained from the Middle Palembang stage (Lower Pliocene). On the Soeban Boeroeng anticline, to the northwest, oil was struck at a depth corresponding to either the lower beds of the Middle Palembang or the upper strata of the Lower Palembang (Upper Miocene). On the Manggoel anticline, in northwestern Palembang, which is a continuation of the Ketalo-Manggoel anticline of southeastern Djambi, a gusher was struck in the Lower Palembang strata. Gas emanations and an oil seepage on the flanks of the Pendjårokan - Boengin - Badak anticline of southeast Djambi, the outcrops of an oily clay on the north flank of the Rantau-Limau-Manis anticline of central Djambi, are both referred to the Lower Palembang stage.

The progressive descent to lower geologic levels in the occurrence of the oil along a southeast-northwest line has been attributed by Hövig[4] to the conditions under which the sediments were originally laid down. The synclinal basin of central Djambi and Palembang was occupied in Upper Tertiary times, according to this author, by a marine gulf, whose major axis extended northwest-southeast, in which the strata of that epoch were successively deposited. Frequent secondary oscillations of level, alternate elevations and subsidences, caused this body of water to alternate between a swamp in which lignite beds were formed and a deep-sea gulf in which rocks barren of organic matter were deposited.

At the successive climaxes of elevation, a "drift zone" would be constituted in the shallow waters under the northwest head of the gulf, in which the organic remains which Hövig assumes to have constituted the basis of the oil would accumulate. The gradual filling of the gulf by sedimentation would cause the "drift zones" of later geologic stages created by the successive alternations of elevation and subsidence to migrate in geographic position constantly toward the southeast. Accordingly, the oil-bearing strata derived from these "drift zones" would be found at successively higher geologic levels to the southeast and at successively lower geologic levels to the northwest.

---

[3] "Soengei" in Malay means "stream."

[4] See reference in appended bibliography.

Analyses of oil from seepages in the Djambi field have not so far been published, and there has been no drilling. Analyses are available, however, of the oils of the adjacent Palembang fields. These show, in general, a series of asphalt-base oils, dark brown, red-brown, or greenish gray in color, and rich in gasoline and in kerosene. The specific gravities of the Moeara Enim oil range from 0.835 (37.6 deg. Bé.) to 0.875 (30 deg. Bé.) at 15 deg. C. The percentage of gasoline of the Palembang oils has been known to reach as high as 70; the majority of the analyses, however, show a percentage of light oils ranging between 40 and 60. The average kerosene content varies between 40 and 30 per cent.

To what extent these analyses of Palembang oils are of value in determining the characteristics of the oil to be obtained from the Djambi fields is open to question. The evidence would appear to show that the oil-bearing formations of Djambi belong to the Lower Palembang stage of the Miocene, whereas those of Palembang occur in the Middle Palembang stage.

Few analyses of the Pliocene and Miocene lignites of Djambi and Palembang are available. The lignites of the Middle Palembang (Lower Pliocene) strata of Moeara Enim show a water content of 23 to 25 per cent. The percentage of water in the Lower Palembang (Upper Miocene) lignites of Djambi is not known; the Miocene lignites of Benkoelen, however, contain 14 to 20 per cent of moisture. The Eocene coals of Tapan, in the lowlands of Padang, show 5.3 per cent water.

David White[1] has shown in the Appalachian oil fields of the United States a fixed relation between the degree of carbonization of coals and the quality of the associated mineral oils. Jezler's[2] study of the water content of the lignites in the Sanga Sanga oil field of Borneo indicates a similar relation between the grade of the oil and the moisture content of the associated lignites. On the basis of the known data regarding the lignites of Sumatra, it may not be amiss to assume that the oils of Djambi field will show an even lower specific gravity and an even higher content of light oils than the average of the Palembang oils. No analyses, however, have been published which would substantiate or disprove this assumption.

The right to exploit the oil fields of the Residency of Djambi is vested by a bill recently passed by the States-General of The Netherlands in the Nederlandsche Indische Aardolie Maatschappij (Netherlands India Mineral Oil Co.). Its capital is 10,000,000 guilders ($4,020,-000), half of which is supplied by the Dutch East Indian government and half by the Bataafsche Petroleum Maatschappij (Batavia Petroleum Co.), a subsidiary of the Royal Dutch Shell group. The control of the Netherlands India Mineral Oil Co. rests in a board of five members, three of whom are nominated by the Dutch Colonial Office.

A petition for participation in the Djambi field was presented to the First Chamber of the States General by the N. V. Nederlandsche Koloniale Petroleum Maatschappij (Netherlands Colonial Petroleum Co.), of Rotterdam, a subsidiary of the Standard Oil Co. of New Jersey.

The bill vesting the rights of exploration and exploitation of the Djambi fields in the Netherlands India Mineral Oil Co. passed the Second Chamber of the States-General in April, 1921. This proposed grant has been the subject of negotiations between the governments of the United States and of The Netherlands. The subsequent passage of the bill by the First Chamber and the royal approval have since made the bill a law.

BIBLIOGRAPHY

Bosquet, M. J. G., "Les richesses minérales des Indes Orientales Neerlandaises." Société des Ingénieurs Civils, Mémoires et Compte Rendu des Travaux, Vol. 57, 6th series, No. 4, pp. 436-495. Paris, April, 1904.

Clement, M., "Le pétrole aux Indes Néerlandaises." *Annales des Mines*, 10th series, Vol. 17, No. 4, pp. 386-433. Paris, 1910.

Emmons, W. H., "Geology of Petroleum," pp. 557-559. New York, 1921.

Engler, C. and Höfer, H., "Das Erdöl. Vol. 2, pp. 518-526. Leipzig, 1919.

Escher, B. G., "Composition of Crude Oils of The Netherlands East Indian Archipelago in Connection With Oil Bearing Strata." General Engineering Congress, Section 5, *Mining and Geology*. Batavia, May, 1920.

Fennema, R., "Rapport over het voorkomen van petroleum in Beneden-Langkat, Oostkust van Sumatra." Jaarboek van het Mijnwezen, Vol. 19, Part 2, pp. 1-90. Batavia, 1890.

Hövig, P., "De beteekenis der orde der Zuid-Sumatrasche anticlinalen." Verhandelingen van het Geologisch-Mijnbouwkundig Genootschap voor Nederland en Koloniën. Geol. Series, Part 2, 1916-1918, pp. 233-242. The Hague, 1918.

Jezler, H., "Das Oelfeld Sanga Sanga in Koetei (Niederl.-Ost-Borneo)." Zts. f. prakt. Geologie, Vol. 24, pp. 77-85; 113-125. Berlin, 1916. Abstracted by W. H. Emmons and J. W. Gruner in *Eng. and Min. Journ.*, Vol. 111, pp. 431-432. New York, March 5, 1921.

Schmidt, C., "Observations géologiques à Sumatra et Borneo." Bull. Soc. Geol. France, Series 4, Vol. 1, pp. 260-267. Paris, 1901.

Schneider, C. F. A., "Geologische Uebersicht über den holländischen ostindischen Archipel." Jahrbuch der k. k. geologischen Reichsanstalt, Vol. 26, pp. 113-114. Vienna, 1876.

Scrivenor, J. B., "The Physical Geography of the Southern Part of the Malay Peninsula." *Geographical Review*, Am. Geog. Soc., Vol. 11, No. 3, pp. 351-371. New York, July, 1921.

Suess, E., "The Face of the Earth." English translation, Vol. 1, pp. 457-458; Vol. 3, pp. 231-245. Oxford, 1908.

Tobler, A., "Einige Notizen zur Geologie von Südsumatra." Verhandlungen der Naturforschenden Gesellschaft in Basel, Vol. 15, No. 2, pp. [illegible]. Basel, 1904.
"Topographische und geologische Beschreibung der Petroleumgebiete bei Moeara Enim." Tijdschrift van het Koninklijk Ned. Aardrijkskundig Genootschap, Vol. [illegible], Part 1, pp. [illegible]. Leiden, [illegible].
"Voorloopige mededeeling over de geologie der Residentie Djambi." Jaarboek van het Mijnwezen, Vol. 39, Verhandelingen, Part 1, pp. [illegible]. Batavia, 1910.
"Korte beschrijving der petroleumterreinen gelegen in het zuidelijk deel der Residentie Djambi (Sumatra)." Jaarboek van het Mijnwezen, Vol. 40, Verhandelingen, Part 1, pp. [illegible]. Batavia, 1911.

Van Es, L. J. C., "De tectoniek van het westelijke helft van den Oost-Indischen Archipel." Jaarboek van het Mijnwezen, Vol. 46, Verhandelingen, Part 2, pp. 1-140. Batavia, 1917.

Volz, Wilhelm, "Beiträge zur geologischen Kenntniss von Nord-Sumatra." Zeitschrift der deutschen geologischen Gesellschaft, Vol. 51, No. 1, pp. 1-61. Berlin, 1899.

---

[1] White, David, "Some Relations in Origin Between Coal and Petroleum." Journal of the Washington Academy of Sciences, Vol. [illegible], pp. [illegible]. Washington, [illegible].

[2] See bibliography.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Bureau of Mines Seeks Improved Methods For Mineral Industries

Director Bain's Report Covers Various Activities Including Studies in Metallurgy, in Ore Recovery, Explosives, Oil Production and Refining, and Helium

IN HIS ANNUAL REPORT just made to the Secretary of the Interior, H. Foster Bain, director of the U. S. Bureau of Mines, states that the investigations conducted by the Bureau in the course of a special effort to aid the mineral industries to reestablish themselves on a safe business basis to meet the renewed foreign competition and the changed conditions of supply and demand of the post-war period point the way to the possible saving of vast sums through the application of improved methods in the production of various mineral materials.

Metallurgy of Zinc To Be Investigated

The cost of production of zinc, with the standard retort process, is now so high that it endangers the position of zinc as a cheap metal. Plans have been formulated for an investigation of proposed methods for the electrothermic metallurgy of zinc, with a view to increasing the recovery of the metal and lowering production costs. The results of an investigation regarding the losses of fines in the tailings of zinc metals in the Wisconsin district indicate that the use of concentrating tables of a certain type will greatly increase recovery. It is estimated that this practice would have added about $1,000,000 annually to the value of zinc output in this district had it been in operation in 1917.

Important results in the utilization of the low-grade and complex ores of copper, lead, silver, and zinc, which constitute a great problem in the mineral development of Utah, Colorado and other Rocky Mountain states, are promised by the utilization of the chloride volatilization process. The sulphur dioxide leaching of porphyry copper ores of Arizona holds the promise of important developments for the mineral industry of the Southwest.

Study of Low-Grade Iron Ores

The Bureau investigated the properties and possibilities of molybdenum, of which the United States possesses the largest known deposits, although the country is relatively poor in high-grade deposits of some other important alloying elements used in alloy structural steels, such as automobile steels. The Bureau conducted studies directed toward devising means for utilizing extensive deposits of low-grade iron ores that cannot be smelted profitably by present methods. These studies included investigations of the low-grade iron ores of the Birmingham, Ala., district, the manganiferous iron ores of the Lake Superior district, and the iron and steel situation in the Pacific Coast states.

An investigation of scrap losses in aluminum-alloy foundry practice showed that the annual losses in the United States amount to $1,200,000 and that universal adoption of methods recommended by the Bureau of Mines would probably result in a saving of about $600,000 per annum. Melting losses in this industry, which are largely preventable, aggregate about $3,000,000 yearly. A new method was devised to simplify the collection of radium emanation from radium salts. Experiments are now in progress to perfect the process and to develop apparatus that can be recommended for public use in laboratories and hospitals.

About one-quarter of the bituminous coal produced in the United States is used in industrial power plants, and the waste of unburned coal and coke in the ashes from boiler plants has been investigated by the Bureau. It has been possible to recover the greater part of the unburned fuel by washing the ashes on a concentrating table. As the result of a study of coal washing problems in the State of Washington, one mine has built a table washing plant to treat a pile of refuse amounting to more than one million tons, estimated to contain 200,000 tons of recoverable coal of coking quality.

Explosives Investigated

The Bureau also conducted studies regarding the use of liquid oxygen as an explosive. In co-operation with the Department of Agriculture an investigation was made of the use of cellulose from cornstalks in the manufacture of dynamite. Investigations were conducted to determine the best and safest conditions for the industrial use of 13,000,000 lb. of picric acid, held as a surplus by the War Department. During the year the Bureau called attention to the danger in using certain low-grade foreign detonators, which had been coming into the country in large numbers.

A universal gas mask has been developed by the Bureau for protecting the wearer against all poisonous gas not exceeding 2 or 3 per cent concentration in air where a safety lamp will burn. A fireman's gas mask has also been developed. A small gas mask for the use of train crews in railroad tunnels was devised. Investigations made in connection with the problem of ventilation of vehicular tunnels showed that from 20 to 30 per cent of the heat of the gasoline used as fuel for automobile engines is lost in the form of unburned gases in the exhaust, due to improper carburetor setting.

Investigations at the Ceramic Experiment Station at Columbus, Ohio, indicate that some American clays will yield products closely approaching the English china clay. At the same station it has been demonstrated that better graphite crucibles can be made with the use of domestic bonding clay than have hitherto been made with imported clays.

Pipe-Line and Other Oil Losses

An investigation of losses of crude oil through evaporation in storage and in transportation, conducted during the year by the Bureau, disclosed losses of startling magnitude. It was found that in the few days in which crude oil is stored on the lease before being taken by the pipe line, the aggregate loss per year from evaporation amounts to about 122,000,000 gal. of gasoline in the Mid-Continent field alone. This has a value, at 22c. per gal., of $26,840,000, and represents about 3 per cent of the total gasoline produced in the United States from all fields and all sources. The Bureau found that a large part of this loss could be prevented by the use of efficient equipment.

The Bureau of Mines has pointed out the considerable losses which have resulted from the failure of many refineries to recover gasoline from uncondensed still vapors. The significance of this investigation is shown by the fact that one refinery in the Mid-Continent field is now recovering from still vapors approximately 400 bbl. of gasoline daily that before the installation of this equipment was either lost or burned as fuel under the boilers and stills.

Large quantities of gas are now being wasted in the Osage Nation Reservation in Oklahoma because of low-pressure conditions, and the Bureau of Mines is investigating the feasibility of utilizing this waste gas by the use of low-pressure burners for oil-field boilers. The demand of the export market for "sweet" gasoline led to the development of a process for treating gasoline to remove the objectionable sulphur compounds, by which treatment some grades of American gasoline heretofore objectionable were made suitable for export.

Under the arrangement by which supervision of the drilling and production of oil and gas on the public lands is vested in the Bureau of Mines, the Bureau has supervision of about 100 oil properties which are producing at the rate of about 12,000,000 bbl. of oil per annum. Even at the present reduced price of oil, the Government royalty from this should total perhaps $2,000,000 per annum. A special process, devised at the San Francisco station of the Bureau, for cracking heavy oils and tars, promises the recovery of large yields of gasoline and other lighter products hitherto regarded as unrecoverable. Investigations made by the Bureau in Colorado and Utah indicate that the oil-shale deposits of the Rocky Mountain states contain a potential fuel supply of almost unequaled importance.

HELIUM GAS STUDIES

The experimental helium plant at Petrolia, Tex., conducted under the authority of the Army and Navy Helium Board, was in operation during the year at various times, and helium was produced for short periods. A study of the practicability of storing this gas in mine workings was made at the Bureau's experimental coal mine at Bruceton, Pa.

At the cryogenic or low-temperature laboratory in Washington, D. C., liquid air in quantity is now being produced. The primary object of this laboratory is to investigate gases and liquids at low temperatures, with special reference to the separation of helium from natural gas. Field investigations of possible supplies of helium in natural gas were completed during the year, every known gas field in the United States having been tested. Results were markedly successful, as they have shown that this country contains the largest supply of helium-bearing natural gas in the world.

During the year the Bureau, in co-operation with three of the largest seaboard coal exchanges, developed [illegible] systems of classifying export coal [illegible] by systematic sampling and analysis to supersede the arbitrary classifications used in war time. Further progress was made in the investigation for preparing and utilizing lignite, which constitutes the greater part of the nation's fuel resources.

Work on preparation and analysis of special alloy steels for the Navy was also completed. A comprehensive report on recent developments in electric brass melting was finished.

Methods for preparing caustic magnesia were investigated which determined that high-grade magnesia can be made from some varieties of magnesite hitherto believed to be unsuitable for this purpose. The Bureau investigated dolomite as a substitute for the more costly magnesite in preparing refractories, and demonstrated that there can be obtained from Ohio dolomite a product superior in magnesia content to imported Canadian magnesite.

EXPERIMENTS ON EXPLOSIVES

More experimental work on mining explosives, with reference to increased safety and efficiency, was performed. Plans were initiated for an international conference on the standardization of mine-rescue apparatus. Methods for reducing losses of anthracite in mining operations were studied. Timbering methods for metal mines were investigated. A special study was made of the ventilation of metal mines and of the rock-dust problem in such mines.

The Bureau called attention to certain methods for the prevention of waste in the slate-quarrying industry, and methods for reducing waste in the mining and preparation of talc were also made the subject of a report.

In the course of the year the Bureau trained 12,525 miners in rescue and first-aid methods, the largest number so trained in any fiscal year since the beginning of the training work.

Fall Meeting of St. Louis Section, A. I. M. E.

The St. Louis Section of the A. I. M. E. held a meeting at Rolla, Mo., on Nov. 4-5, in connection with the fiftieth anniversary of the Missouri School of Mines and Metallurgy. At the formal meeting of the section on Nov. 5 about fifty members and guests were present. The speakers were Mr. Graves, secretary of the student group at Rolla; M. M. Valerius, representing the Tulsa Section; A. C. Terrill, representing the Chicago Section; and T. A. Rickard, representing the San Francisco Section. Arthur Thacher spoke briefly on the value of Institute meetings, particularly to the younger members of the profession, and P. N. Moore spoke on the origin and function of the Federated American Engineering Society.

Gold Medals for South African Research Work

At the ordinary general meeting of the Chemical, Metallurgical, and Mining Society of South Africa, held on Oct 15 at Johannesburg, S. A., four gold medals were presented under the terms of the society's Research Endowment Fund. The medal for Chemical Research was presented to James Moir, D.Sc. (Aberdeen), who has for several years been chemist in the Mines Department of the Union of South Africa. The recipients were in each case introduced by Prof. J. A. Wilkinson, a past president of the society. Dr. Moir, in responding, said he has now read one hundred papers, thirty-seven of which had been presented before the C. M. and M. S. of S. A. [illegible] research was awarded to William Arthur Caldecott, D.Sc. (Cape), and another to Henry A. White. These gentlemen are consulting metallurgists to the Consolidated Gold Fields and Union Corporation (A. Goerz) groups, respectively. The medal for mining research was awarded to John Innes for his able work on, and description of, the Kotzé Konimeter.

Minnesota Engineers Make Nominations

The November meeting of the Engineers' Club of Northern Minnesota was held at the Mohami Club, Virginia, on Nov. 26. The following nominations for next years' officers were reported: For president, J. H. McInnis, Virginia, and A. St. Vincent, Hibbing; vice-president, B. M. Concklin, H. E. Loye; secretary and treasurer, Robert McL. Johnson, R. J. [illegible], H. S. Rankin, O. A. Sundness, A. Tancig, F. R. Mott, P. F. Chamberlain, F. A. Pollock and H. R. McAdams.

W. H. Crago addressed the members on mining conditions in the Belgian Congo and detailed his experiences in that country.

Unreliable Potash Promotions in Texas

The National Vigilance Committee of Associated Advertising Clubs of the World has as a purpose "to create public confidence in advertising by making all advertising trustworthy." In its bulletin of Nov. 12 it thus summarizes its investigations on the advertising of the Cox Realization Co., regarding potash in Texas:

"Advertising of the Cox Realization Co., a potash project of the professional promoter, S. E. J. Cox, was the subject of investigation by the committee. A special bulletin was issued under date of Oct. 20. Considerable publicity has been given this report, although the Cox advertising was largely confined to letters and literature sent through the mails. The New York *Herald* devoted a front-page column to a story based on the special bulletin.

"Potash deposits claimed by Cox to have been discovered by the Cox Realization Co. [illegible] were advertised [illegible]. They were claimed to be in Martin County, Tex., and the committee's special bulletin quoted the [illegible] to the effect that no authentic discoveries [illegible] had been reported in Martin County, [illegible]

"The committee's bulletin has been the subject of several communications to the committee from Cox and his attorneys. [illegible] the Federal Trade Commission [illegible] and the use of false and misleading statements in his advertising, in 1919."

Important Achievements of Geological Survey

In his annual report submitted to Congress on Dec. 7, the Secretary of the Interior lists the following among the important achievements of the U. S. Geological Survey during the last fiscal year:

Made field surveys and studies in ten states with a view to determining the occurrence of oil and gas; began the preparation of state maps showing oil and gas fields, and published maps showing the fields in Louisiana and Texas.

Continued co-operative geologic work with seventeen state organizations, with Hawaii, and with Haiti and the Dominican Republic, and co-operated in research with the U. S. Reclamation Service, Bureau of Mines, Forest Service, Federal Power Commission, and other Government organizations.

Made studies of ore deposits in ten states and prepared or began the preparation of sixteen reports on ore deposits or mining districts.

Continued studies of the structure and oil resources of the Osage Indian Reservation, in Oklahoma; prepared maps and reports on them for publication, and made further studies in other areas in that state with a view of directing successful search for oil and gas.

Studied deposits of oil shale in Colorado and Nevada and prepared for publication the manuscript of a general report on oil shales in the Rocky Mountain region.

Made studies of certain coal fields and prepared reports on fields in five states.

In a search for beds of potash salts in the Southwest, discovered at three localities two or more potash-bearing beds that may prove to be of commercial value.

Investigated nitrate-bearing clays in the Mohave Desert and in the valley of Colorado River and adjacent parts of southeastern California and began the preparation of a report on them.

Continued studies of mineral deposits in Alaska.

Made collections and examinations of fossils from twenty-one states for stratigraphic identification or correlation.

Made more than 2,500 analyses of rocks, ores, minerals, and waters.

Continued observations of temperatures in deep wells to determine temperature gradients in oil-bearing areas and in those not oil-bearing.

Continued the collection of statistics of mineral production and co-operated in this work with other Government organizations, with state organizations, and with industrial associations.

Continued studies of foreign mineral resources so far as these may compete with domestic resources or affect domestic industries.

Made reports on nearly 7,000 applications for oil and gas prospecting permits and reduced the oil and gas reserves by more than 60,000 acres.

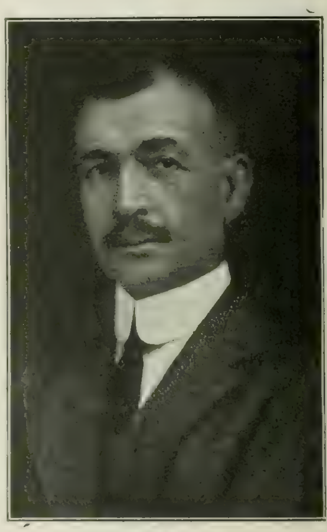
Made reports on 249 applications for coal-prospecting permits and 78 applications for coal leases and reduced the coal-land reserves by more than 200,000 acres.

Defined as leasing territory twenty-four oil and gas producing "structures" containing more than 230,000 acres.

Made more than 7,500 reports on applications under the mineral-leasing laws.

MEN YOU SHOULD KNOW ABOUT

James R. Finlay will make a thorough investigation of mining properties in New Mexico for the State Tax Commission, acting under authority of an act of the 1921 Legislature, which appropriated $30,000 for securing an expert valuation of all mining property in the state for purposes of taxation. Mr. Finlay is now at Mogollon. Following his work there, he will devote his time to the properties of the Chino Copper Co. and the holdings of the Phelps Dodge Corporation at Tyrone, in Grant County.



J. R. FINLAY

Paul A. Gow was a visitor in New York this week, en route from Boston to Butte.

Charles Janin, of San Francisco, is making a trip to Washington, D. C., and New York.

Charles A. Mitke has returned to New York from South America and is en route to Bisbee, Ariz.

H. V. Winchell was recently in New York, and is now at the Iron Cap Mining Co., at Globe, Ariz.

F. J. S. Sur, petroleum geologist, recently returned to his San Antonio office, after having spent six weeks in New Jersey on geological inspections.

J. W. Sherwin, general manager of the West End Consolidated Mining Co. and allied properties, is in Tonopah from Oakland, Cal., making an inspection of the local property.

Frank L. Hess, of the U. S. Geological Survey, has returned from a trip through the uranium fields of Wyoming, Colorado, Utah, Arizona, and New Mexico. He will leave soon for Los Angeles.

James R. Jones, formerly a law examiner of the U. S. Bureau of Mines, and later an attorney with the Royal Dutch-Shell oil companies, has entered the private practice of law with offices at 327-328, Hynds Building, Cheyenne, Wyo.

H. B. Cobban, president of the Chamber of Commerce of Miami, Okla., has been appointed chairman for the month of December of the Tri-State branch of the American Zinc Institute, succeeding **P. R. Coldren**, who served in this capacity during November.

Dr. Alfred C. Redfield, assistant professor of physiology at the Harvard Medical School; **Dr. C. A. L. Binger**, of the Rockefeller Institute, New York; **Dr. George Harrop**, of the Presbyterian Hospital, New York; **Dr. A. V. Book**, of the Massachusetts General Hospital, and **Dr. Henry S. Forbes**, of Harvard University, are in Peru to undertake the first studies ever made of the physiological changes which enable people to live at high altitudes. The commission expects to remain two months in mining towns in the Andes Mountains.

A. J. McQuatters, of New York, is conducting a party of eastern capitalists on a visit to the silver mines of the Parral district, Mexico, in which he is interested. The visitors are **Louis E. Stoddard, J. L. Day, William H. Wright, Franklin Remington, J. F. Shaw** and **Dr. Kuno B. Heberlein.** The party was joined at El Paso by **S. E. Gill**, of Pittsburgh, president, and **J. C. Long**, general manager of the Parral & Durango Ry., and **James I. Long**, formerly general manager of the Alvardo M. & M. company. An inspection will be made of the latter property and also of the Refugio and the Hidalgo mining companies and the P. & D. Ry.

Mining and metallurgical engineers visiting New York City last week included **Chester A. Fulton**, Baltimore, Md.; **W. M. Small**, Tampico, Mexico; **Henry B. Smith**, New Britain, Conn.; **George A. Laird**, South America; **E. G. Robinson**, Youngstown, Ohio.; **Ralph H. Sweetser**, Columbus, Ohio.; and **Harry O. Robinson**, Mexico City.

OBITUARY

James A. Grainger, miner and prospector, died at Colfax, Cal., on Nov. 23. Together with **A. J. Stinson**, now state mine inspector of Nevada, Mr. Grainger located and did the preliminary development work on the Royal mine, at Rawhide, Nev. He was a native of Colorado and was forty-six years old.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

Freight rates on ore and concentrates between California points and the Thompson smelter, at Wabuska, Nev., have been ordered lowered, thus enabling this plant to compete with the smelters in the Salt Lake Valley.

Lake shipments of iron ore for the season just closed were less than in any year since 1904, the total being a little over 22,300,000 tons.

Problems vexing the mining industry in Colorado are to be discussed at a conference to be held in Denver next month.

The bill for revising the United States mining law does not please the Northwest Mining Association, and a resolution has been passed analyzing the objectionable sections of the measure.

Appointment of a state geologist in Utah, an office at present non-existant, would aid the mining industry in the state, in the opinion of the Salt Lake Commercial Club, which will lay the matter before the Governor.

Blue-sky legislation is needed in Ontario, according to some operators in that province. Further study of the matter is to be made before any attempt at drafting a bill is undertaken, however.

Anaconda is doing important work in seeking a new outlet for its copper and zinc. New Cornelia has also been experimenting recently in making copper strips.

Want State Geologist for Utah Appointed

Salt Lake Commercial Club To Ask Governor To Create Position—Would Aid in Rejuvenating Mining Industry

The appointment of a state geologist for Utah and the creation of the permanent position of state geologist will be asked of Governor Mabey by the mining committee of the Commercial Club of Salt Lake City. Efforts are to be made to rejuvenate the mining industry, and the creation of such an office is expected materially to promote this object. It is felt that a proper channel is needed for the dissemination of information in regard to geological data, for which requests are constantly being made. It is planned also to establish a permanent mineral exhibit at the Commercial Club. The pamphlet recently issued through the Commercial Club, in co-operation with members of the local staff of the Bureau of Mines, entitled "Utah's Mineral Wealth," has been favorably received.

Freight Rates to Wabuska Smelter Reduced

The Interstate Commerce Commission, on Nov. 23, rendered an important decision which will reduce rates on ore from California points to the Thompson smelter at Wabuska, Nev. Hitherto the rates were favorable to Utah smelters and prohibitive to Nevada points, making it impossible for the Thompson smelter to operate on custom ore. The old rate was, for example, on ore running between $80 and $100 per ton, $10.50 per ton to Wabuska, or $1 per ton higher than to Utah smelters. The new rate has not yet been announced.

Utah Apex Decision Affirmed By Higher Court

The decision of the lower court upholding the claims of the Utah Apex Mining Co. in its litigation with the Utah Consolidated Mining Co. in the matter of apex rights has been affirmed by the U. S. Circuit Court of Appeals. The ore in dispute occurred in Utah-Apex ground, and was claimed by the Utah Consolidated as occurring in the Yampa limestone. The Utah-Apex claimed the ore as occurring in connection with its fissure system. Judge Johnson, in the Utah court, awarded to the Utah Apex damages of $1,200,000 last October. Additional hearings have been held on the matter of damages, and further accounting is in progress.

Lake Movement of Iron Ore Smallest Since 1904

The iron-ore movement by water from the Lake Superior district for the present season, which closed on Nov. 28, according to *The Iron Age*, was 22,300,726 gross tons, the smallest since 1904, when shipments by water were 21,226,901 tons. The 1921 shipments show a decrease of 61.86 per cent from those of last year, when water shipments amounted to 58,527,226 tons.

Broken Hill Mines To Increase Productive Work

[illegible]
Engineering and Mining Journal

Melbourne, Nov. 30—The Broken Hill companies have issued a joint statement to the effect that current metal quotations now permit the extension of underground operations. Accordingly, the North Broken Hill, the Broken Hill South, and the Broken Hill Proprietary companies have decided to increase their productive work as soon as practicable.

Protest Against Mine Law Revision Bill

Northwest Mining Association in Resolution Asserts Proposed Measure Would Make Present Situation Worse

A resolution passed by the Northwest Mining Association on Nov. 19 protesting against the revision of the United States mining law, as proposed in the bill introduced by Representative S. S. Arentz, which embodies the report of the Ingalls committee (H. R. 7,736), reads as follows:

"Whereas, a bill to revise, amend and codify the laws of the United States, relating to the location of mining claims on the public domain, is now before the 67th Congress and known as H. R. 7,736; and,

"Whereas, the purposes and probable effects of this bill, if enacted, have been carefully studied by competent committees of this association and have been adversely reported upon; and,

"Whereas, the existing Federal mining laws are now well and generally understood, as interpreted by the courts in the last forty-nine years, and have not proved to be sufficiently defective to require drastic revision. Now therefore be it

"Resolved, That the Northwest Mining Association, representing mining interests in the states of Montana, Idaho, Washington, and Oregon, at a regular meeting at Spokane, Wash., Nov. 19, 1921, does hereby vigorously protest the passage of this bill on the ground that it is not competent to improve present mining conditions, but that, on the other hand, it would [illegible] [illegible] loss, litigation and interruption in mineral industry and make confusion worse confounded, as shown by the attached analysis which is hereby made a part hereof, and be it further

"Resolved, that this association believes that no legislation should further handicap the mining industry at this time, but that it should be permitted to recover from its present depression under the old and well-known statutes.

"Also, that copies of this resolution and the analysis of H. R. 7,736 be sent to each Senator and Representative of this region and to the chairmen of the Senate and House Committees on Mines and Mining, with an urgent request for their careful consideration."

In the analysis referred to in the resolution, objection is specifically made to the following sections and subsections of H. R. 7,736, namely, Section 5, A, B and C; Sections 6 and 7; and Section 13-A. A sketch showing the proposed manner of locating mining claims under H. R. 7,736 compared with the present system is also given. (This analysis will be published in full in next week's issue.)

Developing New Uses for Copper and Zinc

The Anaconda Copper Mining Co. has recently been doing a great deal of work with a view to widening the commercial application of copper and zinc. The advantages in employing zinc for all purposes where it can economically displace galvanized iron, and also in combination with asbestos for roofing purposes, is to be emphasized. For the latter purpose, it will be used as a filler between two sheets of asbestos. For shingles, both copper and zinc, colored by oxidation to any shade desired, will be produced to compete with tile. The weight will prove a great factor in their favor, especially where high freight charges are an important factor. It is understood that the Anaconda company will have these products on the market in the near future. An effort will be made to place the goods as directly in the hands of the consumer as possible. A popular advertising campaign is planned, and many selling agencies, which will also function as service stations, will be maintained. Prices will be stabilized and results guaranteed.

International Nickel Men Out

The executives of the International Nickel Co. of Canada, including A. D. Miles, president; G. E. Sylvester, assistant to the president; and W. M. Bennett, treasurer, have tendered their resignations. It is understood that Mr. Miles has also tendered his resignation as a director of the International Nickel Co., of New Jersey. The cause assigned is the depression in the nickel industry, which resulted in the discontinuance of the company's operations in the Sudbury field and the closing down of the Port Colborne refinery.

Use of Helium Demonstrated

The first practical demonstration of the use of helium in regular aircraft was successfully made Dec. 1 at Hampton Roads. The Navy's non-rigid airship "C 7," with a gas capacity of 181,000 cu.ft., was on that date inflated entirely with helium.

New Cornelia Experiments in Making Copper Strips

Colonel Greenway Describes Briefly Results Obtained to Date at Ajo

By James H. McClintock

Phoenix—"We haven't what you would call plans thus far for any copper manufacturing enterprise at Ajo," says John C. Greenway, general manager of the New Cornelia Copper Co. "Any statement that would indicate the contrary is, at least, premature. I can only tell you what we have done. We have produced strips of copper 4 in. wide, 367 ft. long, and 37 gage, this meaning that the material is only 4/1000 of an inch thick. Such a strip will contain less than three holes to the ribbon, and the material is high in the points of strength and ductility. Our Ajo copper cathodes normally run 99.9 per cent pure. They need no refining for commercial uses, but usually are recast in New Jersey into commercial forms.

"In one thing," continued Colonel Greenway, "I feel that we have achieved success, this in the creation of a one-piece copper radiator of cellular type, something unique and much better than the one we made and tried out in our initial experiments. If this second effort proves what we hope it to be, we shall have done a big thing in this one item. We have tried the manufacturing of such things as road signs and of domestic implements, but everything yet is in an experimental stage, and, as I have said, any summing up of results would be premature."

Mine Merger on Cuyuna Range Rumored

It is reported that negotiations are under way for leasing the Cuyuna-Duluth mine by the Inland Steel Co., and that this property, together with the Armour mines, the Pennington (Todd-Stambaugh Co.), and the Kennedy and Meacham (Rogers-Brown Ore Co.), will form an independent ore-producing group on the Cuyuna, controlled by a proposed merger of several independent operators to be dominated by the Pickands-Mather interests. The Cuyuna-Duluth has been operated prior to this year by a subsidiary of the American Manganese Manufacturing Co. The property adjoins the Armour No. 2 mine of the Inland Steel Co.

New Concentrator at Clifton?

A report is in circulation in the Southwest to the effect that among the improvements under consideration by the Phelps Dodge Corporation in the Clifton-Morenci district of Arizona is a 15,000 ton concentrator to be situated somewhere between Morenci and Clifton, probably upon the Coronado railway tracks in the vicinity of Chase Creek. The company recently took over the Arizona Copper Co.'s property in this district.

Colorado Mining Men To Discuss Industry's Troubles

Conference To Be Held Next Month—Questionnaire Sent Out

Colorado mining men have been called to meet Jan. 17, 1922, to consider problems affecting the industry and to devise, if possible, such measures of relief as will assist in the restoration of the industry. A questionnaire has been sent out to the operators and miners of the state, and upon the answers received the program for the meeting will be based.

The principal questions are:

Name in order of importance the five principal contributing causes of mining depression in your district.

Can you suggest any remedy that can be worked out by co-operative effort of Colorado mining men?

Suggest in order of importance five subjects for consideration by the January meeting.

In your opinion, along what line should the state mining organizations direct their activities in the coming year?

Candelaria Mines To Get Mill of Rochester Combined

The news that the Rochester Silver Corporation had agreed to finance the construction of a milling plant at Candelaria for the Candelaria Mines Co., at Candelaria, Nev., has been confirmed by the president of the Rochester company. By the terms of the agreement the Rochester Combined mill, which was built three years ago, but which was never operated, is to be moved to Candelaria at once. It is reported that orders for lumber and supplies have been placed and that the mill will be ready about June, 1922.

Welsh Gold Mines Reopened

By Cable From Reuters to "Engineering and Mining Journal"

London, Nov. 28—Mining operations have been resumed at the Ologau gold properties at Bontddu, near Barmouth, Merionethshire, Wales. Work is being done on a level from which $300,000 worth of gold was taken in 1899.

Suit Against Inland Steel Co. Deferred

The suit of Thomas Keating Co., a foreign corporation, against the Inland Steel Co., a foreign corporation, which was on the civil calendar for November in the district court at Brainerd, Minn., on the Cuyuna Range, will not be heard until the May term of court. The Keating company, owning fee to mining property formerly under lease to the Inland Steel Co., claims $300,000 loss through improper mining methods and infringement of lease.

The week of Dec. 5 was Anti-smoke Week in Salt Lake City, Utah, in continuance of the effort successfully begun last winter to abate the smoke nuisance of the winter months.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Alaska's Prosperity Dependent on Mining Industry

Engineering Commission Emphasizes Importance of Development of Rail Transportation in Territory

That the growth of all industry in Alaska is dependent upon mining is pointed out in a report by the chairman of the Alaskan Engineering Commission submitted to Congress on Dec. 7. The report declares, however, that the mining industry is greatly handicapped by the lack of railroad transportation. It is predicted that the opening of the Government railroad will stimulate mining operations greatly. Chairman Mears says that the Copper River & Northwestern R.R., running from Cordova 192 miles inland to the Kennecott copper mine, has been a very profitable operation. He embodies in his report figures showing the operating expenses and revenues of that road from 1912 to 1916 inclusive, as follows:

Year	Operating Expenses	Revenue
1912	$[illegible]	$[illegible]
1913	[illegible]	[illegible]
1914	[illegible]	[illegible]
1915	[illegible]	[illegible]
1916	[illegible]	[illegible]

Continuing, the report says:

"It is reasonable to presume that much greater development may ultimately be looked for along the line of the Government railroad, as the resources tributary to the country are more varied and diversified in character, and the climate of the Cook Inlet and Tanana Valley regions is better suited to agricultural development and permanent settlement.

"One producing copper mine was sufficient reason for the expenditure of about $25,000,000 in the construction of the Copper River & Northwestern R.R. to transfer the ore to tidewater. With very little other resources the mine has made the railroad pay. If one or two good producing mines are developed in the country tributary to the Government railroad, or if the coal fields at Matanuska or Healy begin to produce tonnage on a commercial scale, both of which would have a tendency to develop the adjacent farming districts, it is believed that it would not be long before the new railroad would be on a self-supporting basis.

"To answer the specific inquiry as to the probable service of the railroad, it may be stated that a twice-a-week mixed train service in both directions is deemed sufficient to meet demands, supplemented by freight extras when necessary. By running trains twice a week, the interval between trains is not so great as to handicap the business of the country and would probably meet all demands for some time to come. In this way the operating expenses of the road would be kept at a minimum."

London Nitrate Sales Show Marked Increase

Large nitrate sales in London have greatly encouraged the Chilean producers, according to advices reaching the Department of Commerce. The agreement reached between the Nitrate Producers' Association and the Nitrate Pool, of London, caused a decided rise in the exchange value of the Chilean peso. A part of this gain was lost because of the report that the agreement provided for a material reduction of existing stocks in Europe before further exports were to be attempted. The recent brisk demand for nitrate, however, promises to consume the European stocks sooner than had been expected.

The consul at Iquique reports September nitrate production to have been 1,493,229 quintals. In September of 1920 the production was 4,501,850 quintals. The present rate of production is practically double the rate of exportation, with the result that stocks in Chile are increasing rapidly. The consul states that 29,000,000 quintals has been estimated as the probable 1921 production. The 1920 production of nitrate was 55,514,000 quintals.

Government's Silver Purchases

Purchases of silver by the Bureau of the Mint during the week ended Dec. 3 totaled 1,714,000 fine ounces. This brings the total purchases under the Pittman Act to 84,759,863 fine ounces.

Interest Manifested in Mineral Leases and Claims

That there is great interest in mineral leases and claims is indicated by the figures covering these activities submitted to Congress on Dec. 7 by the General Land Office. As to mining claims, 114 mineral entries and fifty-nine coal entries were received; also ninety-four mineral contests. As to prospecting permits and leases, twelve applications for sodium permits were allowed and ten rejected. Applications for potash prospecting permits received totaled 180, of which thirty-seven were allowed. Fourteen applications for patent based on discovery were received, of which twelve were allowed. Oil prospecting permits received up to July 1 totaled [illegible]. Of these [illegible] have been granted and 1,5[illegible] rejected.

Ask $3,381,525 for Bureau of Mines and Survey

Appropriation Sought by Each for Next Year's Work Represents Increase of $186,000 and $106,000 Respectively

Appropriations totaling $3,381,525 have been requested by the President and the Director of the Budget for the work of the Geological Survey and the Bureau of Mines during the next fiscal year. Of that amount, $1,721,060 is requested for the Geological Survey and $1,660,465 for the Bureau of Mines. The Survey's estimate represents an increase of $106,720 over the amount appropriated for its work during the current fiscal year. The Bureau of Mines' estimate requests $186,165 more than was appropriated for the current year's work.

The major divisions of the Survey's appropriation are as follows: Topographic surveys, $430,000; geologic surveys, $352,000; chemical and physical researches, $40,000; mineral resources, $125,000; mineral resources of Alaska, $75,000; gaging of streams, $180,000; geological maps, $140,000; classification of lands, $300,000. The major increase over last year's expenses is in connection with the topographic surveys, in which instance an additional $100,000 appropriation is requested.

The major divisions of the Bureau of Mines' appropriation are as follows: Investigating mine accidents, $414,065; testing fuel, $136,000; mineral mining investigations, $130,000; non-metallic investigations, $35,000; petroleum and natural gas investigations, $[illegible]; mining experiment stations, $[illegible]; experiment station and mine inspection in Alaska, $[illegible]; operating mine rescue cars, $[illegible]; enforcement of oil leasing act, $162,000.

The increases asked as compared with the amounts appropriated for the current year's work are as follows: Investigating mine accidents, $[illegible]; mineral mining investigations, $[illegible]; enforcement of oil leasing act, $[illegible]. There was a reduction of $[illegible] in the amount asked for the operation of mining experiment stations and a reduction of $[illegible] in the amount requested for testing fuel.

The Navy renews its request that $1,000,000 of its fuel appropriation be made available for the coal-mining operations in Alaska.

Reports on Mineral Applications

During the last fiscal year the U. S. Geological Survey made [illegible] reports covering applications under the Federal leasing law.

NEWS BY MINING DISTRICTS

London Letter

Consolidated Gold Fields Passes Dividend—New Chairman Elected to Gaika Gold Board—West African Gold Property Shows Good Ore

By W. A. Doman

London, Nov. 23.—Taking into consideration the depressed condition of the mining market during the last eighteen months or so, shareholders in the Consolidated Gold Fields of South Africa naturally looked for a reduction in profits for the twelve months ended June 30 last, but it is questionable whether they expected the dividend to be passed. This position is brought about by the heavy sums required for depreciation in investments held by the New Consolidated Gold Fields. To bring the shares down to market value, no less than £492,287 is required. This amount follows upon the writing off of £165,408 a year ago, and £194,335 in the preceding period.

Presumably the greatest amount of depreciation was in gold mining shares, though the company has placed large amounts of capital in industrial undertakings. Apparently little profit was derived from sales of shares, so that the bulk of the revenue of £429,984 was provided by dividends on investments. The company has invested about £188,000 in new undertakings, and has sold its gilt-edged securities. Unless the operating company can make a distribution for the current year the interest on the Consolidated Gold Fields preference shares is none too well covered.

Some of the companies in which the New Consolidated Gold Fields is interested have proved disappointing, particularly the American Trona and a South African coal deposit. The report gives a good review of the Rand mining industry, and points out the influence of the gold premium and the high wages paid for labor.

For October the Gaika Gold Mining Co. crushed 4,181 tons, for a yield of 1,400 oz. of fine gold, or about 6.7 dwt. per ton.

At 85/— per fine ounce the revenue was £5,950, and as working expenses were £5,263, the profit at normal was only £687. As, however, gold is taken at 100/— per oz., the profit amounts to £1,737. It will be seen that with costs at 25/2 per ton, the profit would have been negligible had there been no premium.

Although the production of tin in the Federated Malay States has been considerably curtailed, the quantity exported keeps up remarkably well. Last month's exports, 3,161 tons, were the highest of the year apart from January, when they were 3,298 tons. For the ten months to date, the total is 28,211 tons, as compared with 29,517 tons for the corresponding months in 1920 and 31,554 for the same period in 1919.

Though still satisfactory, developments at Lonely Reef in October were not on the high level of previous months. On the 23d level, north drive, the ground from 363 ft. to 423 ft. averages 36 dwt. over 44 in. In the next level below, north drive, from 203 ft. to 244 ft., the average is 18 dwt. over 59 in. During the month 5,100 tons was crushed, for a recovery of 4,610 oz. of fine gold, or 18.08 dwt. Costs were 48/4 per ton.

A little interest has been created in West African gold mining shares by the development results of the Obuom Concession of the Obbuassi Mines. On No. 5 level south of prospecting shaft samples taken every 5 ft. from 100 ft. to 125 ft. show: 18 in. 13.5 dwt.; 42 in. 30; 30 in. 45; 20 in. 35—a short but good run of ore. A winze sunk 160 ft. south of prospecting shaft from No. 4 to No. 5 level, a distance of 50 ft., shows an average width of reef of 23 in. and an average value of 150 dwt.

At the meeting of shareholders in the Gaika Gold Mining Co. there was a good deal of discussion on mining policy. A Colonial shareholder, who was well supported, succeeded in getting elected to the board in place of James Prinsep, the chairman and director and representative of the Consolidated Gold Fields and of the Gold Fields Rhodesian Development Co. The latter, which provides the technical management, is not financially interested in the Gaika. The new chairman intends to appoint a consulting engineer whose sole duty will be to attend to the Gaika.

CANADA

British Columbia

New Mining Association at Nelson Organized—Consolidated Men Visit Princeton

Princeton—A recent visit of J. J. Warren, president of Consolidated Mining & Smelting Co., and W. M. Archibald, manager of mines for the same company, to Princeton, where they were met by Emil Voigt, who has large copper holdings in the vicinity of Copper Mountain, has given rise to hopes of early activity in the Copper Mountain section. Nothing further to substantiate such hopes than the facts noted has been reported.

New Denver—The crew at the Bosun property of the Rosebery-Surprise Mining Co. has been increased to thirty men, now ranking second to the Silversmith as the largest employer of labor in the Slocan.

Nelson—Election of officers of the newly formed Mining Association of British Columbia, held at Nelson recently, resulted as follows: President, R. Randolph Bruce, Invermere; vice-president, Clarence Cunningham, Alamo; secretary-treasurer, W. H. Burgess, Kaslo; executive committee, S. S. Fowler, Riondel; T. W. Bingay, Trail; Major A. W. Davis, Nelson; J. P. McFadden, New Denver; W. T. McDowell, Ymir; Douglas Lay, Rossland; S. G. Blaylock, Trail.

Trail—Ore received at the Consolidated smelter from Nov. 15 to 21 totaled 7,449 tons, coming from the following shippers: Sally mine, Beaverdell, 36 tons; J. Anderson, Gerrard, 13; Paradise, Lake Windermere, 25; Surprise, Northport, 54; company mines, 7,272; and Van Roi, Silverton, 49.

Ontario

Advisability of Blue-Sky Legislation Studied—King-Kirkland To Increase Capitalization

Toronto—During the last year or so a great flood of wildcat stocks has been offered to the Canadian public, and the Province of Ontario has for some time had under consideration the enactment of a blue-sky or so-called "fraud law." The difficulty is to draft a law which will prevent the sale of wildcat stocks, but which will not prevent legitimate speculations.

A. H. O'Brien was commissioned by the Attorney General to investigate this matter, and has submitted an interim report. He advises that before attempting to draft a bill for the Legislature, existing types of similar legislation should be studied. Such laws are at present in force in three of the Western provinces, and also in several of the states across the border. If, after investigation, a bill then seems advisable, he holds, a tentative draft should be drawn and submitted to the various interests affected.

Cobalt—The Nipissing has dropped its option on the Edwards property, in Porcupine, as results were not satisfactory. Drilling is still being continued on the Rochester, but it is, understood that the values found are not high. November silver production was good, but less than that of the previous month.

No ore was shipped from Cobalt over the T. & N. O. Ry. during the week ended Nov. 25. The Hudson Bay is sampling the Cane silver mines, near Elk Lake.

Ore running 7,000 oz. of silver has recently been struck on the Frontier property, in South Lorrain, now under option to the Mining Corporation.

Kirkland Lake—A special meeting of the shareholders of the King Kirkland approved the increase of the capital from 2,500,000 shares to 5,000,000 shares, par value $1, and the purchase of the Ferguson property for 450,000 shares. There will be over 3,000,000 shares in the treasury for future financing.

Recent development work on the Tough Oakes has been so satisfactory that the company is considering starting milling early in 1922. In the early days of the camp the Tough Oakes was the leading mine, its mill being the first to be built.

The Orr property, adjoining the Teck Hughes, is being sampled by engineers representing J. J. Godfrey.

In view of the recent discovery on the 900 level of the Kirkland Gold near the Elliott line, an amalgamation of these two properties is being discussed.

Porcupine Dome is treating about 30,000 tons a month, and heads are averaging about $7. Sinking of the main shaft to 1,450 ft. will start soon.

MEXICO

Sonora

Cananea Paymaster Held Up—Moctezuma Copper Working 600 Men

Nogales — A paymaster of the Cananea Consolidated Copper Co. was robbed by two masked bandits of the payroll of $10,000 he was taking by auto from Cananea to the Chivatera camp. The hold-up came at a sharp turn of the road, where the bandits had all advantage of the paymaster and his guard.

At Nacozari and Pilares 600 men are employed by the Moctezuma Copper Co., a Phelps Dodge subsidiary, on development work, of which 2,500 ft. a month has been done since copper production stopped, and on construction of the new mill.

The Tigre and Las Chispas mines of northern Sonora are making ore shipments to El Paso through Douglas.

KOREA

Oriental Consolidated Output Increased

A clean-up of $101,940 was made in November by the Oriental Consolidated Mining Co. at its property at Unsankinko, Korea. That for October was $92,868.74. The company's Tabowie mill handled a smaller tonnage in October than could have been treated owing to the fact that the native labor gave much trouble.

TEXAS

Chisos Quicksilver Mine Running—Sulphur Company Alters Plant

Terlingua—The Chisos quicksilver mine is working. The Study Butte and Mariposa properties were shut down several months ago. They are prepared to start up when the market improves.

Pecos—The Toya Valley Sulphur Co. has completed the installation of new retorts, and the new machinery will be tested this week. Imperfections in planning the original retorts caused a delay of several months in getting operations, although a large part of the sulphur ore have been ground into fertilizer.

ARIZONA

U. V. Extension Appeals in Smoke Case—Arizona Copper Bids Employees Farewell

By JAMES H. McCLINTOCK

Phoenix—At Kingman an award of $20,000 was given by a jury to the plaintiff in the suit of the Wallapai Mining & Development Co. against the U. S. Smelting, Refining & Mining Co., the U. S. Smelting, Refining & Exploration Co., and A. P. Anderson. Notice of appeal was given to the state Supreme Court.

Appeal to the Supreme Court of Arizona has been made by the United Verde Extension Mining Co. from a judgment of $1 and costs, amounting to $1,620, secured in the Yavapai County Superior Court in a jury trial of an action preferred by David H. Biles and S. P. Wells, who had asked $2,557 for alleged damage to their crops on farms in the Verde valley from fumes from the defendant's smelter at Clemenceau.

In the Superior Court at Los Angeles, Cal., Charles T. Lindley, for himself and other stockholders, has sued the Jerome-Superior Copper Co. for an accounting and for $33,000. There are charges of unnecessary expenditures and of planning to oust directors and secure control of the corporation.

Miami—One of the three reverberatories of the International smelter is in operation, with consequent pouring of the first copper bullion produced in this district for seven months. The resumption was the cause of much public rejoicing, this including a "Pollyanna" banquet in which three civic organizations were sponsors. The run is to continue until the present stock of about 40,000 tons of Miami concentrates has been reduced.

Clifton—George Readman, chairman, and William Exley Miller, secretary, of the board of the Arizona Copper Co., Ltd., have issued a notice to the company's employees that "the whole of the business of the company in the United States, including the Arizona & New Mexico Railway Co., has been transferred to the Phelps Dodge Corporation," adding that, "the board bids farewell with great reluctance."

Clifton has been visited by a party of officials of the Phelps Dodge Corporation, including Walter Douglas. The property lately acquired from the Arizona Copper Co., Ltd., was inspected.

Pearce—The mill of the Commonwealth Mining & Milling Co. is running two shifts a day on ore from the company's mine, which is being operated under the lease system.

Tucson—The first mine in this section to resume production is that of the [illegible] Mining Co., operated by [illegible], of Tucson, [illegible] in the Papago district, [illegible] miles southwest, at [illegible].

Yuma—The Arizona Barite Co. has been organized to work barite claims in the Mohawk Mountains. The material is to be [illegible] and roasted and the product shipped to Los Angeles for manufacturing uses.

Jerome—In connection with the visit of several stockholders, it is said that plans for the Dundee-Arizona include sinking a winze from the 960 level, where W. E. Defty, the engineer, intends to follow a good streak. More than 2,700 ft. of work had been done on the lowest level when the pumps were pulled.

Bisbee—With the payment Dec. 19 to shareholders of record Dec. 2 of a dividend of 50c. per share, Calumet & Arizona will have disbursed $2 per share this year. It has been able to do this because of the fact that it held something in reserve in its treasury during the "fat years" when liberal disbursements were made, but which were not quite satisfactory to many of the shareholders at that time. The wisdom of a conservative policy during that period has since been well demonstrated, in the opinion of George A. Newett, one of the directors. The dividends of the present year have not been made from this year's earnings, as is well understood, as no copper has been made since last spring, when the company's smelter was shut down. Several hundred men have been on the payroll since that time, however, for the main purpose of aiding labor, and which the company also was able to do because it had not drawn everything from its treasury. It has been conducting development and repair work.

No time for resumption has been set. The company has much less blister or refined copper on hand than many others, and will not have so much metal on which it can realize when prices become better. Its two-thirds interest in the copper surplus of New Cornelia is a considerable item, however, on which it will realize sooner or later.

NEW MEXICO

Great Eagle Co. Shipping Fluorspar—Hoisting Plant at Central Burned

By JAMES P. PORTEOUS

Lordsburg—The Great Eagle Fluorspar Co. shipped [illegible] cars of ore during November. This product [illegible] the Pacific Coast, New England, and Chicago territory. The mill machinery has been overhauled, and [illegible] operations [illegible] have been started.

The [illegible] carloads of [illegible] ore to the El Paso smelter. About twenty men are employed.

Steins—Development work on the [illegible] mine is going ahead under the direction of [illegible], who has [illegible] men working. [illegible] on the 100 level.

Central—Fire at the [illegible] mine on the night of [illegible] which was started by the [illegible] of oil from the base of the engine [illegible] destroyed the hoisting plant and the timbering in the shaft to a depth of 100 ft.

COLORADO

Ouray-Silverton Mail Route Discontinued—Bird Creek Company May Build Mill

Ouray—The Welch-Worland Mines Syndicate has completed its negotiations for the Wanakah mine and has taken over the property, which was a heavy producer a few years ago, but which has been idle for some time. The price of the mine is $175,000, under long-time lease and bond, and the first payment is being applied entirely to the debts of the Ouray Union Mining & Milling Co., who bought the mine this year and attempted to operate it, closed down, and sold out to the present operators. The mill is being overhauled and will soon be started on a moderate tonnage basis.

The Barstow, after a short period of idleness, has resumed, with the Ouray Leasing Co. and the Imogene Leasing Co. starting extensive development projects, under sublease from C. R. Wilfley, who also acts as manager of these companies. The upper level is to be extended by drifting ahead beyond the oreshoot which made such good production this year, and the lower tunnel level is to be extended likewise, under the same ground.

The Lucky Twenty Mining Co. is now well started on its winter campaign of driving a crosscut to the vein on the Guadaloupe by air drills, with subsequent drifting on the vein. Results should be attained by next spring. James A. Lannon is manager. Stone, Hoffman, and Jackson, leasing on this property, are making shipments of very good silver-copper ore to the smelter. The Paymaster and Whitecloud companies, Hoffman brothers on the Guston, Andrew Meldrum, with a new prospect near the Guston, with the Barstow and Lucky Twenty, are the prospective winter operators of the Ironton-Red Mountain section.

The Post Office department has ordered the Ouray-Silverton mail route discontinued indefinitely. This is the first time in decades that the mail carrier, almost an historic figure, has not "bucked" the heavy snows of this road, carrying mail and small supplies to the many but scattered residents and operators of this isolated section. The discontinuing of this service will be a great hardship to the operators, and a vigorous protest is being made.

The Gold Bud Mining Co., of which Robert Kinley is superintendent, has been organized to operate the new discovery of gold made by Kinley and Davis north of Ouray last summer. Operations began on Nov. 26, when supplies were taken to the mine. Prospecting in the neighborhood of the Teller mine, on Corbett Creek, last summer, Kinley and Davis, old prospectors, developed a small vein in the sedimentaries, carrying free gold and giving good assays, an unusual occurrence in this part of the country. H. C. Funk, an attorney of Montrose, undertook the financing in and near Montrose, and raised money to start the enterprise, which will be watched with interest on account of its unusual geology.

Prospectors from Montrose last fall located a vein near the old Roscoe Conklin, near the head waters of Cimarron Creek east of Ouray, a wild and remote part of the county. Samples showed very high-grade gold ore.

Silverton—The richest ore shipped from the Silverton district this year was produced from the Giono lease in the Silver Lake property of the A. S. & R. Co. The twenty-five-ton shipment to the Durango smelter assayed 8 oz. gold, 70 oz. silver, and 24 per cent lead. The ore pocket from which the material was mined has not been fully developed.

Victor—During October, the Portland mill treated 23,440 tons of ore from mines and dumps, with an average value of $4.30 a ton. The total tonnage hoisted during the month was 46,340, compared with 39,404 during September. The average value of all ore hoisted was $8.77 a ton.

Silver Plume—The Wasatch Mining Co. has dismantled the Scotia mill, and has moved it to the Mendota mine. Rebuilding and remodeling are under way.

Creede—The Bird Creek Mining Co. is considering the erection of a twenty-five-ton concentrator. From the upper crosscut tunnel, which cut the vein at 1,100 ft., a drift has been advanced 300 ft. on a vein in ore assaying 30 per cent lead and 16 oz. silver. The vein is also opened by a lower tunnel at a distance of 2,800 ft. George S. Bentley is superintendent.

Boulder—A revival of mining activity has taken place in Boulder County, and numerous properties that have been idle for some time are being reopened. At a recent meeting of the Boulder County Metal Mining Association the following officers and directors were elected: Eugene Stevens, president; John R. Wolff, vice-president; E. B. Hill, secretary; Timothy O'Conner, treasurer; and J. W. Valentine, J. R. Pherson, J. G. Clark, Steven Corfield, Fred White, V. I. Noxen, William Todd, Guy Miller, J. E. Brock, Horace Atkinson, and A. W. Widdifield, directors.

NORTH CAROLINA

Coggin Gold Mine Resumes Operations

Ashboro — A ten-stamp mill recently built at the Pee Dee mine (formerly the Spoon), near Ashboro, is producing gold bullion from high-grade ore.

A small cyanide plant will be built at the Alred mine, near Gray's Chapel, for the treatment of concentrates.

Eldorado—The Coggin mine, near Eldorado, has resumed work after a year's shutdown, and is putting on men.

Hiddenite—It is reported from Hiddenite, in Alexander County, that the principal hiddenite gemstone mine has changed hands and that work has been resumed. Hiddenite is the emerald green spodumene gem, discovered in this region some years ago by W. E. Hidden.

UTAH

New Map of Alta District Published—Ventilating Water Lily Shaft Successfully

By Our Special Correspondent

Park City—Shipments for the week ended Nov. 26 amount to 2,110 tons. Shippers were: Judge allied companies, 911 tons; Silver King Coalition, 721; Ontario, 428; New Quincy, 50.

Alta—The South Hecla Mines Co. has published a new map of the Alta district. The South Hecla, which started out about eighteen years ago with eighty acres, has gradually increased its holdings until it controls about 3,000 acres. The map shows the new boundaries of the property.

Eureka—Ore shipments from the Tintic district for the week ended Nov. 24 amounted to 170 cars, as compared with 164 cars the week preceding. Shippers were: Tintic Standard, 55 cars; Chief Consolidated, 44; Victoria, 16; Dragon, 16; Iron Blossom, 13; Eagle & Blue Bell, 7; Centennial-Eureka, 4; Colorado, 3; Grand Central, 3; Empire Mines, 2; Mammoth, 1; Bullion Beck, 1; George Castleton, 1; Sunbeam, 1.

The Iron Blossom, which in 1920 operated at a net loss of about $3,400, has paid dividends of $25,000 this year. The property, in its heyday one of the largest dividend payers in Tintic, is now shipping silver-lead ores. These are going principally to the plant of the Tintic Milling Co.

The Tintic Standard mill is producing about 50,000 ounces of silver every thirty days, and making bi-monthly shipments. The present mill capacity, 160 tons daily, will be considerably increased by the addition of the two new roasters that are now in process of construction.

The ventilating pipes, which were placed as near the bottom of the Chief Consolidated's Water Lily shaft as possible, are solving the problem of ventilating it and of effectively reducing the heat. The shaft is down 1,300 ft. and will be continued to 1,600 ft. A monthly progress of 200 ft. or more is now expected.

Salt Lake City—The Sells Mining Co. has recently increased its capitalization from 600,000 shares, par value 25c., to 1,000,000 shares, par value 15c. Mine development is to be financed by the sale of treasury stock. At a directors' meeting held Nov. 22, it was decided to sell 412,446 shares of treasury stock to George H. Watson & Co., but before the transfer of this stock, stockholders are given the privilege of purchasing treasury stock at 3c. per share on the basis of two shares for every three shares of stock now owned, the right of purchase to be exercised on or before Dec. 22. The newly elected officers and directors are: George H. Watson, president and manager, John Zinc, vice-president; R. F. Marvin, secretary and treasurer; W. H. Weyher and V. S. Snow.

MONTANA

Anaconda Copper Considering Resuming Treatment of Zinc Concentrates—Davis-Daly Balks at High Smelter Costs—Better Feeling in Copper Circles

By A. B. Keith

Butte—Anaconda Copper interests have consulted both the Butte & Superior Mining Co., owner of the Black Rock mine and concentrator, and the W. A. Clark interests, operating the Elm Orlu and the Timber Butte Milling Co., with a view to resuming the treatment of customs silver-zinc concentrates, and it is considered not improbable that Butte & Superior may start production soon. Nothing is obtainable from local officials of the Butte & Superior regarding the situation, but from an eastern officer of the company comes a report of the corporation's intention to resume. Though there has been no substantial improvement in the zinc market, it is known that the Anaconda has found some demand for the metal of the quality which it produces by its electrolytic process, and with the company controlling the National Brass Co. of Ohio and possibly making headway in a program credited to it in obtaining some voice in the affairs of the American Brass Co., the presumption is permitted that the Anaconda will have more than one outlet for its zinc production, in addition to supplying the copper requirements of these two brass concerns, if plans work out. In this connection a local Anaconda official said that within two years there would be little produced by the Anaconda which would not be utilized in the manufacture of products with which the corporation was identified, and this was attributed as bearing upon the Anaconda's diversification program and entry into the field of merchandizing. Frederick Laist, in charge of the metallurgical end of the Anaconda, is achieving much in the way of improved recoveries at the company's electrolytic zinc plant at Great Falls, Mont.

The Davis-Daly—East Butte situation is nothing more than a refusal on the part of the Davis-Daly to continue to pay a smelting cost exacted by the East Butte at its Pittsmont smelter which is as high now as when the price of copper was 30c., according to opinion in circles friendly to the latter. Though it was necessary for the Davis-Daly to [illegible] certain development work at the Colorado mine, [illegible] mined, as chutes were raised in the orebodies every 30 ft. in order to be able to expedite the extraction of a large tonnage when the market warrants. When this was completed it was not considered good business to continue shipments unless an adequate profit could be realized, and under the present smelting schedule and low copper prices this could not be had, despite the generally high [illegible] of the copper content of the Davis-Daly's Colorado ore. There has been talk of efforts to bring about a consolidation of the two companies and rumors of an offer by the East Butte to exchange one of its shares for two of the Davis-Daly. Among some of the larger stockholders, it is intimated locally an even exchange will result in opposition which might reach the courts.

On behalf of the East Butte it is said that lower reduction costs will have to follow lower operating expenses, the smelter being faced by high costs of coke and smelter supplies generally, and to reduce its charges would necessitate a wage reduction. The East Butte smelter is continuing to operate on a surplus stock of concentrates and [illegible] ores.

Philipsburg—The Philipsburg Mining Co. is making definite plans to install a magnetic separator to treat its manganese ores. At present the company is making a chemical grade of manganese with its wet concentrator. After April next the wet concentrator will be used to concentrate lead-zinc-silver ores from the Granite Bimetallic mine, when it is believed the magnetic separator will be ready for operations.

NEVADA

Hornsilver Mine Said To Have Cut Good Ore on 700 Level

Hornsilver—The official report from the mine states that the southeast drift on the vein from the shaft crosscut on the 700 level has entered good ore. The drift shows 6 ft. of ore, 2 ft. of which should assay $100 per ton, the other 4 ft. being ore of milling grade. This ore is regarded as a part of the shoot developed on the 600 level.

Tonopah—The Tonopah Belmont bullion shipment representing production for the first fifteen days of November was $145,000. The Tonopah Extension has ordered two Aldrich 600-gal. triplex pumps for installation on the 1,540 level of the McKane shaft. The water is to be pumped direct to surface through a 10-in. column. In the Cash Boy mine the winze being sunk on the south dipping vein entered 7 ft. of $40 ore at a depth of 60 ft. below the 1,645 level. A crosscut on the 1,785 has 70 ft. to go to reach the projected position of the orebody on this level.

Battle Mountain—The Betty O'Neal mine is being developed through a series of raises driven from the 150 level of the shaft to a connection to the old tunnel workings. Drifts were [illegible] The shaft is 300 ft. deep, but work is at present confined to the 150 level to avoid the costs of pumping. The water is to be drained later by a tunnel, and development work will then be started on the 300 level.

Ely—The Boston & Ely will soon be [illegible]

[illegible]

MINNESOTA

Cuyuna Range

Season's Shipments Now Completed—Inland Steel Co. Alone Mining Ore—Surface Improvements at Sagamore

Crosby—Cuyuna Range mines completed [illegible] Nov. 19. The range is credited with a total [illegible] 1920. Individual shipments were as follows: Armour No. 2 mine (Inland Steel Co.), 214,040 tons; Hillcrest (Coates & Tweed), 116,072; Mahnomen (Clement K. Quinn & Co.), 42,272; Kennedy (Rogers-Brown Ore Co.), 36,383; Meacham (Rogers-Brown Ore Co.), 35,035; Croft (John A. Savage Co.), 29,726; Cuyuna-Duluth (American Manganese Manufacturing Co.), 10,208; and Maroco (Marquette Ore Co.), 2,322.

The Inland Steel Co. is at present the only operator mining ore on the range. At its Armour No. 2 mine stockpiling for the winter has been begun, with a full crew on double shift. Although no definite plans have been announced, it is anticipated that the Rogers-Brown Ore Co. may resume operations at either its Kennedy or Meacham mines before the winter season is over. The company has a residue in stockpile at its Kennedy mine of 70,000 tons and about 30,000 tons at the Meacham.

Trommald—Hydraulic stripping at the open pit of the Marquette Ore Co. is held up indefinitely owing to inability of the Cuyuna Range Power Co. to supply necessary electric power. Stripping has been continued with two steam shovels.

Mesabi Range

Oliver To Strip Little & Pendle Property—Harrison Concentrator Shuts Down

Keewatin—[illegible]

Nashwauk—[illegible] closed [illegible]

Aurora—[illegible]

ALABAMA

Unemployment Greatly Decreased—The Shannon Deep Mining Project—Raimund Mine May Resume

By George Huntington Clark

Birmingham—The Birmingham district continues to lead other steel centers in percentage of production. The present activity of the U. S. Steel Corporation at large is stated authoritatively to be 52 per cent of capacity, and that of independents at 40 to 50. Compared with this, the Tennessee Coal, Iron & Railroad Co. has been for some time on a 55 per cent basis. The explanation of this activity mainly lies in the resumption of long withheld railroad buying, both domestic and foreign.

Unemployment under existing conditions has shown a decrease, district payrolls for October recording an increase of 5.2 per cent, or an increase of men employed from 22,344 to 23,497 during the month.

The improved position of Gulf States is beginning to be better appreciated. Three of the six open-hearth furnaces of this company were blown in on Oct. 30, and all departments are now active except the iron furnace, which, it is stated, may be blown in before the close of the year or early in January, 1922.

Attendant upon the operation of this furnace will be a resumption of operations at the Shannon mine, shut down when the furnace went out of blast.

The Shannon is the initial deep-mining project in the local red ore, as distinguished from the hitherto universal practice of developing by means of slopes sunk from the outcrops on the summit of Red Mountain. A drill hole sunk several miles back from the outcrop showed at a depth of 1,930 ft. over 19 ft. of largely self-fluxing ore. The upper and lower bench of the big seam were found to have only a 3-in. parting. The Gulf States company subsequently acquired this property, and opened it up by means of a slope 2,816 ft. long, terminating at a vertical depth of 2,073 ft. in an orebody found to be 20 ft. thick at this point and of self-fluxing ore.

The slope is a 10 x 18-ft. double-compartment concrete-lined incline, carrying a double track and airway, equipped at the foot with a complete and modern loading plant, similarly of concrete. The orebody entered at the base of the slope, having basined out at this distance back from the Red Mountain outcrop, has here very little dip, and has been systematically opened up by entries and rooms, the entire 20 ft. of the vein being taken out. At the time of shutting down, an output of 400 tons per day was being made, and the mine is estimated to have a capacity much in excess of any anticipated requirements of the company for an indefinite period.

There are indications that the Raimund iron mine of the Republic Iron & Steel Co. on Red Mountain may resume this month.

JOPLIN-MIAMI DISTRICT

O. K. Chandler Heads Indian Agency—May Discontinue Miami Office

By P. R. Coldren

Joplin—A government appointment of interest in the Tri-State zinc and lead field last week was that of Oliver K. Chandler, of Claremore, Okla., to the position of superintendent of the Quapaw Indian Agency, a place made vacant by the death of Carl F. Mayer, several weeks ago.

A large part of the rich zinc and lead lands of Ottawa County, Okla., the heaviest producing section of the Tri-State district, is owned by Quapaw Indians, and for this reason the appointment was of special interest in this field. Mr. Chandler has been in the Indian service for fourteen years, and at the time of his appointment was field clerk for seven counties, with office at Claremore. He was at one time secretary to Congressman C. E. Creager, of Muskogee.

It has been rumored lately that the Indian office at Miami is to be discontinued in favor of the office at Wyandotte, Okla., the original home of the Quapaw agency. Another rumor now is to the effect that the Miami office is to be continued and the Wyandotte office discontinued. It is expected that something definite will be announced as to this as soon as Mr. Chandler assumes office.

The recent taking over of the Huttig Milling Co. at Kansas City by the Commerce Trust Co. will not, it is announced, in any way effect the operation of the Huttig Lead & Zinc Co. in this field. William Huttig is at the head of both companies. The Huttig company has been one of the large producers of zinc ore in this district, and has never stopped production. It is also developing a promising tract to the north of Crestline, Kan., which it plans to develop later. B. E. Brown is manager for the company here.

SOUTHEAST MISSOURI

Four Producers Active—Planning Mill for New Mine at Annapolis—No Mining in Madison County

St. Louis—There is a fair amount of activity among the four large producing companies of the disseminated lead belt in southeast Missouri, operating at 65 and 75 per cent capacity. Though the price of pig lead in the St. Louis market, 4.35c. per lb., would yield an attractive margin of profit under normal conditions, the present high rates for labor, coal, and supplies leave such a small margin of profit as to render it undesirable to push production. Labor costs have been reduced twice since the peak of war prices, but living conditions have not declined sufficiently to warrant another cut. After next spring, when a new contract will be made with the Illinois coal mines at probably a considerable reduction in wages, under a new two-years' contract, a material reduction in coal prices will probably be effected. The district is now receiving its coal supply direct from the Sparta district over the revivified Illinois Southern R.R. at a marked reduction in freight rates over the shipments through the St. Louis gateway. At the Herculaneum smelter of the St. Joseph Lead Co. only two of the four stacks are in operation, but a third stack will, it is expected, be blown in within the next thirty days.

There has been little diamond drilling carried on during the last season, and all the drills have now been called in, as usual, for the winter.

The new lead mine at Annapolis, on the main line of the Iron Mountain R.R., in Iron County, has been closed down after completing its shaft. Plans are being drawn for the erection of a 500-ton mill, which will probably be erected on this property next spring.

No mining is being done in Madison County, and the properties of the Missouri Cobalt, Mine La Motte and the Catherine companies have been closed down for some time.

Chronology of Mining

November, 1921

Nov. 3—Hearing on accounting proceedings between Butte & Superior and Minerals Separation opened in New York, lasting until Nov. 16.

Nov. 4—Wisconsin State Industrial Commission held public hearing in Platteville on proposed safety regulations for mines.

Nov. 5—Gold miners on the Rand, South Africa, threatened to strike over proposed increase in proportion of native labor employed. Dispute was compromised later in month.

Nov. 12—Boston & Montana Development Co. started new concentrator at Elkhorn, Mont.

No. 14—Davis-Daly Copper Co. suspended production, owing to high smelting charges.

Nov. 15—Simon Silver-Lead Mines Co. started new mill at Simon, Nev.

Nov. 17—Emergency tariff act signed.

Nov. 20—One reverberatory started at International smelter, Miami, Ariz., storage space for concentrates having been completely filled.

Nov. 21—Steel & Tube Co. of America resumed operations at its Newport and Palms-Anvil mines, in Michigan.—Day-Smith injunction suit to prevent joint operation of Star mine by Hecla and Bunker Hill & Sullivan companies began in Spokane. Suit adjourned a few days later.

Nov. 23—Tax Revision bill (H. R. 8,245) signed.—War Minerals Relief bill signed.

Nov. 24—Announced Alaska Railroad had been completed between Anchorage and Fairbanks.

Nov. 28—Hearing held at Coeur d'Alene, Idaho, on matter of compensation due Star Mining Co. from Federal Mining & Smelting Co. for ore alleged to have been illegally extracted.

The Situation at the Mines in November

ASIDE from the copper camps, the situation in most metal mining districts in November compared favorably with that in October and in some districts showed improvement. There was no marked distress from unemployment, though labor was said to be plentiful, in general.

Conditions at the copper camps in the West were practically unchanged. Ray, Chino, Utah, and Nevada Consolidated confined their operations to turning their mills over twice a week to keep the tables from warping. The last named also proceeded with the development of its high-grade orebody. The Phelps Dodge Corporation stopped work on its Sacramento Hill project on Nov. 1, slightly decreasing its force in the Warren district, which had been about 1,200 men. All other branches of the company were down tight. About 400 to 500 tons of ore was taken daily from the fire zone at its Coronado mine at Morenci.

Operation by the International smelter on stored Miami concentrates was the only change in copper activities in Arizona during the month. This yielded 1,647 tons of bullion. Inspiration and the smelter added 300 men. Miami's mill output was little changed from October, being equivalent to about 4,500,000 lb. of copper. New Cornelia's cathode copper production was 1,600,000 lb., slightly over October. Production in the Southwest was confined to these two.

In Montana, at Butte, Davis-Daly stopped production. East Butte operated one furnace, in part on surplus concentrates, though talking of suspension if sufficient custom ore could not be obtained. Anaconda's smelters remained down, the company producing no copper but its regular output of zinc. The A. S. & R.'s East Helena plant ran two furnaces (lead). In British Columbia the Granby smelter ran at about 90 per cent of capacity. There was also activity in the Plumas County copper district of California.

All smelters in northern Michigan showed an increase in production of refined copper in November, the output being estimated at 8,000,000 lb., or approximately 36 per cent of normal. The month closed with fifteen furnaces in blast, against eleven in October. Of these, Quincy had one, Michigan three, and Calumet & Hecla eleven. Copper Range and Quincy increased working forces slightly. Relief for the unemployed, where needed, was available. The total number employed was about 25 per cent of normal.

In Tennessee, the Ducktown Sulphur, Copper & Iron Co. ran its smelter at normal capacity, and its new mill handled the largest tonnage to date. In general there was a slight increase in capacity over October. There was, however, some unemployment in the district owing to the fact that Tennessee Copper ran considerably below capacity.

Mining in the Black Hills of South Dakota showed improvement, with the labor situation better. The Homestake and Trojan companies ran at capacity. The former's gold and tonnage output was the same as in October. Trojan produced $28,000 in gold bullion from 5,810 tons of ore, compared with $26,000 from 6,150 tons in October. Other smaller operators were active.

The outstanding feature in Colorado was the number of new companies organizing to open up properties long idle. The American Smelting & Refining Co. reported increasing receipts of ore. Output from Cripple Creek, Telluride, and Ouray continued to improve, with no appreciable decline in other districts. The labor situation was fairly good.

Shipments from Utah camps increased slightly during the month. Park City shipped [illegible] tons of ore and concentrates, against 8,139 in October. This was average normal production. Bingham's output was unchanged around [illegible] tons. The Tintic output was [illegible] tons, compared with 21,350 in October. There was little change in the smelting situation, except around the middle of the month, when the smelters became overstocked with siliceous silver ores, causing some Tintic mines to curtail. Midvale ran three lead furnaces and Murray three. Garfield ran three reverberatories. The labor situation remained good.

Conditions at most Nevada camps were about the same as in October, with indications of future improvement. The Simon Silver Lead Mines Co. started its new mill, and steps were taken to finance the building of a new cyanide plant at Candelaria. Royston, Hornsilver, and some other small camps were active. The situation was good at Tonopah and Divide, and output normal. The Comstock was busy.

Tonnage shipped from the Coeur d'Alene district, in northern Idaho, was a little larger than in October, owing to a 10 per cent increase in the output of the Hecla company, which produced between 3,800 and 3,900 tons. The Bunker Hill & Sullivan and the Federal companies produced a normal tonnage of 6,000 and [illegible] tons, respectively, unchanged from October. Significant of further improvement was the blowing in of a second furnace at the Bunker Hill smelter on Nov. 25, this bringing the daily tonnage handled at this plant to 600. Important leasing operations were under way. The labor situation was unchanged, the supply being equal to the demand, with few men idle.

On the Coast, conditions were unchanged from October, no events of economic importance occurring. The Tacoma and Trail smelters continued to operate on a curtailed basis, and the Northport plant remained down. In California gold mining continued its slow recovery, the copper districts remaining dead except in Plumas County.

Zinc-ore surplus was decidedly reduced in the Joplin-Miami district in November, not exceeding 65,000 to 70,000 tons at the end of the month. Purchases exceeded production, which was rated at 5,500 to 6,000 tons per week. At the close of the month it was announced that the Illinois Zinc Co. would re-enter the buying market after being out a year. Several retorts at the American Metal Co.'s Bartlesville smelter were started. Activity was retarded by impending decreases in ore freight rates. The labor supply remained adequate, practically all miners being employed.

In the southeast Missouri lead district operations were conducted at 65 to 75 per cent capacity. Despite a price for lead normally attractive, labor, coal, and supplies remained high, leaving a profit so small as to make it undesirable to push production. Wages were about 30 per cent above pre-war normal, comparing favorably with the present cost of living. Plans were being drawn for a 500-ton mill for the new lead mine at Annapolis.

In the Wisconsin zinc-lead district operations continued as in October at full capacity. Production is estimated at 2,500 tons of crude blende concentrates, 1,000 tons roasted blende concentrates, and 250 tons lead ore. Five producers were active; also one roaster, one acid plant, and one oxide plant. One mill was under construction and one mine preparing to open. Seventy-five individuals were engaged in prospecting. Blende concentrates in bins were equivalent in tonnage to 25,000 tons of roasted ore. The demand for ore was light, with another lull at the end of the month. Miners who left last spring were gradually returning.

Iron-ore shipments from Lake Superior ports for the lower lakes were completed for the season during the month, bringing the total tonnage for the year to about 22,300,000. The attitude of operators was more cheerful on the Michigan ranges than a month ago, work being resumed at several mines and the scale of operations increased at some others. In Minnesota the [illegible] shut down for the winter, except for stripping work. A few Mesabi underground mines continued on part time. All Vermilion Range properties worked but on a reduced basis.

In the Birmingham district [illegible] remained in blast unchanged from October, [illegible] furnaces were started. Stocks of [illegible] furnace yards on Nov. 1 showed a reduction of [illegible] compared with October. Ore production for the month reflected steel-making conditions.

In Ontario, in the Sudbury district, the International Nickel Co. laid off a large part of its staff. The Mond continued a limited production. At Cobalt, producers continued their output, the attention being [illegible]. Kirkland continued active. The Ontario Kirkland mill was completed. Production of the camp is increasing slowly. Porcupine continued to set new production records. Heavy rainfalls gave promise of a plentiful supply of power, and McIntyre decided to add a [illegible]. Hollinger's daily tonnage increased to over [illegible]. Labor was plentiful

THE MARKET REPORT

Daily Prices of Metals

Dec.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
1	13.375@13.50	30.375	30.50	4.70	4.35	4.70
2	13.375@13.50	30.625	30.875	4.70	4.35@4.40	4.75@4.80
3	13.375@13.50	30.625	30.875	4.70	4.35@4.40	4.80
5	13.50	31.375	31.625	4.70	4.35@4.40	4.85
6	13.50	31.375	31.75	4.70	4.35@4.40	4.85@4.90
7	13.50	31.25	31.50	4.70	4.35@4.40	4.85@4.90

*These prices correspond to the following quotations for copper delivered: Dec. 1, 2, 3, 13.625@13.75c.; Dec. 5, 6, 7, 13.75c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Dec.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
1	67⅛	68	75½	163¼	165⅛	26	25¼	26½	27
2	67	67⅞	75	164¾	166¼	25¼	24⅞	26¼	26¾
3	...	...	...	...	...	...	...	...	...
5	67¼	68	75	167	168¾	25⅜	24½	26¼	26¾
6	67¼	68⅛	75	167⅞	169½	25⅜	24⅝	26⅛	26¾
7	67⅜	68¼	75	167¼	169	25⅝	24¾	26¼	26⅞

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Dec.	Sterling Exchange "Checks"	Silver			Dec.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
1	402½	99⅝	68	37½	5	405	99⅝	66¼	36⅝
2	404¼	99⅝	67⅝	37½	6	407	99⅝	66¼	36¾
3	404½	99⅝	67	37¼	7	408¼	99⅝	66¼	36¼

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Metal Markets

New York, Dec. 7, 1921

All metal producers were cheered by the developments of last week. The prices of copper, lead, zinc, and tin all showed firmer tendencies, and the hope of settlement of international difficulties seems a little brighter.

Copper

The price has again advanced, both in the outside market and among the large producers. Most of the metal sold during the last week has netted producers about 13.50c., f.o.b. refinery. The delivered price generally quoted for December and January shipment has been about 13.75c., but this has been shaded slightly on desirable business where the freight rate is not high; or in other cases this price has been quoted for forward deliveries. Producers generally are unwilling to quote beyond February at current prices. Domestic business has been of about the same volume as during the last two months but export sales have fallen off somewhat, largely owing to financial conditions in Germany. Inquiries have picked up somewhat in the last three days.

Lead

Most of the business has been done in the Middle West during the last week. Chemical lead has found a ready market in St. Louis at 4.35c., and some has sold as high as 4.40@4.425c. reduced to St. Louis basis. Desilverized has commanded considerably higher prices, but not enough has been sold to establish exact quotations. New York business has been done all week at 4.70c., which remains the official contract price of the American Smelting & Refining Co. Some reports of outside sales at 4.75c. have been heard, but by far the largest business has been done at the lower level. The market looks stronger, however, and it would appear that intending purchasers can make no mistake in buying at current levels. Several large orders are expected to be placed within the next few days.

Zinc

The market rose steadily during the week, but producers are at a loss to explain what caused the advance, as sales have not been much heavier than for the last few weeks. The rise induced several important producers to dispose of some metal at 4.85c. who had formerly kept out of the market. Inquiries have not been noted in any large volume. Zinc was sold yesterday at 4.90c., the price that is being generally quoted today. Business from brass mills is reported to continue its improvement. High-grade zinc is still going forward at 6c., delivered.

Tin

The market was active up till today, with a great demand for prompt metal from tin-plate interests, many of which are reopening their mills or increasing production. The London prices have advanced, no doubt partially because of better business reports from this side, and the price of sterling exchange has taken a violent spurt upward. There is little tin now being produced in this country and still less on the market.

March deliveries of Straits were quoted as follows: Dec. 1st, 30.375c.; 2d, 30.625c.; 3d, 30.625c.; 5th, 31.375c.; 6th, 31.125c.; 7th, 31.625c.

Arrivals of tin, in long tons: Total for November, 2,525; Dec. 1, Straits, 5; 5th, Straits, 275; 6th, Straits, 325.

Gold

Gold in London: Dec. 1st, 102s. 7d.; 2d, 101s. 3d.; 5th, 101s. 8d. 6th, 101s. 2d.; 7th, 100s. 6d.

Foreign Exchange

Several items in the news of the week affected the European exchanges favorably and marked advances were generally recorded. On Tuesday, Dec. 6th, francs were 7.60c.; lire, 4.3925c.; and marks, 0.505c. New York funds in Montreal, 8¹³⁄₁₆ per cent premium.

Silver

Since our last report the price of silver in London has dropped steadily. The New York market has also fallen, and the decline would have been greater had it not been for the strength of sterling exchange. Both the rupee rate and China exchanges have fallen, with the result that buying from the Far East has been on a small scale and competition between India and China was negligible. The market closes quiet, with no factors in evidence which might tend to improve the price.

Mexican Dollars—Dec. 1st, 51[illegible]; 2d, [illegible]; 3d, [illegible]; 5th, 50[illegible]; 6th, 50[illegible]; 7th, 50[illegible].

Other Metals

Quotations cover wholesale lots unless otherwise specified

Aluminum—20c. per lb. for 99 per cent grade; 19c. for 98@99 per cent; 18c. for 94@98 per cent. Outside market nominal at 17@18c. for 98@99 per cent virgin grades.

Antimony—Chinese and Japanese brands, 4.50c.; W. C. C. brand, 5.25@5.75c. per lb. Cookson's "C" grade, spot, 9c. per lb. Chinese needle antimony, lump, nominal at 4c. per lb. Standard powdered needle antimony (200 mesh), nominal at 5.25c. per lb.

White antimony oxide, Chinese, guaranteed 99 per cent Sb_2O_3, wholesale lots, 6½@7c.

Bismuth—$1.50@$1.55 per lb.

Cadmium—Range $1@$1.10 per lb., in 1,000-lb. lots. Smaller quantities, $1.10@$1.25 per lb.

Cobalt—Metal, $3@$3.25 per lb.; black oxide, $2@$2.10 per lb. in bbls.

Iridium—Nominal, $150@$170 per oz.

Molybdenum Metal—In rod or wire form, 99.9 per cent pure, $32@$40 per lb., according to gage.

Nickel—Standard market, ingot, 41c.; shot, 41c.; electrolytic, 44c. Small tonnages, spot, 35@38c. Market dead.

Monel Metal—Shot, 35c.; blocks, 35c., and ingots, 38c. per lb., f.o.b. Bayonne.

Osmium—$[illegible]@$70 per oz. Nominal $70 Los Angeles, Cal.

Palladium—Nominal, $55@$60 per oz.

Platinum—Declined to $75@$78 per oz. Market quiet.

Quicksilver—$4[illegible] per 75-lb. flask. San Francisco wires $47.50. Market [illegible]ing.

The prices of the following metals remain unchanged from the figures published in these columns on Dec. 3: Rhodium, Selenium, Thallium, and Tungsten.

Metallic Ores

Manganese Ore—[illegible], per unit, seaport; chemical ore, $[illegible]@$60 per gross ton, lump; $[illegible] per net ton, powdered. Nominal.

The market is generally exceedingly quiet, and prices on the following ores remain unchanged from the figures published in the Market Report in the Dec. 3 issue: Chrome, Iron, Magnetite, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, Zircon, and Zirkite ores.

Zinc and Lead Ore Markets

Joplin, Mo., Dec. 3—Zinc blende, per ton, high, $28.85; basis 60 per cent zinc, premium, $26; Prime Western, $25; fines and slimes, $23@$22; average settling price, all grades of blende, $25.25.

Lead, high, $58.95; basis 80 per cent lead, $52.50@$54; average settling price, all grades of lead, $55.43 per ton.

Shipments for the week: Blende, 7,317; lead, 1,630 tons. Value, all ores the week, $276,130.

Purchases dropped from 13,800 last week to 7,500 tons this week, and shipments were 800 tons lower.

With shipments 7,300 to 8,500 tons per week and production around 6,000 tons, the reserve stock is shown to be moving outward. National Zinc, having secured a favorable court decision on the gas rate at Bartlesville, was in the market for a considerable tonnage. It is said that American Metal, also benefited by the lower rate, will restart furnaces at Bartlesville.

Federal Lead has stopped the downward march of lead ore by coming in with a capacity to absorb several thousand tons. Rumors of a price as high as $55 basis are heard, but $54 basis is [illegible] to have been paid.

Platteville, Wis., Dec. 3—Blende, basis 60 per cent zinc, $28. Lead ore, basis 80 per cent lead, $55 per ton. Shipments for the week, none. Shipments for the year: Blende, 10,719; lead ore, 1,763 tons. Shipped during the week to separating plants, 431 tons blende.

Non-Metallic Minerals

Fuller's Earth—16 to 30 mesh, $2[illegible] per ton; 30 to 60 mesh, $20; 60 to 100 mesh, $17; 100 mesh and over, $15, f.o.b. Pennsylvania points. Market quiet.

Graphite—Ceylon lump, first quality, 5½@6½c. per lb.; chip, 4@5c.; dust, 2½@3⅞c.; No. 1 flake, 5@7c.; amorphous crude, $15@$42.50 per ton. All f.o.b. New York. Market reported weak, with absolutely nothing doing. Large consumers appear to be well [illegible]. Shaded prices fail to move buyers, who claim to have no use for the material at present.

Talc—[illegible] mesh, $[illegible] per ton, f.o.b. Vermont; $8.25@$13, f.o.b. [illegible] [illegible] of 1921 [illegible].

Generally, dull markets exist for the non-metallic minerals, and there is no quotable change in the following from the prices published in the Dec. 3 issue: Asbestos, Barytes, Bauxite, [illegible] Clay, [illegible], Emery, [illegible], Kaolin, Lime[illegible], Magnesite, Mica, Monazite, Phosphate Rock, [illegible], Pyrites, [illegible], and [illegible].

Mineral Products

Arsenic—[illegible] New York.

Potassium Sulphate—[illegible] f.o.b. New York.

Sodium Nitrate—$2.30 per cwt. ex vessel, Atlantic ports.

The price of [illegible] and copper sulphate is unchanged from the quotations published Dec. 3.

Ferro-Alloys

Ferrochrome—[illegible] and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 12c. per lb. of chromium contained; 4 to 6 per cent carbon, 13c., f.o.b. works.

Ferromanganese—English and German, $58.35@$54, c.i.f. Atlantic seaports. Other quotations unchanged.

No quotable changes have taken place in the following ferro-alloys from the prices quoted in the Dec. 3 issue: Ferrotitanium, Ferrocerium, Ferromolybdenum, Ferrosilicon, Ferrotungsten, Ferro-Uranium, and Ferrovanadium.

Metal Products

Copper Sheets — Current New York list price, 21.25c. per lb.; wire, 15@15.25c.

Yellow Metal — Dimension sheets, 17.75c.; sheathing, 16.25c.; rods ⅜ to 3 in. 14.75c.

Lead Sheets, Nickel Silver, and Zinc Sheets unchanged from Dec. 3 quotations.

Refractories

Prices on the following are unchanged from the figures published in the Dec. 3 issue: Bauxite Brick, Chrome Cement, Chrome Brick, Fire Brick, Magnesite Brick, and Silica Brick.

The Iron Trade

Pittsburgh, Dec. 6, 1921

Practically all branches of the finished-steel trade show lighter demand and [illegible], with two conspicuous exceptions, tubular goods and tin plate. There may be a [illegible] of about 70 per cent of capacity.

[illegible]

Pig Iron—[illegible]

Coke

Connellsville—Furnace, $3.[illegible]@$3.50; foundry, $4[illegible]@$4.[illegible] per ton.

COMPANY REPORTS

Burma Corporation, Ltd.

The first annual report, for 1920, of operations of the Burma Corporation, Ltd., which has taken over Burma Mines, Ltd., states that a gross profit of £455,516 3s. 5d. was made, and a net profit of £246,770 7s. 4d. carried to surplus. Production amounted to 23,821.14 tons of refined lead and 2,869,727 oz. of silver. Profit and loss account follows:

	£	s.	d.
Operating expenditure:			
Ore extraction and transport	101,257	11	3
Treatment	402,174	15	5
Freight, shipping and realization charges on lead and silver	135,014	9	3
Salaries and wages	24,955	1	3
Maintenance of roads, bridges, buildings and telephone services	18,208	13	7
Hospital and sanitation	9,428	16	11
Miscellaneous	28,320	8	1
	£719,359	15	9
Mine development	12,220	17	2
Reports and experimental expenses	2,494	17	7
Prospecting, exploration and surveying	3 212	18	0
Head office expenses	8,286	8	5
London representative's office	5,666	6	4
Balance carried to appropriation account	455,516	3	5
	£1,206,757	6	8

	£	s.	d.
Lead and silver sales	1,081,380	16	6
Lead and silver on hand	111,096	15	11
Sundry profits and receipts	13,972	3	7
Transfer fees	307	10	8
	£1,206,757	6	8

APPROPRIATION ACCOUNT	£	s.	d.
Interest	10,715	19	11
Interest on first mortgage 8 per cent convertible debenture stock	9,644	14	4
Debenture trustees' fees	33	6	8
Loss on realization of 5 per cent war loan stock	7,022	3	4
Depreciation on machinery, plant and railway	95,018	19	2
Preliminary expenses and cost of issue of debenture stock, including Rs. 5,000,000 underwriting commission wholly written off	46,835	6	3
Income and super tax	39,475	6	5
Balance, being net profit carried to balance sheet	246,770	7	4
	£455,516	3	5
Balance brought down from profit and loss account for year ended Dec. 31, 1920	455,516	3	5
	£455,516	3	5

Burma Corporation, Ltd., is capitalized at Rs. 20,000,000 of Rs. 10 each, of which 13,541,689 shares have been issued, valued at £9,027,792 13s. 4d. A first mortgage of 8 per cent convertible debenture stock to the value of £1,000,000 is outstanding.

The directors have decided that the future policy to be adopted must be capable of being carried out by the company on its existing resources, which made it necessary:

1. To close up the construction of the zinc works in India, as financial considerations prevented the government of India contributing the anticipated loan and the Tata Iron & Steel Co. desired to limit its participation.

2. To discontinue the erection of the new lead smelter and to rely upon the extension and improvement, at a much smaller cost, of the existing smelter.

3. To suspend for the time being all further expenditure on the development of the Namma coal field.

The present programme now in operation is based on an annual output of 45,000 tons of refined lead and 4,500,000 oz. of silver, requiring a daily output of 700 tons of ore.

The directors are satisfied that this program of operations can be carried out within the corporation's own financial resources and without any additional issues of shares or debentures. The completion of the new program will reduce the capital claims on the company's resources and enable the board to devote surplus funds to dividends.

Ore reserves at the end of 1920 were 4,429,458 tons, assaying 23.2 oz. of silver per ton, 25.3 per cent lead, and 17.7 per cent zinc. Included in the above are 335,861 tons of ore carrying 11 per cent copper.

Burma Mines, Ltd.

A report of operations of Burma Mines, Ltd., for 1919 shows a net profit of £54,823 19s. The following table shows production, (1920 and 1918 also included):

	1920	1919	1918
Tons material smelted	136,450 20	105,559.58	116,343.87
Lead contents, tons	40,348.01	29,647.50	26,300.49
Silver contents, ounces	3,646 10	2,764,700 00	2,477,314.00
Zinc contents, tons	21,149.80	16,995.00	10,936 00
Hard lead produced, tons	28.484.70	21,228.60	21,196.70
Refined lead produced, tons	23.821.14	18,545.06	18,641.84
Fine silver, ounces	2,869,727.24	2,164,856.00	1,970,614 00
Coke used, tons	18,333.50	15,192.80	16,578.30
Coke used per cent of hard lead	64.30	71 50	78.2

Profit and loss account follows:

Operating expenditure	£	s.	d.	£	s.	d.
Ore extraction, slag recovery and transport expenditure	69,442	4	0			
Treatment	318,082	13	10			
Freight, shipping and realization charges on lead and silver	167,493	1	10			
Salaries and wages	31,373	3	7			
Maintenance of road, bridges, buildings and telephone service	18,855	18	2			
Miscellaneous	29,493	13	4			
				634,740	15	9
Experimental and reasearch expenditure				9,420	11	8
Mine development				15,712	6	11
Prospecting and exploration				9,890	16	2
Monochang Exploration Co., Ltd:						
Shares and expenditure written off				20,681	15	4
Exchange				31,893	15	7
Balance of interest, Burma and London.				3,694	8	1
General expenses, London				16,162	16	3
Burma Corporation, Ltd.—Debenture interest				103	2	2
Burma Corporation, Ltd.—Directors' fees				448	15	0
Depreciation on buildings, plant, machinery, railway and rolling stock				103,228	3	4
Balance carried to appropriation account.				159,768	2	5
				£1,005,745	7	8

	£	s	d.
Lead and silver sales	866,367	8	8
Lead and silver on hand in Burma.	135,524	1	3
Sundry profits and receipts	3,850	18	9
Transfer fees	3	0	0
	£1,005,745	[illegible]	8

APPROPRIATION ACCOUNT	£	s.	d.
Amount payable to Burma Corporation, Ltd, Oct. 16, 1919, under agreement dated May 29, 1914	94,944	3	5
Provision for income tax	10,000	0	0
Balance carried to balance sheet	54,823	9	0
	£159,768	2	5
Balance from profit and loss account	159,768	2	5
	£159,768	2	5

The company is capitalized at £200,000, of which 724,577 shares at 4s. each have been issued. Balance as per account for 1918 was £72,405 19s. 4d. Adding profit of £54,823 19s. gives a balance of £127,229 18s. 4d.

Burma Mines, Ltd., operates one of the largest silver-lead mines in the world. Ore reserves on Jan. 1, 1920, were estimated at 4,493,143 tons, containing 107,260,848 oz. of silver, 1,156,121 tons of lead, 806,758 tons of zinc, and 53,729 tons of copper.

Burma Mines, Ltd., was taken over by Burma Corporation, Ltd., on Dec. 17, 1919, the consideration being £768,163 0s. 4d.

Mount Lyell Mining & Ry. Co., Ltd.

A cable advice from Melbourne, Australia, from the Mount Lyell Mining & Ry. Co. to the London office states that ore smelted during the year ended Sept. 30 last was: Mount Lyell mine, 93,107 tons; North Mount Lyell mine, 45,235 tons; total, 138,342 tons; also concentrates, 14,343 tons. Produced, 5,786 tons of blister copper, containing copper, 5,738 tons; silver, 178,380 oz.; and gold, 4,744 oz. Recent increased output due to modifications of treatment methods, assisted by higher grade of ore treated from the North Mount Lyell mine, has lowered cost of production.

Application is now before Commonwealth Court of Conciliation and Arbitration for a reduction of mining wages to agree more nearly with the reduced cost of living figures. Operations for the year have resulted in a net profit of £51,830, after writing off depreciation £48,590 and prospecting and development expenditure of £4,459. Credit balance to profit and loss account was £269,454; and liquid assets in excess of liabilities, £472,455. The directors regret that under the present circumstances payment of a dividend is impossible.

Ore reserves are as follows: Mount Lyell mine, including South Mount Lyell mine, based on previous figures, 1,711,088 tons; North Mount Lyell mine, newly calculated, 1,095,981 tons. Diamond drilling indicates important accession to ore reserves. At the concentration plant, hand sorting started in January and equals expectations. The flotation plant treated 60,639 tons of ore and produced 15,083 tons of concentrates, assaying 15.9 per cent copper. Output from the chemical works at Yarraville and Fremantle was about as usual. It has become necessary to begin the replacing of one of the acid units at the works at Yarraville. The outlook is gratifying for the coming wheat season.

Production of Gold and Silver in the United States in 1920

The Bureau of the Mint, with the co-operation of the Geological Survey, has issued the following statement of the final compilation of the production of gold and silver in the United States during the calendar year 1920:

UNITED STATES GOLD AND SILVER PRODUCTION FOR 1920

State or Territory	Gold Ounces	Gold Value	Silver Ounces	Silver Value (a)
Alaska	412,915	$8,535,700	822,410	$903,228
Alabama	10	200	[illegible]	4
Arizona	240,032	4,961,900	[illegible]	5,965,406
California	716,477	14,810,900	[illegible]	1,817,252
Colorado	363,218	7,508,400	[illegible]	5,674,624
Georgia	34	700	4	5
Idaho	22,668	468,600	7,364,785	8,088,523
Illinois			8,625	9,474
Massachusetts	10	200	[illegible]	1,275
Michigan			[illegible]	561,940
Missouri	14	300	[illegible]	[illegible]
Montana	91,802	1,897,700	[illegible]	14,566,749
Nevada	175,451	3,626,900	[illegible]	[illegible]
New Mexico	21,720	449,000	[illegible]	[illegible]
North Carolina	54	1,100	[illegible]	11
Oregon	49,714	1,027,700	[illegible]	111,648
Pennsylvania			90	99
South Carolina	14	300	1	1
South Dakota	209,842	4,337,800	87,623	96,234
Tennessee	285	[illegible]	107,250	117,790
Texas	5	[illegible]	[illegible]	574,195
Utah	102,975	2,128,700	[illegible]	12,910,615
Washington	7,160	[illegible]	177,758	195,226
Wyoming	10	[illegible]	56,959	62,556
Philippines	61,756	[illegible]	[illegible]	24,292
Totals	2,476,166	[illegible]	[illegible]	[illegible]

(a) Valued at $1.09827 per ounce, [illegible]

Reduction is indicated of both gold and silver as compared with 1919, the differences being on gold, $9,146,500, and on silver, 1,320,872 ounces.

Mining Dividends for November, 1921

The following dividends were paid by [illegible] companies during November, 1921:

Companies in the United States	Situation	Per Share	Total
[illegible]	[illegible]	[illegible]	[illegible]
[illegible] & Iron, pfd.	[illegible]	[illegible]	40,000
[illegible]	[illegible]	[illegible]	10,000
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Ariz.	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Companies in Canada and Mexico			
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

The dividend list shows little change. It is probable that Bunker Hill & Sullivan is continuing its monthly dividend of 25c., but that company refuses to report dividends to the press. Eureka Hill, of Utah, again enters the dividend column, making a small distribution from profits due to royalties and rentals. International Nickel paid its dividend out of surplus, as its properties are closed down and expected to remain so for some time. United Verde Extension resumes its usual quarterly distribution, omitted in August, no doubt because of the improvement in the copper market. Its properties remain closed down.

Ore and Metal Movements for October, 1921

Imports and exports of the more important metals and ores, as reported to the Department of Commerce for October, 1921, and the figures for October, 1920, as finally revised, are as follows:

IMPORTS FOR OCTOBER, 1920 AND 1921

In Pounds Unless Otherwise Stated

	October, 1920	October, 1921
Antimony ore, contents	[illegible]	
Antimony matte, regulus or metal	[illegible]	[illegible]
Copper		
Ore, contents	2,628,987	7,824,656
Concentrates, contents	[illegible]	[illegible]
Matte and regulus, contents	437,087	451,929
Imported from, in part		
Spain		271,555
Canada	1,455,614	226,425
Mexico	2,740,003	443,389
Chile	1,632,738	3,924,383
Peru	1,387	1,813,887
Unrefined, black and blister	14,347,663	23,360,893
Refined, in bars and plates	[illegible]	[illegible]
Old, for remanufacture	99,293	203,141
Composition metal, copper chief value	[illegible]	[illegible]
Lead		
Ore, contents	[illegible]	[illegible]
Bullion, contents	[illegible]	[illegible]
Imported from, in part		
Canada	579,630	1,200
Mexico	2,870,018	18,273,846
Other countries	...	179,550
Pigs, bars and old	20,652,897	1,969,187
Manganese ore, long tons	44,700	36,760
Imported from, in part		
Cuba, long tons	14	14
Brazil, long tons	26,100	35,700
British India, long tons	7,988	1,000
Tungsten ore, long tons	24	14
Pyrites, long tons	[illegible]	[illegible]
Imported from		
Spain, long tons	[illegible]	[illegible]
Canada, long tons	5,600	7,000
Tin ore, long tons	[illegible]	[illegible]
Tin bars, blocks and pigs	6,741,331	4,351,541
Imported from, in part		
United Kingdom	[illegible]	[illegible]
British Straits Settlements	3,545,977	3,663,882
Dutch East Indies	[illegible]	[illegible]
Australia	[illegible]	[illegible]
Zinc		
Ore, contents	[illegible]	
Imported from		
Canada	[illegible]	
Mexico	1,504,458	

EXPORTS OF COPPER, LEAD AND ZINC

In Pounds

	October, 1920	October, 1921
Copper		
Refined, in ingots and bars	[illegible]	[illegible]
Exported to		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
The Netherlands	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
United Kingdom	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Other countries	[illegible]	[illegible]
Composition metal, copper chief value	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Lead		
[illegible]		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Exported to		
[illegible]	[illegible]	[illegible]
United Kingdom		[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Other countries	[illegible]	[illegible]
Zinc		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	
Exported to		
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
Other countries	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

MINING STOCKS

Week Ended December 3, 1921

Stock	Exch.	High	Low	Last	Last Div.	
COPPER						
Ahmeek	Boston	57¾	56½	57½	Sept. '20, Q	$0.50
Alaska-Br. Col. new	N. Y. Curb	3¼	2½	3		
Allouez	Boston	24½	24	24	Mar. '19	1.00
Anaconda	New York	47	45¾	46¾	Nov. '20, Q	1.00
Arcadian Consol.	Boston	3½	3	3		
Ariz. Com'l	Boston	9¼	8¾	8⅞	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*30	*28	*30		
Bingham Mines	Boston	13½	13	13	Sept. '19, Q	.25
Calumet & Arizona	Boston			53¼	Sept. '21, Q	.50
Calumet & Hecla	Boston	269	250	250	June '20, Q	5.00
Canada Copper	N. Y. Curb	*30	*28	*28		
Centennial	Boston	9½	9	9½	Dec. '18, SA	1.00
Cerro de Pasco	New York	34¾	33½	34	Mar. '21, Q	.50
Chile Copper	New York	13	12⅛	12¼		
Chino	New York	27½	26½	27	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*13½	*10	*10		
Con. Arizona	N. Y. Curb			*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1¼	1⅛	1¼		
Copper Range	Boston	39½	36⅛	38½	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*41	*38	*38		
Davis-Daly	Boston	7	6½	6¾	Mar. '20, Q	.25
East Butte	Boston	11	10¼	10⅝	Dec. '19, A	.50
First National	Boston Curb	*90	*75	*85	Feb. '19, SA	.15
Franklin	Boston	2¼	2	2		
Gadsden Copper	Boston Curb	†*50	†*40	*45		
Granby Consol.	New York	30	26	26½	May '19, Q	1.25
Greene-Cananea	New York	27	25	26⅛	Nov. '20, Q	.50
Hancock	Boston	†2¼	†2	2½		
Howe Sound	N. Y. Curb	2⅝	2½	2⅝	Jan. '21, Q	.05
Inspiration Consol.	New York	38¾	37⅝	38¼	Oct. '20, Q	1.00
Iron Cap	Boston Curb	7¾	7	7	Sept. '20, K	.25
Isle Royale	Boston	24	22½	24	Sept. '19, SA	.50
Kennecott	New York	25⅝	24⅝	25⅜	Dec. '20, Q	.50
Keweenaw	Boston	1½	1½	1½		
Lake Copper	Boston	3	2¼	2¼		
La Salle	Boston	2	1¾	1¾		
Magma Chief	N. Y. Curb	....	....	*8		
Magma Copper	N. Y. Curb	22	21	21½	Jan. '19, Q	.50
Majestic	Boston Curb	*5	*5	*5		
Mason Valley	Boston	1¼	1¼	1¾		
Mass Consolidated	Boston	2¾	2½	2¾	Nov. '17, Q	1.00
Miami Copper	New York	26	25¼	26	Nov. '21, Q	.50
Michigan	Boston	†2½	†2	2		
Mohawk	Boston	56½	54½	56½	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	5¾	5½	5¾		
Nevada Consol.	New York	14⅛	13½	13¾	Sept. '20, Q	.25
New Cornelia	Boston	17¼	16¼	16¾	Aug. '20, K	.25
North Butte	Boston	13¼	12¼	12½	Oct. '18, Q	.25
North Lake	Boston	*20	*20	*20		
Ohio Copper	N. Y. Curb	*12	*9	*10		
Old Dominion	Boston	25¾	25½	25½	Dec. '18, Q	1.00
Osceola	Boston	31½	31	31	June '20, Q	.50
Phelps Dodge	Open Mar.	†185	†175		Oct. '21, Q	1.00
Quincy	Boston	43	42	42	Mar. '20, Q	1.00
Ray Consolidated	New York	14¾	14¼	14⅜	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*23	*20	*20		
St. Mary's Min. Ld.	Boston	44½	42	44	June '20, K	2.00
Seneca Copper	Boston			24½		
Shannon	Boston	1¾	1¼	1¼	Nov. '17, Q	.25
Shattuck Arizona	New York	7¼	6¾	7¼	Jan. '20, Q	.25
South Lake	Boston	†1	†*60	*62		
Superior & Boston	Boston	1¼	1¼	1¼		
Tenn. C. & C. cfs.	New York	10¾	10	10	May '18, I	1.00
Tuolumne	Boston	*85	*43	*70	May '13	.10
United Verde Ex.	Boston Curb	29	27½	28½	Nov. 21, Q	.25
Utah Consol.	Boston	2¼	2	2	Sept. '18	.25
Utah Copper	New York	60¼	58¼	59½	June '21, Q	.50
Utah Metal & T.	Boston	1⅝	1½	1⅝	Dec. '17	.30
Victoria	Boston	1¾	1¼	1⅜		
Winona	Boston	*50	*40	*50		
Wolverine	Boston	12	11½	11½		
NICKEL-COPPER						
Internat. Nickel	New York	12½	11¾	12	Mar. '19	.50
Internat. Nickel pf.	New York	70	70	70	Nov. '21, Q	1.50
LEAD						
National Lead	New York	81¼	80¼	80½	Sept. '21, Q	1.50
National Lead pfd.	New York	107	[illegible]	106¾	Sept. '21, Q	1.75
St. Joseph Lead	New York	14¼	13¾	14⅛	Sept. '21, Q	.25
QUICKSILVER						
New Idria	Boston	†*50	†*35	*40		
ZINC						
Am. Z. L. & S.	New York	11½	11	11	[illegible] '19	1.00
Am. Z. L. & S. pfd.	New York	36	35½	35½	[illegible] Q	1.50
Butte C. & Z.	New York	5¾	[illegible]	5½	June '18	.50
Butte & Superior	New York	17¼	16¾	17	Sept. '20	1.25
Callahan Zn.-Ld.	New York	7¼	[illegible]	[illegible]	[illegible]	.50
New Jersey Zn.	N. Y. Curb	124	123	124	[illegible]	2.00
Yellow Pine	Los Angeles	*40	*35	*40	[illegible] '20, Q	.03

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton [illegible] Salt Lake Stock and Mining Exchange; Los Angeles, [illegible] Colorado Springs, The Financial Press, N. Y.

Stock	Exch.	High	Low	Last	Last Div.	
GOLD						
Alaska Gold	New York		⅜	⅜		
Alaska Juneau	New York	1	⅞	⅞		
Carson Hill	New York	15	11½	11¾		
Cresson Consol. G.	N. Y. Curb	2¼	2⅛	2¼	June '20, Q	$0.10
Dome Extension	Toronto	71	71	*71		
Dome Mines	New York	19½	19	19½	Oct. '21, Q	.25
Florence Goldfield	N.Y. Curb	*45	*25	*36		
Golden Cycle	Colo. Springs	*80	*77	78	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*4	*3	*3	Dec. '19	.05
Hollinger Consol.	Toronto	7.80	7.70	7.80	Dec. '21, 4 wks.	.05
Homestake Mining	New York	55	55	55	Nov. '21, M	.25
Kirkland Lake	Toronto	*33	*31½	*32		
Lake Shore	Toronto	1.23	1.18	1.21	Nov. '21, K	.02
McIntyre-Porcupine	Toronto	1.98	1.91	1.96	Sept. '21, K	.05
Porcupine Crown	Toronto	*15	*13½	*14	July '17	.03
Porcupine V. N. T.	Toronto	*18	*15½	*17½		
Portland	Colo. Springs	*40	*33	*40	Oct. '20, Q	.01
Schumacher	Toronto	*26	*24	*24½		
Silver Pick	N. Y. Curb	*7	*7	*7		
Teck Hughes	Toronto	*15	15	*15½		
Tom Reed	Los Angeles	*38	*36	*37	Dec. '19	.02
United Eastern	N. Y. Curb	2¼	2¼	2¼	Oct. '21, Q	.15
Vindicator Consol.	Colo. Springs	*22½	*22	*22½	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*6	*6	*6		
Yukon Gold	N. Y. Curb	1	1 1/16	1 1/16	June '18	.02½
SILVER						
Batopilas Mining	New York	⅝	½	½	Dec. '07, I	.12½
Beaver Consol.	Toronto	*25	*21	*23	May '20, K	.03
Coniagas	Toronto	1.50	1.15	1.25	May '21, Q	.12½
Crown Reserve	Toronto	*11	*9	*10	Jan. '17	.05
Kerr Lake	N. Y. Curb	3½	3¼	3½	Oct. '21, Q	.12½
La Rose	Toronto	*33½	*31½	*33½	Apr. '18	.02
McKinley-Dar.-Sav.	Toronto	*17	*14	*17	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.15	1.05	1.10	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	6½	6¼	6½	Oct. '21, Q	.03
Ontario Silver	New York	4¼	4	4¼	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb			*12	Jan. '12	.10
Temiskaming	Toronto	*27	*25	*27	Jan. '20, K	.04
Trethewey	Toronto	*10½	*8	*9¾	Jan. '19	.05
GOLD AND SILVER						
Boston & Montana	N. Y. Curb	*84	*80	*80		
Cash Boy	N. Y. Curb	*7	*4	*7		
Consol. Virginia	San Francisco	†66	†65			
Dolores Esperanza	N. Y. Curb	1½	1¼	1⅜		
El Salvador	N. Y. Curb	*11	*10	*10		
Jim Butler	N. Y. Curb	*6	*6	*6	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*4	*4	*4	June '16	.05
Louisiana Con.	N. Y. Curb	....	....	¼		
MacNamara M.& M.	N. Y. Curb	*13	*11	*13	May '10	.02½
Tonopah-Belmont	N. Y. Curb	1¼	1 3/16	1 3/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*67	*60	*61		
Tonopah-Extension	N. Y. Curb	1 5/16	1 3/16	1 5/16	Oct. '21, Q	.05
Tonopah Mining	N. Y. Curb	1½	1⅜	1⅜	Oct. '21, SA	.05
West End Consol.	N. Y. Curb	*88	*81	*81	Dec. '19, SA	.05
SILVER-LEAD						
Caledonia	N. Y. Curb	*6	*6	*6	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake			*92	Dec. '20	.15
Chief Consol.	Boston Curb	3¼	2¾	2¾	Aug. '21, Q	.05
Consol. M. & S.	Montreal	18½	18	18½	Oct. '20, Q	.62½
Daly Mining	Salt Lake	....	†1.00	..	July '20, Q	.10
Daly-West	Boston	†2	†1½	1½	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†3	†2¾	2¾	Apr. '21, K	.05
Electric Point	Spokane	*4	*3	*3	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*33	*26	*31		
Federal M. & S.	New York	9¾	9¼	9½	Jan. '09	1.50
Federal M. & S., pfd	New York	34½	31¼	31¼	Sept. '21, Q	1.00
Florence Silver	Spokane	*12	*11	*12	Apr. '19	.01¼
Grand Central	Salt Lake		†*21	..	June '20, K	.03
Hecla Mining	N. Y. Curb	4¾	4¼	4½	Sept. '21, Q	.10
Iron Blossom Con.	N. Y. Curb	*21	*19	*20	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†3.00	†2.00	..	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*4	*4	*4	June '21, I	.02
Prince Consol.	Salt Lake	*6	*6	*6½	Nov. '17	.02½
Rambler-Cariboo	Spokane	[illegible]	*1½	*3	Feb. '19	.01
Rex Consol.	N. Y. Curb	*8	*8	*8		
South Hecla	Salt Lake	†*30	20		Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*10	*10	*10	Oct. '17	.05
Stewart Mining	N. Y. Curb	*3	3	*3	Dec. '15	.05
Tamarack-Custer	Spokane	1.95	1.00	1.95	Jan. '21, K	.04
Tintic Standard	Salt Lake	2.02½	1.95	2.00	July '21, Q	.05
Utah Apex	Boston	3½	3¼	3	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	1	*1	1	Nov. '17	.01
VANADIUM						
Vanadium Corp.	New York	33¼	30¾	33	Jan. '21, Q	1.00
ASBESTOS						
Asbestos Corp.	Montreal	59	55	58½	Oct. '21, Q	1.50
Asbestos Corp. pfd.	Montreal	†79½		79½	Oct. '21, Q	1.75
SULPHUR						
Freeport Texas	New York	15½	15	15¼	Nov. '19, Q	1.00
Texas Gulf	New York	35¾	32¼	34		
MINING, SMELTING AND REFINING						
Amer. Sm. & Ref.	New York	43¼	41⅞	43½	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf.	New York	87¼	84¾	87½	[illegible] '21, Q	1.75
Am. Sm. pf. A	New York	88	88	88	Oct. '21, Q	1.50
U. S. Sm. R. & M.	New York	34	34	34	Jan. '21, Q	.50
U.S.Sm. R.& M. pf.	New York	42½	42¼	42½	Oct. '21, Q	.87½

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and
Mining Journal

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, December 17, 1921 Number 25

The Burden of Taxation

AT THE PRESENT COST of running the Government, $4,000,000,000 a year, as compared, for example, with $500,000,000 a year in 1900, it has been estimated that the first-named amount will absorb more than the total profits of American business for 1921. This refers to the Federal Government alone. The total expenditures of the Washington Government will amount to nearly $180 for every family in the United States, and most of this sum will be raised by direct taxation, an amount which it has been estimated is equal to twice the amount of the personal savings of the people of the whole country. In other words—as taxation by any device must draw, not by any possibility on special interests alone, but on the general wealth—the total possible savings of the country will be commandeered as taxes and an equal amount will be deducted from the average standard of living, leaving our scale of expenditure and our normal share of comforts and luxuries reduced by just that much. When we come to add state, municipal, and special taxes, it will be seen what a grievous burden we have to bear, and how taxation is drawing heavily on our national prosperity.

Our case is that of the other nations in the world in general. The problem of the high cost of living, which engrossed us some time ago, has now become that of the high cost of government, whether it be in the United States, Japan, Russia, or France. The great part of our enormous expenditures will be for war purposes, past, present, and future. The Conference in Washington will have made a step or gesture in the direction of arresting but not reducing this to a material degree. To proceed means greater hardship and the further reduction of living standards. But aside from the tribute to Mars, the civil expenditures of our Government are nearly three times as much as they were ten years ago. The functions of our Government have multiplied, and are being still eagerly further multiplied by Congress—the urge from within of executive departments for expansion, and the demands of the people that the Government should do this and that for them. In the end they—the people—are bowed down with taxation.

The fact is that the Government [illegible] have already become too extensive and expensive. Much as we would like to afford the luxury of civil servants in Washington for every conceivable function, the situation is that our overhead has become too great for the size of our business, and to that extent the business languishes.

Nitrates at Muscle Shoals

THE PROPOSAL of Henry Ford to buy Muscle Shoals from the Government is worthy of the public attention it has attracted. The Muscle Shoals plant was built by the Government to produce nitrogen by fixation from the air and so render the country independent of the Chilean mineral nitrates, on which we now depend for our main supply of nitrate fertilizer, and on which we have always depended. Our Government and its experts, however, have never been able to find a way to produce these air-derived nitrates except at a cost so far above that of the imported Chilean mineral that as an economic proposition the plan is ruinous; and hence in this time of financial stress the Government has interrupted and at least temporarily abandoned the project.

Now comes our own Henry, with a proposition to take the matter off the Government's hands, and provide the country with "cheap" fertilizer. Along with this goes a lot of talk about energy unit currency in the place of gold currency, about securing peace by abandoning the gold standard, and a similar obscuring line of smoke-screen theories that we at once recognize as loose and ignorant talk. Lenine and Trotzky had the same belief as Ford as to the pernicious nature of gold currency. They at least have had their lesson. But the point is that though Ford has a habit of talking "tall and tactless," he has a habit of being very long-headed in his actual operations—barring, of course, his Jasonic expedition in the quarrelsome "peace ship."

The point is—does Ford want the Muscle Shoals power site for manufacture of nitrates, or, say, of Fords, tractors, and the rest of the things he knows so well how to make? If nitrates, then by all means we should let him try, for the Government knows it cannot do it economically. A ninety-nine year lease to him, contingent on his manufacturing nitrates, would be the best of business for the public. But a sale to him of the great power of the Tennessee River, with no further binding agreement, should be thought over more carefully. If he can make air-fixed nitrates cheaper than the imported article, he will be one of our greatest national benefactors—much more, we mean, than he already is. Our supply of mineral nitrates in this country is negligible; and our supply from organic sources is quite insufficient.

Setting Europe Up in Business Again

THE NATIONAL CITY BANK, in a recent circular, points out anew, what might well be considered an axiom but has not always been admitted as true, that the course of depreciation of European money, in those countries where the outstanding paper currency is far in excess of the gold reserves, proves the futility of a paper currency without guarantees for redemption in metal, and is thus a vindication of the gold standard. Certainly by now the vague economists who saw behind paper money only the necessity of "credit" have had their minds further enlightened by experience. Credit, they believed, rested on national wealth; yet here is Germany, with an enormous strength and a national wealth practically undiminished by the war, facing a fiscal and financial disaster—because she has not the metal money to ballast and make stable her runaway paper mark. The invention of metal money (and paper money secured by and representing metal money is only a phase of the metal money system) has been one of the most notable discoveries which have made possible the growth of civilization: it is a device for quick, uniform, and general trade, comparable in completeness (but still more universal and indispensable) to the railroad, the telegraph, the printing press.

Take it away, as in Russia, and paralysis of modern life is inevitable. In Russia goods are not transported; therefore, the railroads stop running. The cities drop to pieces and rot. St. Petersburg is going the way of the deserted ancient commercial cities such as Nineveh and Tyre—far more swiftly than they. Why should the peasants bring wood and food to the cities? What have the cities to give them in exchange? Formerly they gave them gold and silver—money—of a known intrinsic value and the universal purchasing agent—good as an exchange for anything under the sun. Well, the Bolsheviks have demonstrated with the most dramatic vigor the falsity of their theory that money was an evil. They have demonstrated it to be the greatest blessing of modern times—an economic necessity, without which culture and comfort disappear.

The world is still in a curious situation as to its money. Our money — American money — is good, because it is gold and silver money. But we have the lion's share of the gold reserves of the world in our vaults. Prosperous as we still are, we see that the prosperity we demand depends upon the revived prosperity of the rest of the world. Through inflation—through vast issues of paper money produced with a superstitious idea that it would turn out to be good or half good—and the exhaustion of gold to pay nations like the United States which would accept, not paper, but gold alone, in settlement of trade balances, many of the European countries besides Russia—such as Poland, Germany, and Austria—find themselves without money.

Our problem is to help them to get money again—gold or silver. We must loan them a stack of chips if they are ever going to be able to sit in on the game again. We have enough metal in our treasury—therefore, the justification that existed not long ago for the governmental stimulation of gold production no longer holds, and we cannot argue it. We must now find some way of distributing our metallic reserve in part among the other nation members of our world of trade. But when we take our eyes off from the comfortably fixed United States—since she has raked in the whole pot—and visualize the necessity of again distributing the chips—have we enough metal, after all, for the vastly increased trade demands and for the vast modern currencies which must be supported?

Great as is the store of gold in the world, as compared with former times, it is relatively less, when we consider the increased wealth which it represents and the trade it must accomplish. Our position is strengthened through increased reserves of gold and silver, and the covering into the United States Treasury, for use as money (through the Pittman Act), of all the silver produced in the United-States. This will go on for some years. Our gold and silver is at a fixed ratio—20 to 1, practically, or, to be exact, $20.67 to $1.

The unstabilized price of silver in the outside world has fluctuated as widely, almost, as the exchanges. Therefore, the silver money of the world, primarily intended as a medium of trade, has become an object of trade, has been melted down and sold outside the countries of issue, thus further stripping these unhappy nations of that money without which they cannot go on.

All of these countries have plenty of goods to barter—it is money they need, and that money must be gold or silver. Under these conditions it is a waste to use more than a minimum of gold and silver in the arts; but to use silver as a commodity to be bought and sold at a fluctuating price and for speculative purposes not only destroys its use as money but also its usefulness for this capacity. Hence, European countries are reverting to metallic tokens of minor value or none—a debased silver alloy in England, base metal alloys in France.

Silver should be stabilized in Europe and Asia, in the plan of assembling and distributing money to those countries which have lost their metallic medium for doing business. The existing stabilization in the United States should be made permanent; and a corresponding stabilization should be adopted for other countries.

A True Yarn

ONE AUTUMN DAY we hitched our horse to the post outside the bare board, one-story "hotel" at Silver Peak, in Nevada. Silver Peak was an ancient and deserted mining town in those days. The mines had long been closed. Down the one long straggly sand-swept street, the irregular board shacks, with their rusty stovepipes, projecting, straight or tilted, from the roofs, lined themselves without order or hopefulness. Nearly all of them were empty, windows broken, sand drifted over the doorsills. The few remaining inhabitants—who knows what held them there or what they lived on?—had more or less concentrated into the little shacks around the "hotel," where at least there was a bottle of whisky behind the bar, a stove for cold nights, and card tables.

When we walked in, there were five or six residents, old "desert rats," each with his chair tilted back against the wall, and his head sunk on his breast in an attitude of hopeless despondency. The bartender and proprietor took hardly a casual interest in our arrival, in a place where arrivals were very rare; the wall-pillars none save a cynical and crestfallen glance. The atmosphere was of some great evil, some community disaster, which might have soured so completely this silent crew.

We inquired the cause—asked the reason for the funeral. At last we found out. One of the old-timers told us without humor, but with pathos and a justly wounded spirit. He informed us that there had been, for some months past, almost exactly three hundred dollars in money in that town. They had their supply of grub; and had not had occasion to buy any supplies for a long time. But they had their social life—they talked, they drank, they played poker. Especially poker. Sometimes one man had the three hundred dollars, sometimes another; but always, Desert Bill observed, there was a chance of getting it back, and the game went on. The proprietor got some of it for drinks, but he lost it again to one of the boys. All went happily for weeks in this little sequestered remnant of life, as Desert Bill gave me to understand, till one day a feller hove in sight and said he was out to work some mining claims. And he played poker with the rest.

It wasn't, said Bill, that he didn't play a straight game, but the fact is that he had left very early in the morning after he had won the three hundred dollars. God knows he was welcome to the three hundred, which they didn't need, and he had won fair; but they had their occupation removed, and couldn't go on playing poker. Their whole joyous life was past; wherefore, if they caught that mean skunk they'd surely take a shot at him. And with hopeless sighs the boys hunched into their chairs and relapsed against the wall.

When we consider the unpopularity of America among the European nations at this time, we think of Desert Bill at Silver Peak in 1899, and we understand. It isn't that she did not get the world's gold, in a fair game, but she has taken the pot and gone home with it; and they sit around with no gold to get in on the game with; and if they should get a chance at the United States they "shore would get even."

The Latest in Doodlebugs

THE RADIOSCOPE LABORATORIES CO., of Fort Worth, Tex., carried a full-page advertisement in the *El Paso Herald* of Nov. 20. The company offers its stock for sale, boldly asserting that its oil-prospecting device, which it calls a "radioscope," is a wireless instrument attuned "to pick up and record the waves and vibrations being sent off by the mass or bodies of petroleum in the earth." The company strings out such rot as this for an entire page, interlarding it with such phrases as "now or never," "success sure," "easy to pay dividends," and "the discovery of a new world."

No one with horse sense would fail to classify such stuff as nonsense on its face, least of all the *El Paso Herald*. This, one of the leading papers of the Southwest, thus sells its advertising space to a group of doodlebugs.

The president of the Radioscope Laboratories Co. is Abner Davis; A. D. Lloyd, its "eminent geological engineer"; and M. S. Blackburn its scientist, the last a "student of physics and radioactivity who understands the laws and principles of planetary phenomena as well as the phenomena of wireless and etherical waves."

The company expects, the advertisement says, to acquire a "million acres of the richest oil leases in the world," getting them directly from the land owner at nominal expense. It expects to co-operate with the land owner through a great oil development company for drilling wells upon a profit-sharing and royalty basis. The Laboratories company will take no risk and drill no wells, but "will acquire leases and royalty holdings in payment of its services in geologizing the territory and locating the oil pools by the use of radioscope science." The promoters announce that they expect the company to become "one of the three parties to the greatest oil development organization in the world."

According to Davis, the possibilities of a $100 share of the stock offered is a thousand times greater than the possibilities that a share of Standard Oil ever had. The fame of the radioscope has spread throughout the country, it is claimed. An offer of [illegible] for three months' test work has been made by a group of millionaires and refused "flatly," it is said. The "radioscope cannot be controlled by the great wealth of the country," the company asserts. The names of "Blackburn and Davis will go down in history as benefactors of mankind, men who refuse to be tempted by [illegible] wealth from the already vulgar rich, but [illegible] loyal to their friends who backed them through poverty to affluence and wealth."

Those who frame the policies of the *El Paso Herald* should have a greater sense of responsibility to the public than they manifest. Is it that the Southwest approves this sort of thing? Is it not the duty of the leading engineers there to take a public stand against it?

It is said that the remedy for existing evils is not more legislation but enforcement of existing laws. This is a pat statement, which flows readily from the tongue and is therefore much used. But is it correct? The number of fool laws could be cut down, it is true. Many a case, however, is dismissed simply because the law does not cover it, even though something wrong has obviously been done. Certainly there is need of some check upon fraudulent stock promoters that will be uniform and effective, but whenever the issue is raised and some form of so-called blue-sky legislation urged, great opposition develops. Such legislation, the opponents fear or profess to fear, would greatly interfere with legitimate promotion schemes, and, in mining prospects, would hamper the development of new properties. Thus while the matter is debated and delayed, the poor public is fleeced and flim-flammed with some of the rawest schemes that were ever concocted, the promoters of which should be in jail.

Hardened Copper Shears

SEVERAL SIGNS have come to our notice that the campaign which we started many months ago for reasonable prices and for the wider marketing of copper and brass manufactured goods is bearing fruit. In our Nov. 26 issue we mentioned a "No Profit" sale held in Rome, N. Y. Now word comes to us from Los Angeles that hardened copper shears and scissors were being extensively advertised in that section at special prices for the week beginning Nov. 21. Eight-inch shears, for example, were being sold at $1.49. They "will not rust, oxidize or corrode," according to the advertisement; "are unaffected by salt water, fruit acids, or electrolysis. They are the color of gold and keep that color forever. The most beautiful shears made." The name of the distributor is B. H. Lamont, 430 South Broadway, Los Angeles, Cal. Full particulars can be obtained from Mr. Lamont as to dealer's discounts, or prices direct to consumer.

A Los Angeles correspondent writes:

> "Enclosed you will find the first [illegible] copper advertisement I have ever seen since I have been in the copper game. This is the first authentic attempt I know of to push anything made of copper; the first time the public has ever been apprised that any article of [illegible] use could be made of copper.
>
> "A friend in Douglas, Ariz., writes me occasionally and always on the envelope, 'Buy Something Made of Copper.' The other day I wrote [illegible] this inquiry, 'What is it that I buy, and where in hell shall I get it?'"

That is just the problem. If we go into a department store, about the only things made of copper that attract our eye are after-dinner coffee sets. These are considered a side line, and are priced accordingly. Nickel-plated utensils are much more in evidence, and aluminum—why that is everywhere, with plenty of special sales to attract purchasers. Aluminum metal of course sells for a higher price than copper, but so are its manufactured products.

The Rome Brass & Wire Co. and Mr. Lamont are pioneers in the movement to merchandise copper [illegible] rather than words. Who will carry the idea along on a bigger scale?

WHAT OTHERS THINK

The United States Mining Act

House Resolution 7,736, entitled "United States Mining Act," now in the House Committee on Mines and Mining, contains much that appears to threaten the mining industry; therefore, the undersigned respectfully invite earnest attention to this protest against its passage.

Though not admitting the need of any extensive revision of the present mining statutes, if such should be undertaken, and if our mineral resources are to be discovered and utilized, it is of paramount importance that the prospector be encouraged and protected to the utmost degree.

In the opinions of the members of the Northwest Mining Association, H.R. 7,736 not only fails to accomplish this protection and encouragement, but it also actually introduces fresh complications and imposes new and unnecessary hardships, besides requiring that the usual gamut of the courts be run; whereas the existing laws have already been interpreted and are now well and generally understood.

Objection is specifically made to the following sections and sub-sections of H.R. 7,736, namely: Section 5 A, B and C; Sections 6 and 7; and Section 13 A.

Emphatic objection is made to Section 5 A for the following reasons: To require a prospector, or locator, to stake his claims in conformity with the cardinal lines of public-land surveys argues an ignorance of the practical difficulties that would be introduced by such a system. Principal among these may be mentioned, first, the usual difficulty in quickly locating public-survey corners; second, on unsurveyed land, the impracticability of locating claims by means of cardinal lines that shall even approximately agree with the definite lines of a final and subsequent public survey; third, and especially in rugged, broken country, covered with forests and brush perhaps, the impracticability of so staking claims on veins that meander obliquely across a checkerboard of cardinal lines as to guarantee possession of valuable portions of those veins on their dip, particularly when groups are limited to 160 acres. (See sketch.)

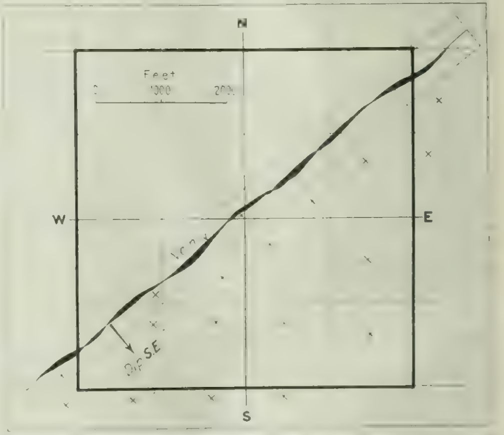
The prospector, or locator, is seldom or never a surveyor, nor can he be expected to employ one to aid him in the rush and excitement of staking new discoveries. Even under the present simple system of locating claims, the obstacles to be met are frequently many and harassing. In British Columbia, the square location may be made with one side parallel to the vein—not with sides running due north, south, east and west—thereby greatly simplifying matters and guaranteeing possession of valuable portions of the vein on its dip.

As to subdivision B of Section 5, the Northwest Mining Association considers it to be one of the most vicious pieces of legislation ever proposed for the regulation of land holdings.

Though it is conceded that some well-guarded provision should be made by which territory lacking visible signs of valuable minerals may be honestly prospected for suspected deposits, to throw land open to location for five years without discovery and with no more safeguards against fraud than are proposed in this subsection, would most certainly result in the immediate plastering of vast acreages with blackmailing and obstructing locations, with the further net result of retarding mining development indefinitely.

Subdivision C, Section 5, is objectionable because it compels the filing of location notices and proofs of assessment work in the United States Land Office *only*. The same objection obtains in other sections of this bill wherein the Land Office is mentioned in this connection.

The locator of a mining claim should be permitted to file his notices and proofs of assessment work in the office of the county recorder of the county in which his locations are made as at present; but, it should be mandatory upon the recorder to file, immediately, in the district land office, a copy of every such location in order to prevent the interferences that now arise.



SKETCH SHOWING PROPOSED MANNER OF LOCATING MINING CLAIMS UNDER H. R. 7,736 COMPARED WITH PRESENT SYSTEM INDICATED BY DOTTED LINES. SKETCH SHOWS SECTION LINES

United States land offices are often far distant from mineral locations, and the prospector, locator, or owner should not be compelled to travel those distances to consult the records.

Subdivision B, Section 6, is objectionable as regards the acceptance of a cash payment in lieu of actual assessment work on a claim. The Northwest Mining Association believes that too many claims lie undeveloped because of this privilege. It is also believed that lapsed claims should not be relocatable by delinquent owners, or their representatives, for a period of one year from the date of lapse.

As to Section 7, dealing with the extralateral right, thirty-five or forty years ago an abolishment of the extralateral right would have prevented considerable costly litigation and could have been accomplished without confusion; certainly it would have been of great benefit. But that was before most of the great camps of the United States had been discovered. Now, however, it is doubtful if there remains unprospected any considerable region, except Alaska, within which an important camp is likely to arise, or where the square location, bounded by vertical planes, could prove of any advantage whatsoever. On the contrary, in the relocation of lapsed claims in the midst of present locations it would not only prove useless but might well cause confusion.

Furthermore, "the law of the apex" is now so well understood by all mining men that locations are made with it in view and its hazard is taken with open eyes. Consequently, the Northwest Mining Association is strongly opposed to any tampering with the well-established extralateral right at this late day, especially as no enactment can be retroactive.

Referring to Section 13 A, this association objects to any change in the present method of obtaining mill sites.

In conclusion, the undersigned is of the opinion that most mining men prefer evils that they know, if such there be, to those they know not of; moreover, that the mining industry as a whole will sooner recover from the present depression, and thrive better in future, if permitted to work out its many problems unhampered at this time by legislation of any sort.

Consequently, as stated in the beginning, careful attention to these matters is earnestly solicited.

NORTHWEST MINING ASSOCIATION.

Spokane, Wash.

Coloring Precious Stones by Radium

Relative to the account which appeared in *Engineering and Mining Journal* of Nov. 19 of the experiments on the coloring of precious stones by radium emanation that is being conducted at the Rare and Precious Mineral Experimental Station of the U. S. Bureau of Mines, at Reno, Nev., I believe the late Sir William Crookes was among the first to note the influence of radium emanation on diamonds. He describes his observations in the *Philosophical Transactions of the Royal Society* for 1914, as follows:

> "A large brilliant-cut diamond of pure water assumed a fine green color after having been kept for sixteen months (from May, 1904, to September, 1905) in a tube and covered with powdered radium bromide. At the end of that time it was highly radio-active. This diamond has been carried about in my pocket, off and on, since then, and has been tested on a sensitive photographic plate at intervals of a year or more. No appreciable diminution in its radio-activity can be detected from that which it possessed when first removed from the radium bromide in September, 1905. Examined at the present time, nine years after its removal from the tube of radium bromide, it is brilliant in the dark; it rapidly discharged a sensitive electroscope, when held near it, and produces scintillations on a zinc sulphide screen as if it were a radium compound."

The diamond has retained the green given it by the radium emanation, despite the fact that Sir William tried to dissipate it by boiling the stones in acids, alkalies, and other chemical reagents. This would seem to indicate that the colors given to gems are likely to be permanent.

It has long been known, of course, that glass tubes in which radium salts are preserved acquire an amethyst color, similar to that given to glass by long exposure to the sun's rays or to those from the electric-arc light. This, I believe, in all instances was supposed to be due to a chemical change in the manganese compounds in the glass, manganese dioxide having been added in the manufacture of the glass to correct the color given to glass by ferrous oxide, which is nearly always present to a greater or less extent in the silica used in the manufacture of glass. In the light of the experiments at the experimental station at Reno, coloration of glass by radium compounds may have nothing to do with the manganese in the glass.

F. H. MASON.

Victoria, B. C.

The Olive Branch

The publication of the "War Problems in Minerals" was interesting indeed. The explanations of different actions in Articles III and IV under this heading are apparently apologies. If they were intended for such they are accepted. Even though they be apologies, it should be the reader's prerogative to criticize them.

In Article III the editor apparently cannot get the thought of war out of his mind, and he bases his syllogism on the subject of future wars. Truly this does not coincide with Secretary Hughes' idea of disarmament. From a War Minerals Relief claimant's point of view the explanations and apologies in these articles would not have been necessary had we enjoyed *laissez faire* from the *Engineering and Mining Journal*. We wonder now if a feeling of *malaise* prompted the writings of these articles. We think Article IV belongs in the nugatory class. Both articles are notable for the mutual admiration of the authors. This was to be expected when it is not long since the editor commended the author of Article IV for the quality of truculence.

Among the explanations, the editor in Article III did not state why in his choice of engineers he did not include those who were chosen for the purpose of stimulation in the beginning; but, instead, a different set were selected; and in the list published in Article III surely the word "the" is omitted between the names of the thirteenth and fourteenth engineers.

The author of Article IV takes the position of Commissioner Emeritus, and neither article refers to the hearings before the House Committee on Mines and Mining, where the truculence was well displayed but not commended.

Again referring to these as apologies, we can say, gentlemen, Your apologies are accepted.

San Francisco, Cal. C. S. MALTBY.

[Mr. Maltby's contributions are always stimulating, if only for their rich vocabulary. We got the sense of *malaise* from its suggestion of mal de mer, which arouses vivid impressions, but we had to look up *nugatory* in the dictionary. Our first impression was that it was Latin from [illegible], for one who would say [illegible] fine and valuable, but it isn't. Au contraire, as the Frenchman on board the ship replied when asked if he had breakfasted.—EDITOR.]

New Uses of Asbestos

Asbestos twine is used in laboratories to bind together parts of apparatus exposed to the acid fumes, according to the *South African Mining & Engineering Journal*. A number of household articles, and especially kitchen utensils, are made out of asbestos. Fiber felts made out of pure asbestos fiber are used in large quantities for insulating the heat-radiating surfaces of automobiles, the insulation of electric service wires, and in the construction of battery holders and other [illegible] uses. Asbestos can be used for all kinds of purposes, for purposes as widely different as cloth, twine and [illegible] and solid building material.

GENERAL VIEW OF PLANT AND SETTLEMENT AT BAJO GOLD MINE

A Mining Company in Japan

Bajo Gold Mine, of Narukiyo Company, First Opened Almost Three Centuries Ago and Still Producing—Takamine Property Under Development—Iron Works at Oita Also Operated

BY N. ISHIKAWA AND H. KITAMURA

Written for Engineering and Mining Journal

THE PROPERTY of the Narukiyo Mining Co., Ltd., a Japanese company operating in Japan, includes two working gold mines and an iron works. The head office of the company is at Hiji-machi, Oita-ken. The gold properties are the Bajo mine, at Tateishi-machi, Oita-ken, and the Takamine mine, at Kamo-mura, Kagoshima-ken. The office of the Oita iron works is at Ikushi, Oita-ken. Nobuye Narukiyo is president and Seigo Yeguchi vice-president of the company, which is a joint stock company, organized in 1917, with a fully paid-up capital of 2,000,000 yen.

The Bajo gold mine is situated in Kyushu, about sixty miles south of Moji, on the Hoshu railway, one mile from Tateishi station. The deposit was discovered as early as 1630, and for some time was worked extensively, but on account of the difficulty of pumping water after a certain depth was reached, it ceased to be prosperous, and many changes of ownership seem to have taken place.

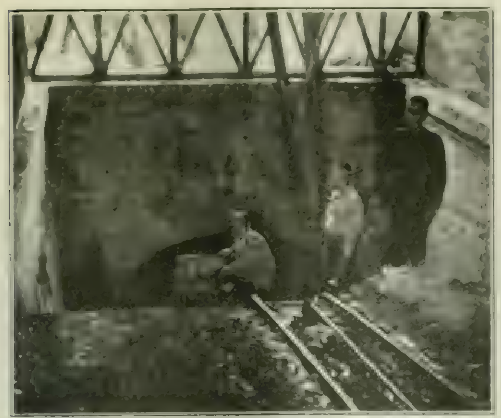
In November, 1907, Hiroye Narukiyo obtained by transfer part of the gold-producing ground from Yoshikata Hoashi, the owner at that time. Under the new ownership vigorous steps of improvement were immediately taken, with the result that the property became widely known throughout Japan. Hiroye Narukiyo died in January, 1916, the property passing to the son, Nobuye Narukiyo. The latter organized the present company, which is in flourishing condition today.

In area the Bajo property includes 3,591,111 *tsubo* (about 2,934 acres). The rocks of the mineralized area consists of andesite, which is being developed extensively; granite, gneiss, and tuff. The deposits are of the fissure type, the gold occurring in quartz veins in andesite and granite. The ores consist of native gold, pyrargyrite, proustite, stephanite, argentite, gold and silver-bearing chalcopyrite, and silver-bearing tetrahedrite. The associated minerals include iron pyrites, arsenopyrite, stibnite and native arsenic. This mine is famous for producing a large quantity of native gold and beautiful crystals of pyrargyrite. Gold and silver are associated with all sulphides, but usually a more pronounced affinity for chalcopyrite and stephanite is noticeable. Distribution of the sulphides is irregular. They also occur in massive form.

The principal veins are known as the Sakura, Ume, Take, Matsu, Kosei, and the Oatari. These veins have been worked over a distance of 1,000 ft. and vary in width from 2 ft. to 20 ft., striking approximately east and west. The dip varies between 40 and 70 deg., with the inclination usually to the north. The gold content of the ore in the principal veins varies from 1.75 oz. to 3.5 oz. per ton of ore, and the silver content from 7 oz. to about 14 oz. per ton. Occasionally very rich pockets have been found. In this property about one hundred outcrops are known, but these have not been as yet completely prospected.

The workings include vertical and inclined shafts, from which many levels have been driven along veins at intervals of 50 or 100 ft. vertically, these being connected by many winzes. The drifts are 7 x 7 ft., 7 x 6 ft., or 5 x 6 ft. in cross section and are equipped with well-laid 12-lb. rails for hand-trammed mine cars.

The mining is effected chiefly by an irregular overhand long-wall method. In some places ordinary over-



NO. 1 SHAFT, BAJO MINE

hand stoping and a modified form of underhand stoping are practical. After removal of the ore the stopes are filled with waste or soil.

Air drills are used in addition to drilling by hand, and, of course, a large quantity of explosives is consumed. The drills used are: five No. 26 Leyner-Ingersoll drills; three Besshi-type hand hammer drills; and two Besshi-type stopers. The compressor is an I-R Imperial XB2, belt-driven and requiring 75 hp.

Tramming is entirely by hand. Steam or electric hoists are used at the shafts. Natural ventilation has so far been relied upon to keep the working places in condition for mining operations, and drainage is effected by means of steam or electric pumps.

The main shafts are described briefly as follows:

No. 1 inclined shaft is 7 x 11 ft. in cross section and 592 ft. in vertical depth, the inclination being 35 deg. It is used for hoisting, ventilating, and draining. It is now in the course of further sinking.

No. 2 vertical shaft is about 420 ft. deep and 6 x 12 ft. in cross section. This is used for hoisting, ventilating, and as a pipe-way for steam and compressed air.

No. 3 vertical shaft is 217 ft. deep vertically and 6 x 10 ft. in section, and is used for the same purposes as the shaft mentioned in the preceding paragraph.

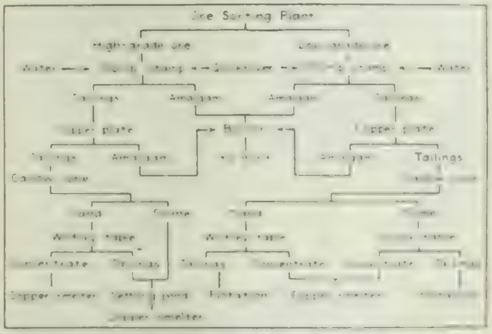
The mechanical equipment consists of the following: One 60-hp. steam-driven hoisting engine, with horizontal cylinders 12 in. in diameter; also a hoisting engine of similar type but of 35 hp. and with 10-in. cylinders; one 5-hp. electric hoist. There are six steam pumps, four of which are of special make. Two of these have a capacity of 80 cu.ft. of water per minute, the capacity of the others being 50, 40, 25 and 15 cu.ft. respectively.

[illegible] SHAFT, BAJO MINE

PART OF ORE SMELTED DIRECT—REST MILLED

As a large part of the ore is sold to the Saganoseki copper smelter, the mining company has adopted a method of ore dressing that will yield a product suitable for the smelter's requirements. The waste is picked out by hand from the crushed ore, which is classified according to tenor and size. Part is sent to Saganoseki and part is stamped in the mining company's mills, and the rest, which is of too low grade to sell or stamp, is put on the dump. It is roughly estimated that about 110 tons of ore is treated in this mill and that one-third is sold to Saganoseki.

Part of the dressed ore is treated by a wet process as follows: The ore is stamped in water, using a 40-mesh battery screen. The amalgamation is carried out both in the battery and on an outside copper plate. The tailings of the stamp batteries are run into the Callow cones and classified into sand and slime. The sand from the cones is concentrated on Wilfley tables and the slime by sluice tables. These tailings will be treated by flotation when construction of this plant is completed. The mill equipment is as follows: Ten stamps weighing 1,050 lb. each, the stamp duty, that is, the quantity of ore crushed per stamp per twenty-hour day, being 1.85 tons. Thirty stamps weighing [illegible] lb. each, the stamp duty being 0.6 ton. Four Wilfley tables for the product from the heavy stamps and one for that of the lighter stamps. The flow sheet of the mill is given in Fig. 1.



FLOW SHEET OF MILL AT BAJO MINE

Steam power is principally used at mine and mill. The Kyushu Hydro-electric Co. is supplying electric power for lighting purposes as well as for small motors. The company is planning to replace steam with electricity in the near future. Five Lancashire boilers aggregating 540 hp. are now in use.

The production of ores and metals by the Bajo mine in 1919 and 1920 was as given in the following table:

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

The mine workers, including both underground and surface hands, number in all about [illegible]. There is a hospital at the mine. All the mine workers are supplied with the necessaries of life at a canteen established for their exclusive service.

The Takamine gold mine is situated in the Province of Satsuma, in the southern part of Kyushu. It is said to have been first opened about thirty years ago. The Narukiyo Mining Co. purchased part of it in 1916 and the rest in 1918. The property covers 834,106 *tsubo* (681.4 acres).

A STOPE IN THE BAJO GOLD MINE

The country rock is andesite. The ores carry principally native gold and argentite. They occur in the quartz veins found in the andesite and are usually associated with a small amount of pyrite.

The prospecting had been carried on by driving levels at different elevations along the vein. At present, the operators are considering sinking the main shaft at the richest part, which will be 150 ft. deep when completed, by hand labor. The mine is naturally ventilated, and drainage is effected by means of electric sinking pumps.

To supply power required for pumping and lighting there is an electric power station, consisting of one set of suction gas engines driving a dynamo of 62.7 kw. The mine workers number about sixty.

SORTING ORE AT BAJO MINE

The Oita iron works consists of a shop for a dockyard and a boiler shop. It was established in July, 1917, by the president of the company, Nobuye Narukiyo. Mr. Narukiyo, seeing that the reclaimed ground of Oita harbor was not utilized as it ought to be, and that there was no iron works in the eastern part of Kyushu, rented 3,300 *tsubo* (about 2.7 acres) of the reclaimed ground and a dockyard, and started shipbuilding, not only for his company but for the public interest. In December, 1917, he incorporated the present company, controlling all his mines as well as the iron works. Since then the shop has been improved and its equipment increased. The kind of work done comprises the manufacture of engines and boilers of both land and marine type, machine tools, the erection of steel structures, shipbuilding and repair work. The plant has a casting capacity of 3,600 tons per year. The value of its products is about 1,500,000 yen annually.

STAMP MILL AT BAJO MINE EQUIPPED WITH 1,050-LB. STAMPS

Dust Reduction by Use of Wet Stopers

In the study of miner's consumption it has been found that dry drilling, especially in unventilated places, is by far the most dangerous underground occupation, according to D. Harrington in *Reports of Investigations*, U. S. Bureau of Mines. Detailed study indicates that in general the drilling of upper holes creates the worst condition in air breathed by drillers. The introduction of machines with water injection through the drill for crosscutting and driving readily controls the dust menace for practically horizontal holes or those with a downward inclination. Where the hammer type of dry drill is used for the same work, the dustiness of the surrounding air is likely to be as great as or even greater than in dry drilling of upper holes with the stoper types.

It is Mr. Harrington's opinion that the use of external sprays in connection with dry drills is an inefficient method of dust prevention. It is evident that use of water through hollow steel has been effective in dust prevention where piston types of machines have been used in driving, and even in stoping and in raising where conditions were such that they could be used.

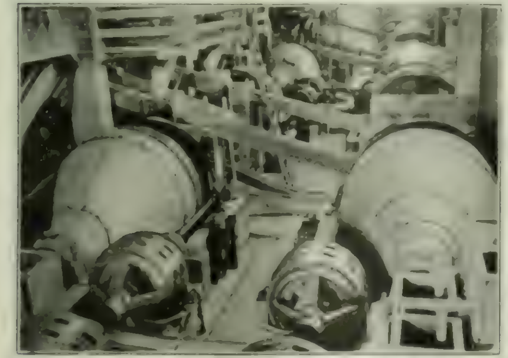
Belt, Gear, and Chain Drives for Grinding Mills

Short-Center Belt Drives, Recently Introduced, Becoming Popular — Silent Chains Excellent, Though Now Somewhat High in First Cost — Single-Reduction-Gear Drives From Individual Motors Best in Large Plants

BY GEORGE J. YOUNG
Western Editor, Engineering and Mining Journal

THE MECHANICAL ARRANGEMENT for the driving of tube, ball, and rod mills is capable of a number of variations, no one of which can be termed universally the best. Thus, in a given mill which may be designed for an uncertain length of operating time, due to limited mine development or small ore reserves, the saving of first cost may be the vital element. A relatively cheap drive in first cost may suffice, although the maintenance costs may be high and safety considerations be sacrificed. On the other hand, in a mill designed for heavy continuous operation over a period of ten to fifteen years or longer, first cost becomes secondary and operation and maintenance of primary importance.

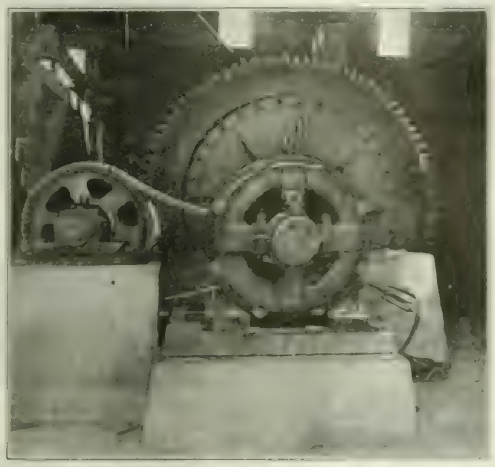
From a mechanical point of view, the driving of tube, ball, and rod mills is essentially alike. Each consists of a cylindrical or conical shell, lined with wearing plates which may or may not be ribbed. Usually the shell is supported on hollow trunnion bearings, or, in some mills, one bearing is a hollow trunnion and the other is constructed of a ring about the mill supported on rollers. The selection of drive is not greatly influenced by the trunnion or trunnion and ring support. The weight to be rotated is great and the speed attained is comparatively low.



CONICAL MILL DRIVE, MOTOR CONNECTED TO COUNTERSHAFT THROUGH FLEXIBLE COUPLING, HELICAL GEAR. ARIZONA COPPER CO., MORENCI, ARIZ.

CONTINUOUS VIBRATION MUST BE OVERCOME BY DRIVE MECHANISM

The power required varies with the size and type of mill, but may reach a maximum of 215 hp. in the larger ball mills and may be as low as 12½ hp. for the smallest conical mill. Owing to the pebble or ball load constantly adjusting itself, the power curve consists of a series of maxima and minima, the difference between the peaks and depressions of the power curve depending upon the ball loading, the proportion of water, the condition of the lining and ribs, and the maintenance of the alignment of the mill. The result is a continuous vibration which must be overcome in the driving mechanism and which wears the bearings and other parts of the drive.



CHAIN DRIVE, 5 X 18 FT. TUBE MILL, [illegible] MOTOR MEXICAN GOLD & SILVER MINING CO., VIRGINIA CITY, NEV.

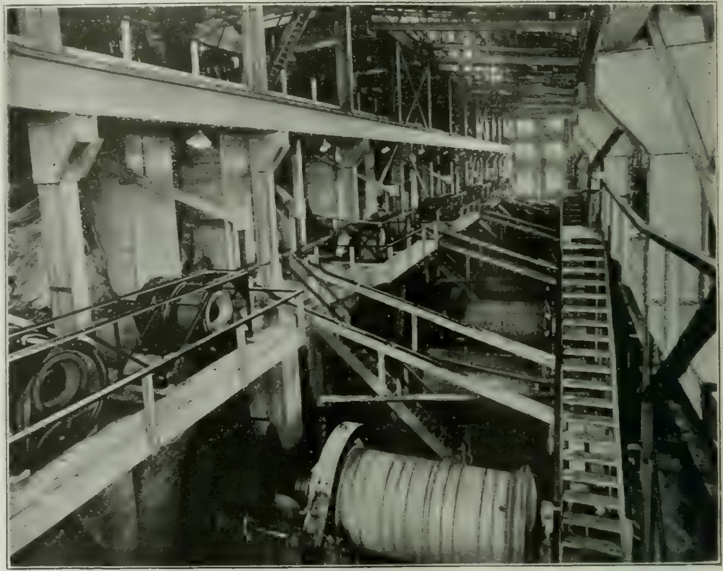
There is no end thrust if the mill is perfectly aligned, but this is seldom continuously possible. This end thrust is, under common operating conditions, readily taken care of by the trunnion bearings.

The principal function of the drive is to reduce the speed of the motor to the low speed of the mill. Although this appears to be easy, it is surprising to note the variety of arrangements that are in current use. One of the first drives which I had an opportunity of studying was installed at the Butters' plant at Virginia City. This consisted of a motor and a belt drive of about 30 ft. centers to a countershaft which carried a friction clutch pulley and a bevel pinion which meshed with a bevel gear on the tube mill. The arrangement gave a lot of trouble, owing to the end thrust produced by the bevel gears. It admitted of a compact arrangement, but the belt was in a bad place for the operators. This form of drive has disappeared.

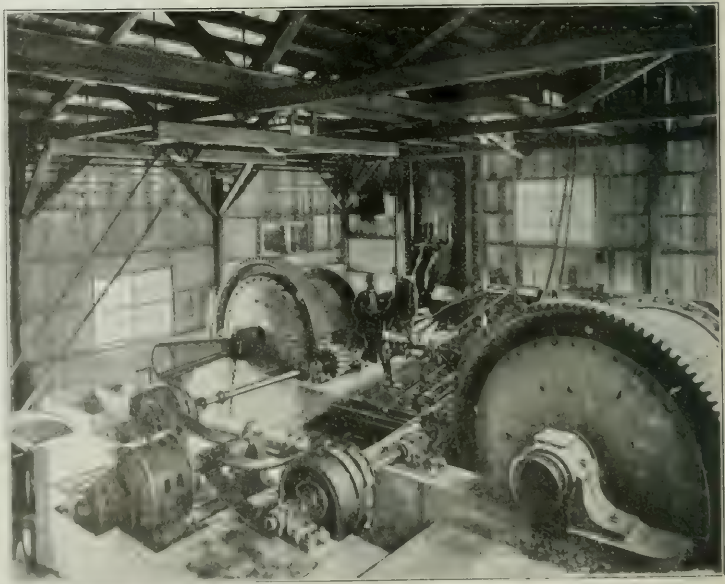
The simplest drive is a horizontal belt drive from the motor to a countershaft and a spur gear drive from the countershaft to the mill. Mechanically this arrangement is sufficient where a proper distance is allowed between pulley centers and the loose side of the belt is above. Driving several mills from an overhead lineshaft by belts to the mill countershaft is sometimes done, but it is necessary to use a belt tightener. This arrangement is in use at the mill of the Carson Hill Gold Mining Co. at Melones. Three conical mills are driven from an overhead lineshaft. The horizontal belt drive is objectionable, both on account of the mill space taken up and the dangerous position of the belt. The overhead drive with belt tightener does not take up floor space, and the belt is out of the way. Though objectionable mechanically, no special criticism of the arrangement from the metallurgical standpoint is warrantable.

The most recent belt drive is the short-center drive which is carried either horizontally or vertically from above the countershaft. Short-center belt drives with well-designed idler pulleys, such as the "Meeseco" and others of similar design, answer the purposes excellently, and many mills are driven in this manner. The pulley ratios are from 1 to 5, and higher ratios are practicable. The drive is noiselesss and the slippage small. The floor space is greatly reduced as compared with the horizontal belt drive. The objection to the short-center belt drive is the increased cost of belt maintenance as compared with the horizontal belt drive. The rapid bending back and forth of the belt due to passing around the driving pulley and the idler undoubtedly wears out the belt much more rapidly than a drive where the belt bending is consistently in one direction. With well-proportioned and flexible belts the belt maintenance can be reduced to a minimum.

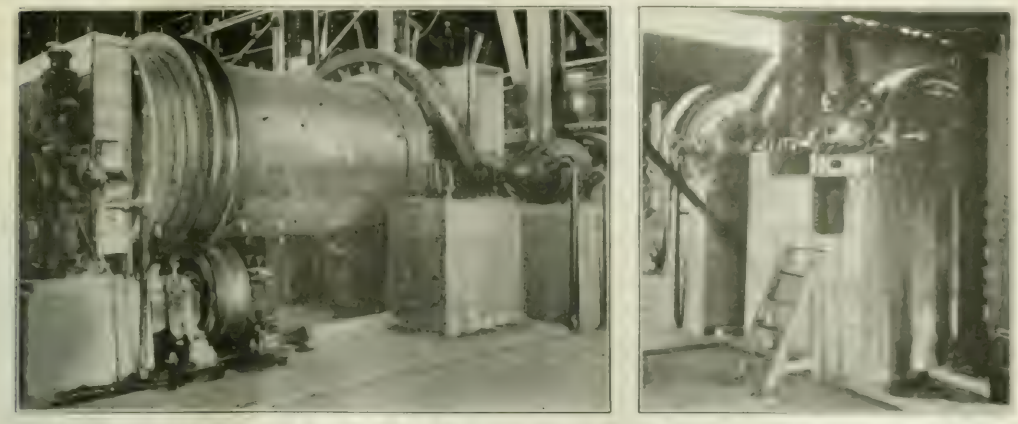
An objection to all belt drives is the element of danger in their use. Also, when they slip off the pulleys they are difficult to replace. Being close to the mill they prevent ready access to all parts of it and are likely to be interfered with by mud, sand and pulp which splashes and leaks from bolt holes occasionally. They are lower in first cost than any other drive and are therefore worthy of consideration for very small mills and low first cost plants. A flexible coupling is not required, but a friction-clutch pulley, in the absence of a belt tightener between the motor and countershaft, is usually necessary where standard squirrel-cage induction motors are used and is always necessary where synchronous motors (rarely employed) are used. The placing of a friction-clutch pulley on the countershaft is objectionable, as there is more or less spillage of sand and pulp about the mill, and some of it inevitably gets into the clutch, interfering with its operation. The result is dissatisfaction and



BELT DRIVE, 150-HP. MOTORS, "MEESECO" BELT TIGHTENER, BONNOT TUBE MILLS



SILENT CHAIN DRIVE AND SPUR GEARS, MARCY MILLS, NEVADA PACKARD MINES CO.



MARCY ROD MILL DRIVEN BY [illegible]-HP. TYPE CW INDUCTION MOTOR THROUGH HERRINGBONE GEARS FOR FIRST AND SPUR GEARS FOR THE SECOND REDUCTION. BURRO MOUNTAIN BRANCH, PHELPS DODGE CORPORATION, TYRONE, N. M.

sometimes damage to the electrical equipment follows.

The silent chain drive has been adopted to some extent. The arrangement consists of a chain drive interposed between motor and countershaft and the driving of the mill from the countershaft by spur or herringbone gears. Neither flexible coupling nor clutch is required, but a clutch is necessary where motors of low starting torque are used. The arrangement is compact and admits of the motor being placed at some distance from the mill, where it will be protected from spillage. It is safe and efficient, and mechanically it works well. If unprotected by suitable housing, the chain is exposed to a certain amount of dust and dirt. The operating objections are the upkeep due to wear and the breakage of chain rods. When worn there is considerable back lash, but this can be compensated by the motor-base adjustment. The principal objections are its first cost and the expense for providing a suitable housing. By the use of a cast-iron spur gear for pinion and mill gear a saving in first cost is possible. On the whole, it is better than a belt drive if the additional first cost is allowable.

It is obvious that either spur or helical gears can be substituted for the chain drive. A double reduction of the motor speed by two sets of gears has certain mechanical advantages. It is more compact than the chain drive and can be readily housed. A flexible coupling is necessary between the motor and the pinion of the first gear. The maintenance cost is low and the first cost is lower than for a chain drive of equivalent speed ratio. Helical gears are to be preferred in place of spur gears, as the sliding contact [illegible] reduces the effect of the vibration caused by the mill load and thus reduces the wear to a minimum. The preferable arrangement would be helical gears for the countershaft drive and a steel spur gear for the mill drive. A still lower first cost would be secured by a cast-iron gear for the mill drive.

Various spur-gear reducers are on the market. These consist of a self-contained unit consisting of a given reduction of speed between the motor and the countershaft. They are in effect the same as the gear drive just described. Some recent installations have adopted them. They are compact, the gears run in a bath of oil, and the upkeep and maintenance are low. As the speed reduction is large, they admit of the use of a high-speed motor, with consequent reduction in the motor cost. The speed-reduction unit is high in first cost and is therefore more suitable for large, long-lived plants. The arrangement protects the motor, is satisfactory from a metallurgical standpoint, and is more compact than the silent chain or ordinary double-gear drive. A flexible coupling between motor and speed reducer is required.

The simplest drive from a mechanical standpoint is the single gear drive with countershaft direct connected to the motor through an interposed flexible coupling, an arrangement which brings the motor in close proximity to the mill and exposes it to spillage. The gears can be cheaply housed, however, and with reasonable care in operation there is comparatively little trouble from spillage. It is the most compact arrangement and may or may not be of lower first cost as compared with double-gear drive and speed-reducing gears.

USE OF HERRINGBONE GEAR GIVES BEST RESULTS

The double helical or herringbone gear drive is essential for satisfactory operation. With the herringbone gear a gear ratio of as high as 1 to 20 can be satisfactorily used. This calls for a countershaft speed of from 345 to 450 r.p.m., and therefore for a special low-speed motor. These motors can, however, be economically produced, although they are of higher cost than the standard induction motors. It is not economical to design small motors suitable for the low speeds required on the single reduction drive, and this drive is therefore restricted to the larger sizes of ball and rod mills. Under careless operating conditions a comparatively high pinion wear is to be expected on account of the exposed position of the gears, and this element should be given consideration, as the gears and pinions are expensive. Apart from this the maintenance cost is low, and the method of drive has been favored in the large long-lived plants. Satisfaction is generally expressed by users of this arrangement.

Individual drives are most satisfactory for large mills and the larger plants. For low-priced mills and smaller plants, group drives are often used, although a complete analysis of each individual operation is essential to determine whether they are more economical in first cost and in operation. Against the saving in first cost of a single large motor as compared with the cost of individual smaller motors, the cost of the line shaft, its installation, and the power used in its operation must be placed. The cost for wiring and motor controls is greater with an individual than with a group drive. The individual drive has the advantage of a smaller reduction in mill capacity than the group drive in cases of line-shaft and motor troubles. The group drive with belts and belt tighteners works out fairly fell, although it is not as safe in operation as other drives.

Motors used for ball, tube, and rod mills all require comparatively heavy starting torque. This is in excess of full-load torque. Motors for long tube mills require 1½ times full-load torque at starting, whereas motors for large-diameter ball and rod mills require twice the full-load torque. Squirrel-cage motors designed for particularly high starting torque can be used, but when permissible, wound-rotor motors are preferable. Wound-rotor motors are necessary for all large ball and rod mills.

Acknowledgment is made to Girard B. Rosenblatt and others for freely discussing their experience on this subject.

Storing Carbide With Explosives*

Extended search reveals no record of any accident attending the storage of carbide with explosives or of any investigation of the possible effect of carbide upon explosives, but something may be learned as to the propriety of storing them in proximity to each other from a consideration of the known properties of calcium carbide, its observed behavior in storage, transportation, and use.

It is apparent that acetylene is an inflammable and combustible gas. It is one of the most easily ignited of the inflammable gases, for when heated in contact with air it takes fire at 480 deg. C. Like all other combustible gases and vapors, acetylene forms explosive mixtures with air, and is unique in that so far as known it forms a wider range of combustible and explosive mixtures with air than any other gas; and hence, as with any combustible gas, special care should be exercised to prevent acetylene escaping into the air to form such mixtures.

Moreover, acetylene differs from other gases in that during its formation it absorbs heat and therefore falls into the class of chemical compounds characterized as endothermic compounds. When acetylene is under a pressure of more than 15 lb. to the square inch above the atmospheric pressure, it can be detonated, and it thus becomes a true explosive. For this reason no one should attempt to compress acetylene, certainly not to more than 15 lb. to the square inch, unless it is simultaneously absorbed by acetone, or other proper solvent, and some approved form of porous material. A process for the compression of acetylene has been developed, but it is highly technical and should not be attempted by the inexperienced.

It is unsafe to store carbide in the same magazine with explosives or in close proximity to them. Moreover, such storage violates the following fundamental rule of practice governing explosives magazines: Nothing but explosives should be stored in an explosives magazine and preferably but a single class of explosives; for explosives of different classes may affect one another unfavorably when stored together. Detonators, caps, fuse, and all other mediums of ignition or detonation should be stored at a distance from explosives.

Burma Corporation Has Peculiar Labor Troubles

The Burma Corporation, one of the largest lead mines in the world, is experiencing unusual difficulties in procuring an adequate supply of native labor. According to a recent report of the company the only other source of labor of any magnitude is the Province of Yunnan, China. During the latter months of autumn and the early months of winter a large migration of coolies takes place from Yunnan to Burma. These people leave their homes after the rains are over and the crops are gathered, and walk in some cases 400 miles, into Namtu. Usually it results in their arriving at Burma Corporation's plant toward the middle or the end of December, so that from the first of November up to the end of December there is a large influx of coolie labor, and it is during that season of the year when all the outside work has to be undertaken, such as railway improvement, grading, forest work, and so forth. But just as these people come in during that season, so in the corresponding spring months they return to their own country. They are essentially cultivators, and no inducement which the company can offer will persuade them to remain in Burma during the unhealthy season prevailing there from June to October.

Two reasons take them back to their country; one being that that is the season of cultivation, and they all have small patches of land, and the other is that they will not stand the rains at the altitude of the Burma Corporation's plant. For outside work the company is entirely dependent on these people, and as this influx is dependent to some extent on cultivating conditions in China, and the quantity available for Burma Corporation operations is dependent on other demands for labor in Burma, it is to be seen that the future presents a grave outlook and one which must be given serious attention.

Burma Corporation has endeavored to make a beginning of colonization of a more permanent population. There are certain tribes on each side of the border, not true Shans but perhaps kindred, who have proved themselves good industrial laborers, and the operators are endeavoring to encourage these people to come and bring their families. Unfortunately, little agricultural land in the neighborhood is available—practically none in or around Namtu or Bawdwin. Colonies of any size will therefore have to go farther afield, but a beginning is being made in this direction and in time a semi-industrial population may be built up on which the operations of the company can more confidently depend. It is to be considered, however, that without question the season from April or May to October or November will always be a period of diminished output, unsatisfactory work, and extreme anxiety. It is unfortunate that the time when the staff is called upon to make the greatest exertions is exactly the period when its personnel are least able to stand the strain. For that reason it is essential that a larger staff than would be necessary under more favorable conditions be retained on operations.

---

*Abstract of an article by Charles E. Munroe in *Reports of Investigations*, U. S. Bureau of Mines.

Scraping and Loading in Mines With Small Compressed Air Hoists—II*

Methods Used in Loading Material Broken in Development Openings—Types Of Scrapers in Successful Use in the Joplin, and Lake Superior Iron and Copper Districts, and Their Application—Utilization of Auxiliary Apparatus

By Ward Royce
Written for Engineering and Mining Journal

As the art of scraping advanced, experiments with the Quincy scraper were started in various Michigan copper mines. Except for some variations in the layout, the procedure was about the same in each operation. The engines used were practically all the same pattern, usually the 6 x 8-in. double-acting hoist that had been fitted with double drums and clutches in the mine shops. The problem of handling rock on the flat foot walls having been pretty well solved, attention was directed to that of loading material broken in the development openings. At those mines where the veins were narrow, some of them as narrow as 3 ft. wide, this was difficult, there being none of the so-called underground shovels or loaders capable of operating in such narrow openings.

In the meantime operators in the Joplin district had developed a "hoe scraper" (Fig. 18) for handling the coarse material broken in the lead and zinc mines, and a scraper of this type was finally adopted for use in the headings in the copper country. It was found that the Quincy scraper was not as successful in handling the coarse material on the levels, for the sides of the scraper prevented it from sinking into the pile and made it necessary for the scraper to travel considerable distance before taking a load. The "hoe scraper" has but one edge to penetrate the broken material and is more successful in coarse material, as digging in directly causes the strain to come on the haul rope. In fine material this scraper has the disadvantage of losing its load easily. The scraper shown weighs about 700 lb., including the dead weight added.

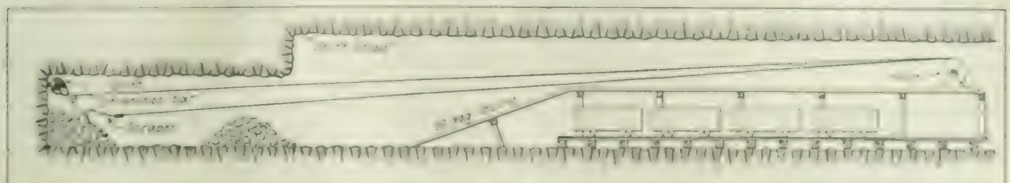


FIG. 19

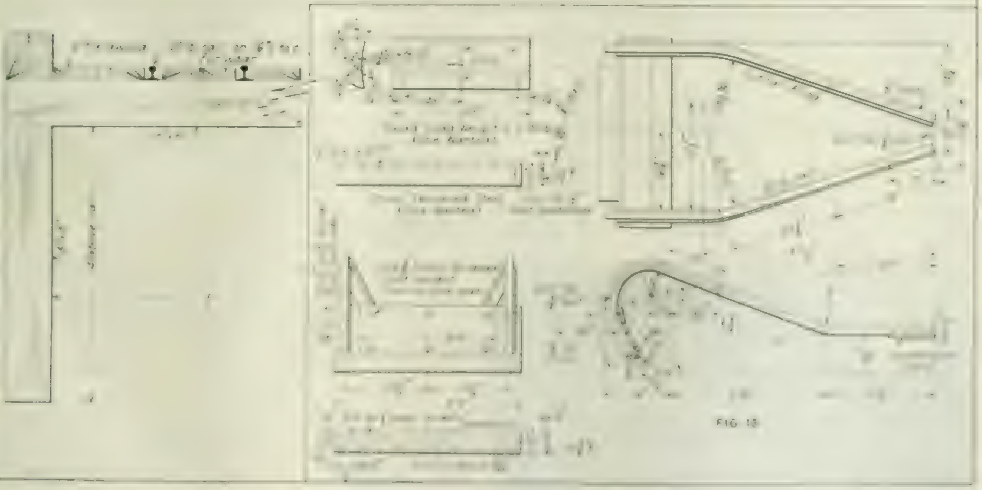


FIG. 18. JOPLIN TYPE SCRAPER. FIG. 19. METHOD OF SCRAPING IN DRIFTS, MICHIGAN COPPER DISTRICT

The method of scraping in the drifts is shown in Fig. 19. A semi-permanent platform of plank, interlaid with light rails to prevent wear, is set up in the drift. The platform is built high enough to permit the passage of the mine cars beneath it and is about 80 ft. long, including a 16-ft. incline of about 20 deg. built up at the forward end. The scraping engine is placed on the rear end of the platform just behind an opening in the floor through which the rock falls into the car set below. This arrangement has one distinct advantage over the loader, or underground shovel—that of storage capacity. If the conditions are such that several cars may be spotted under the platform, the scraper operation may be made practically continuous, and several scraper loads can be dumped on the platform while the cars are being switched. The platform is torn down and moved forward in a few hours when the length of haul has reached about 200 ft.

---

*This is the second of a series of articles [illegible]

The arrangement at the breast of the opening is about the same as in stope scraping. A single snatch block is hung from a stretcher bar jacked across the breast or hung from a cramp belt set in holes drilled in the walls.

ELIMINATION OF CHUTES IN SCRAPING

In these mines a "drift stope" is carried behind the heading, and the material from both operations is handled by the scraper. It is customary in some places to clean up the breast of the drift quickly by scraping the rock part way out and dumping it, allowing the miners to resume drilling, and then to clean up the material broken in the drift stope. Sometimes rock broken in the stopes is allowed to fall to the level and is scraped over the platform, thereby saving the labor and expense of putting in chutes.

The size of the crew employed in this work varies, and, owing to the weight of the scraper, two men are required at the breast. At one of the mines in the Michigan copper country three men handling such a rig will muck from 125 to 150 tons per day, not including the tramming.

Scrapers of the Joplin type have been used successfully in other of the mines in the Lake Superior district, and also in some of the quarry operations. (Fig. 20.)

With the exception of the "Little Tugger" and slusher, the machines described are of rather large capacity and low portability, and have been developed to meet local requirements. Conditions in the Michigan copper country mines are not common to many other districts, and solution of their ore-handling problems does not cover the entire field.

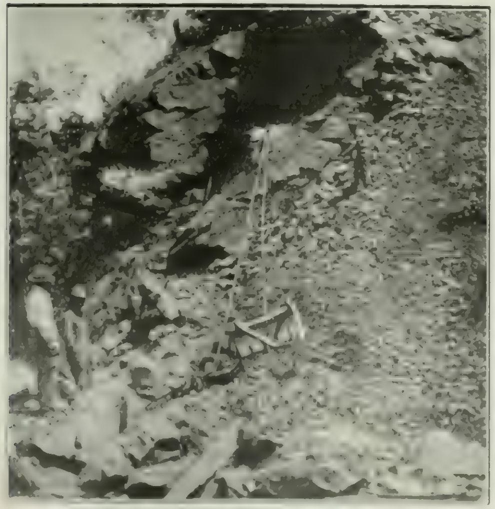


FIG. 20. JOPLIN TYPE SCRAPER IN ROCK QUARRY, IRONWOOD, MICH.

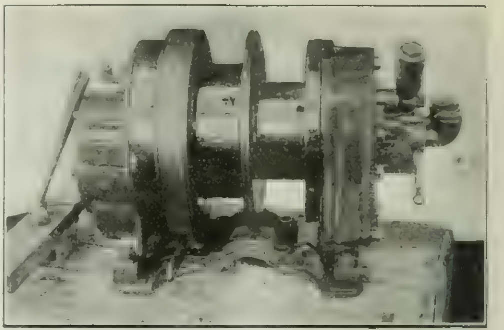


FIG. 21. 6H DOUBLE-DRUM "LITTLE TUGGER" HOIST

The success of the scrapers having been proved, it still remained necessary to devise a scraper outfit that would combine the good features already developed with the necessary requirements of portability, convenience, and capacity for use in the average underground working place, and experiments have been conducted during the last year in the Lake Superior districts with a view to developing such a machine.

LABOR SAVING WITH DOUBLE-ROPE SYSTEM

It was found that the requirements for portability limited the power of the machine to 6 or 7 hp., which is amply sufficient for satisfactory work in the iron-ore mines. The double-rope scraper system was adopted because the least labor is involved, making it possible of operation by men of ordinary physical strength. The double-drum hoist is not limited to this class of scraper work alone, it being possible by laying up one drum to use the machine with a slip scraper or as a hoist for handling timber or supplies.

The first machine brought out was the 4H double-drum "Little Tugger," a tandem-drum machine of about 4 hp., rope speed of 100 to 125 ft. per minute, weighing about 650 lb., and manufactured by the Ingersoll-Rand Co. Although this machine proved fairly successful and served to develop the method, it was finally superseded by a machine of greater power and improved design.

The 6H "Little Tugger," which superseded the 4H machine, is a lighter, more compact machine, which has proved satisfactory and is believed to meet all the requirements. (Fig. 21). Operation of the 6H "Little Tugger" and scraper differs little from that of the larger return-rope scraper units. The outfit is handled by two men, and is intended to be used as part of the equipment of the mine contract gang. The effective length of haul is about double that of the 1H "Little Tugger" in this work, say 100 ft., the most efficient work being done at distances of 75 ft. and less, depending to a great extent on conditions.

The hoist is arranged so that it can be mounted on a vertical column, column arm, or similar attachment, and by use of a cone base attachment it may also be mounted on a turntable set on a skid or a truck, any one of which mountings permits traversing the machine so that the drums may be centered on the line of rope travel.

The tail rope is led from the drum through a snatch block mounted at the pile of broken material and attached to the back of the scraper by a clevis. The haul rope is led from the drum directly to the front of the scraper. The snatch block through which the return rope passes is hung on a sliding ring carried by a stretcher bar jacked across the opening, as the most simple arrangement. Sometimes a chain is thrown around a timber sprag, which is set in hitches and blocked in place. The rigging must be solid enough to hold under the strain of pulling the empty scraper, and the snatch block be easily moved from one side of the opening to the other.

It is sometimes impossible to use a stretcher bar because of loose or open ground at the sides of the breast, and to overcome this a convenient boom arrangement, shown in Fig. 22, has been devised. This consists of a section of 3-in. pipe about 12 ft. long, fitted with a ring at one end to carry the snatch block, chains, and hooks attached to sliding rings for suspending the boom from the caps, and a number of spikes set at intervals in the rear end of the boom.

BOOM IS EASILY ADJUSTED

The boom is hung on the forward cap by the chain attachment, shoved forward until the snatch block will hang well over the pile of broken ore, and then the rear end of the boom is raised, which jams the spikes into the second cap. The strain on the snatch block at the forward end of the boom sets the spikes deeper and assures a solid anchorage. Adjustment is easily made by pulling down the rear end of the boom and swinging it across the opening. This is usually done by the operator hitching into the open end of the pipe with his pick point and pulling the spike free, making the change while the return rope is slack without stopping the scraper. This device presents some decided advantage over the other arrangements in heavy workings or running ground where it might be dangerous to have the men work close to the breast.

The "Little Tugger" is so located at a chute raise so that the scraper is hauled directly to the raise. In instances where this is not possible, the ropes may be led to the raise by two snatch blocks and the machine set up at one side. As the ore is usually soft, most of the raises are cribbed. To prevent the scraper catching on the sill timber, two bent rails, as shown in Fig. 23, are set over the sill on which the scraper may ride.

In handling ordinary material a pliable ⅝-in. wire rope is sufficiently strong and is to be preferred, but for handling heavier loads it is advisable to use ¾-in. rope on the haulage drum. Snatch blocks used in this work should have a steel pulley not less than 6 in. in diameter, the larger the better; the pulley should be deeply grooved for the rope, and the housing should close tightly on the pulley to prevent the rope riding and jamming between pulley and housing. The ordinary cast-iron block intended for use with hemp rope is practically useless here.

Scrapers described are practically the same as those used with the larger units except in size and weight. The material handled and room available govern this up to the power limits of the hoist. Further, it was found advisable under these conditions to reduce the weight of the scraper as much as possible, to avoid excessive air consumption while pulling the empty scraper; any loss in self-filling capacity, due to light weight, could be compensated for by having the man working at the breast ride the scraper for a few feet while it is taking its load.

A successful scraper of the reversible Quincy type is shown in Fig. 24. This scraper was made at one of the iron mines on the Gogebic Range. It is 12 x 24 in. or 30 x 40 in., and had a serrated edge on one side and a straight lip on the other. It has been used in medium soft ore, the broken material being fairly fine, with about 75 per cent of fines, in connection with the 4H [illegible] machine. This scraper has been succeeded by the single-blade scraper shown in Fig. 25, which is 36 x 36 x 14 in., and has about 10 cu.ft. capacity. Fig. 26 shows a similar scraper which has been successfully used for years on the Marquette Range.

For use in medium ore, "box type" scrapers such as are depicted in Fig. 27, are more readily filled in operation, and will handle plastic material more easily.

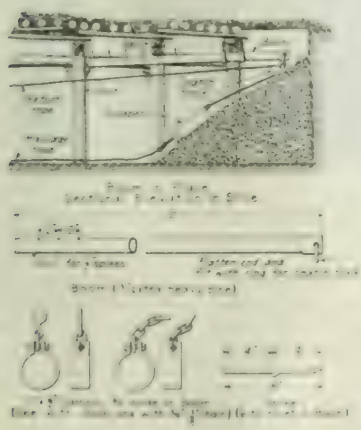


FIG 22

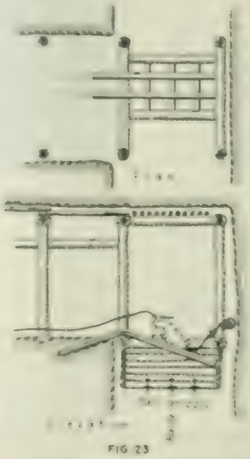


FIG 23

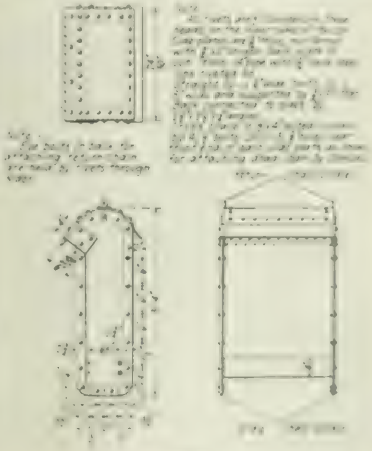


FIG 24

FIG. 22. BOOM USED AS A SUBSTITUTE FOR STRETCHER BAR. FIG. 23. METHOD OF PLACING RAILS OVER CHUTE. FIG. 24. REVERSIBLE QUINCY TYPE SCRAPER

They are not, however, provided with sides and have a greater tendency to spill and lose part of the load as it is hauled to the dump. Some good result were obtained with this scraper at one of the mines at Ishpeming, Mich.

At an iron mine on the Vermilion Range one of the double-faced "Joplin type" of hoe scrapers (Fig. 28) was used with good success in heavy, chunky material.

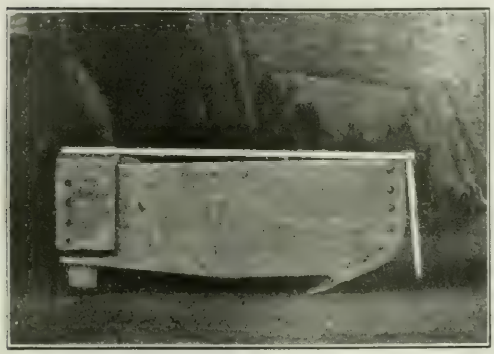
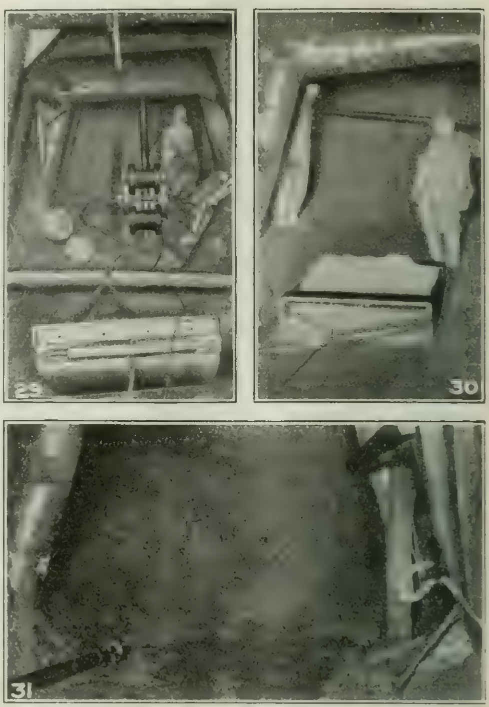


FIG. 25. NON-REVERSIBLE BOTTOMLESS OR SINGLE-SIDE SCRAPER

In operating the scraper outfit one man runs the hoist and the other man works at the breast, picking down and loosening the pile of broken ore, shifting the snatch block as required, and sometimes riding the scraper for a few feet to assist it in taking its load.

TIME SAVING BY USE OF SCRAPER

At one mine on the Gogebic Range in Michigan a contract was let to drive a drift in ore, the scraper and "Little Tugger" being furnished as part of the equipment. The latter was a 4H machine that had been tried out successfully with a Quincy type scraper. The scraper used was the one shown in Fig. 26. The drift was driven to cut a series of raises at 66-ft. intervals, making the maximum haul from 60 to 65 ft. The drift was 8 x 8 x 10 ft., fully timbered, and all of the work was handled by two men on each shift. The ore was fairly hard, and required drilling with regular hollow Jackhamer steel, the drilling time being from three to four hours. It was soon demonstrated that the use of the scraper enabled the men fully to complete the cycle of operations in an eight-hour shift, where previously it had taken nearly a full shift to do the mucking alone with shovel and car.



UNDERGROUND VIEWS OF SCRAPING WORK

Fig. 29—4H "Little Tugger" and Scraper. Scraper in dump position. Fig. 30—Scraper loaded with 1,200 lb. of ore. Note the rigging used. Fig. 31—Floor of drift after mucking with bottomless scraper.

The mucking time was reduced to an average of one and one-half hours, about thirty tons of ore being

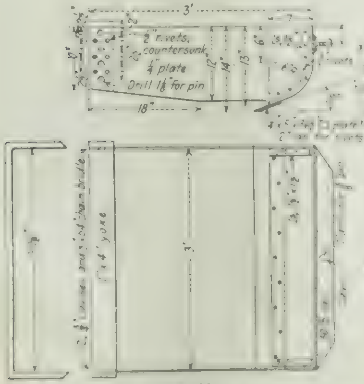


FIG. 26

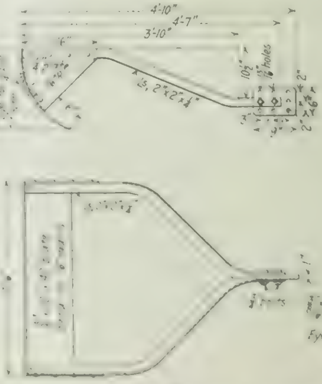


FIG. 27

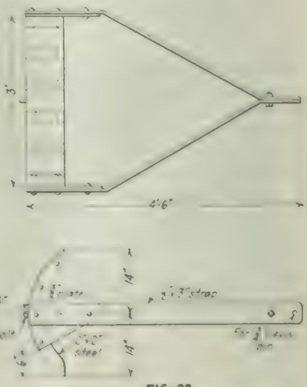


FIG. 28

FIG. 26. DRAG SCRAPER USED ON MARQUETTE IRON RANGE FIG. 27. HOE TYPE SCRAPER FOR MEDIUM ORES FIG. 28. JOPLIN TYPE OF HOE SCRAPER

broken at a blast. The men handled about 15 to 20 cu.yd. an hour, depending on the length of the haul. At one time they handled twenty-seven cars of two and one-quarter tons each, or about sixty tons in two hours and twenty minutes, hauling the loads 30 ft. to the raise. At another time they mucked approximately forty-five tons in one and one-half hours from a distance of 35 ft. At the maximum distance mucking required about two hours. Some of the conditions under which this work was done are shown in Figs. 29, 30 and 31. It was stated that the ore broken in this drift was put on the stockpile for a total cost of $1.37 a ton.

"TUGGER" SHOWS MATERIAL SAVING

At another place in this mine the "Little Tugger" was set up so as to scrape from two working places to the same raise; the two men handled as much as sixty-five tons in two and one-half hours, hauling 35 ft. and 40 ft. from the two places respectively. Two cuts were often mucked in one shift, in addition to drilling and blasting. No timbering was done on these shifts, however.

One of the superintendents of a large group of iron mines on the Marquette Range, who has done a great deal of work with the equipment here described, estimates a saving of 15c. per ton by the use of the 4H "Little Tugger" and scraper at one mine where it was installed. Here two men have regularly handled thirty tons an hour, pulling the ore from as much as 40 ft. to a raise. With the 6H "Little Tugger" and a scraper similar to that shown in Fig. 28, a raise 35 ft. deep was filled in less than two hours. The length of haul was about 50 ft., the ore was rough and chunky, and the mine foreman estimated that the raise held between sixty and eighty tons.

At another mine in the same district the men have used the scraper in hauling ore a distance of 109 ft., and the operations produced fifteen tons per man per day. The distance in this instance is too great to show very good results.

To be concluded

Rock Drilling Tests in the Tri-State Mining District*

During the last few years many improvements have been made in the design and in the use of rock drills and drilling equipment. Among these improvements the use of smaller changes in gage between the different steels has been one of the most important. With the old types of piston drill, gage changes of ¼-in. or more were often used, necessitating the use of steel of from 3 to 3½-in. diameter to start when deep holes were to be drilled. As the work of drilling varies almost directly with the quantity of material removed, the use of these large sizes of steel resulted in a great loss of time and energy.

Until the development of the Carr bit and the modern double-taper bits, gage changes less than ⅛ in. were deemed impracticable. At present many companies throughout the United States are successfully using gage changes of 1/16 in. and in some operations changes of only 1/32 in. are used. Although these small changes require great care and accuracy on the part of the drill sharpener, both in forging and gaging the steels and in proper heat treatment, the cost of the extra work in the drill shop is more than offset by the increased efficiency of the drilling machines.

Another improvement in drilling practice that has been brought about recently by several companies is the use of 1-in. steel in place of 1¼-in. in the large mounted hammer drills. In the Michigan copper mining district 1-in. hollow hexagon steel has been used for some time in place of 1¼-in. round steel. This steel is used in drills with anvil block chucks, requiring no collar or lug on the steel. The Copper Queen mine of the Phelps Dodge Corporation has lately standardized on 1-in. round lugged steel for all machines. The advantage of the smaller cross-section consists in the saving in steel, faster drilling speed, and saving in labor on the part of the miner in handling the lighter steel.

To find out whether these improvements were applicable in the Missouri-Kansas-Oklahoma districts, the Mississippi Valley Experiment Station of the Bureau of Mines, working in co-operation with the Missouri School of Mines and Metallurgy, conducted a series of experiments. The tests were made by I. F. and J. T. Hodges, senior students from the Missouri School of Mines and Metallurgy. The work was done in the Bluebird mine of the O. M. Bilharz Mining Co. near Commerce, Okla.

The possibility of using smaller steel in this district is complicated by the method of mining, which requires many deep holes to be drilled, and also by the character of the ground.

The use of deep holes necessitates large starting bits. With 1-in. steel a bit larger than 2-in. diameter is undesirable. This means that a 16-ft. hole must be collared with a bit not to exceed 2-in. diameter, which makes it more difficult to keep the machine lined up and also causes more trouble in cleaning and loading than where holes are collared with larger starters.

The results of these tests, which are still being continued, should show beyond question the possibilities of 1-in. steel in this district.

Since the completion of the experiments at the Bluebird mine, the Bilharz company has continued the tests, using 1-in. hexagon steel with 1-in. round lugged shanks, and the company is successfully drilling and loading holes up to 16 ft. in depth.

The conclusions from all tests are as follows:

1. One-eighth-inch gage changes and 24-in. changes in steel lengths are best for conditions in the Tri-State district when using 1¼-in. steel.
2. One-inch steel can be used successfully with the large hammer drills for drilling holes up to ten feet in depth, at a considerable saving in time and energy on the part of the miner. Gage changes of 1/16-in. and changes in steel lengths of 24 in. can be used with the 1-in. steel.

---

[*] Abstract of an article by C. R. Forbes, in Reports of Investigations, U. S. Bureau of Mines.

Sulphur Crisis in Sicily

An important meeting was recently held at Rome to discuss means of assisting the sulphur industry, which is at present undergoing a period of depression, according to Consul Louis G. Dreyfus, Jr., in *Commerce Reports*. Representatives of the mine owners, mine operators, laborers, and others were in conference with representatives of the Italian government.

There are 200,000 tons of sulphur unsold in Sicily. It has not been possible to find a market for it in competition with American sulphur, which is delivered in Europe at about 520 lire per ton.

Notes on Lead-Bullion Refining

Résumé of Practice at Different Plants—Processes Follow Same General Flow Sheet, Although Differ as to Details—Skill With Which Work Is Conducted on Kettles Important Influence on Costs

By George G. Griswold

Written for *Engineering and Mining Journal*

LEAD BULLION is commonly refined by one of three methods: the Pattinson, the Betts, or the Parkes process. The first, together with its modifications, the Luce and Rozan, and the Tredinneck process, is nearly obsolete. The second is practicable only when the bismuth content is sufficient to justify the high costs of this method. This, of course, depends upon the price of bismuth. At present prices it is probable that a bismuth content of one-half of 1 per cent would be necessary to show a profit compared with refining by the Parkes process, which latter is almost universally used and is the cheapest in operation of the three. A recent professional trip to a number of refineries gave me an opportunity to observe the practice at different plants, and some of my notes may prove interesting to the profession.

In all the plants the layout, although differing in details, is practically the same, with the softeners, kettles, and refiners on different levels, the flow of lead being from the softeners to the refiners; that of the byproducts at right angles to the line of lead flow.

Receiving Bullion

In plants where bullion receipts are irregular, storage space convenient to the softeners should be provided. Even where the receipts are regular and it is customary to charge the bullion direct to furnaces or kettles, convenient storage space is desirable.

Sampling and Charging

If bullion is to be sampled by the receiving plant, premelting in kettles is necessary, and these should be so situated as to permit pumping the bullion direct to the softeners. This method is in use and is advocated by some metallurgists where the sampling is not done by the receiving plant on the ground that the higher cost of melting in kettles is more than offset by a more thorough decopperizing and by a saving in time on the softeners.

If the refinery is treating bullion from blast furnaces in the same plant, it is cheaper to transfer the liquid bullion to kettles, the kettle expense in such case being small.

When bullion is charged direct to softeners, mechanical charging devices which extend into the bullion cars are the cheapest from a strictly charging standpoint. This advantage, however, is sometimes sacrificed, because too much time is lost on the furnaces. As a matter of fact, charging is one of the small items of lead-refining costs, and the method of charging can be intelligently decided upon only by a close study of local conditions, having in view the entire operation.

Softening

There are two ways of conducting this operation. In one, the reverberatory furnace has a deep bath; in the other a shallow one. In the first process, however, higher temperatures are necessary, to heat the entire bath of metal, and a longer time is required to soften the charge. Consequently, furnace repairs are expensive. However, when bullion is charged direct to the furnaces such softeners are necessary in order to have a protective bath, as otherwise the bottoms would not last. In the second process noted, the item of repairs is small, even with impure bullion, because of the lower temperature and the faster softening. In the first method the sides and bridge wall must be water jacketed; in the second only the bridge wall; but premelting is necessary. In either process the construction should be such as to allow ample combustion space within the furnace. This point is frequently overlooked, and I saw some very large furnaces (300 tons' capacity) which had the skewbacks for the arch eight inches above the metal line throughout the entire length of the furnace, with a ten-inch spring for the arch. The combustion space was far too small, and on my recommendation the dimensions were changed to give combustion space sufficient to burn the fuel necessary to raise the temperature of the bath from 600 deg. F. to 1,500 deg. F. in four hours. A good example of a well-designed furnace is the Selby furnace shown in Hofman's "Metallurgy of Lead."

Where bullion has not been drossed before being charged to the softeners, it is customary, as soon as the charge is melted, to remove the first or copper skim dry. Subsequent skims are removed either liquid or unmelted, according to the practice at the particular plant. In the former practice much bullion is withdrawn, which is objectionable.

Litharge is often used on the softeners to speed the operation, particularly with furnaces having a deep bath. There is some objection to this because the reaction adds copper to the bullion, as litharge is usually cupriferous. On the other hand, it furnishes a quick and easy way to recover the lead and silver, and in plants where blast-furnace campaigns are not continuous it may be advisable. However, with thoroughly decopperized bullion, shallow-bath softeners, and with blast furnaces in continuous operation, it is cheaper to smelt the litharge in the blast furnace.

Bullion should be softened until crystals of yellow litharge appear, as all impurities are objectionable in the subsequent operations.

Desilverizing

If the softened bullion has not been decopperized, or if litharge has been used in softening, it is necessary to cool the bullion in the kettles to liquate out the copper before zincking.

The skill with which work is conducted on the kettles has much to do with lead-refining costs. It is the only place where one may hope to cut down byproducts. The quantity of antimony skim is absolutely fixed according to the arsenic and antimony content of the bullion. The amount of refiner skim is a constant.

By proper work on the kettles, however, one should be able to make on 100-oz. bullion about 54 lb. of zinc dross per ton of bullion. On higher grades, the concentration would not be so great. On 200-oz. bullion, one would expect to make 82 lb. of zinc dross per ton of bullion.

Obviously if one makes, on 160-oz. bullion, 160 lb. of zinc dross per ton of bullion, which was the practice at one plant, the cost per ton of bullion will be high. In this operation, by installing my system of desilverization, the grade of the dross was raised, and a substantial saving resulted.

To insure good work it is necessary to have good presses, and they should be kept in good condition. A pressure of 150 lb. should be sufficient.

The temperature of the kettle contents should not be over 825 deg. F. when the first zinc is added, owing to the tendency of this metal to oxidize, which causes an undue production of blue powder and other troubles in retorting. A temperature of 875 deg. F. is proper for pressing.

After pressing off the dross formed when the first zinc is added, the second zinc is stirred in, and the resultant dross is removed and molded for use on the next charge. The kettle is then cooled down, and the dross molded from time to time. This operation is finished when a thick rim of frozen metal adheres to the kettle at the metal line. This rim of frozen metal is usually removed and added to the next charge. The desilverized bullion is then heated up and pumped to the refiner.

REFINING

This operation is akin to softening. With shallow-bath furnaces, water jackets are not necessary, and oxidation can be effected without the use of air or steam. In such practice the repairs on the refiner are practically nil. In most operations, however, water-jacketed furnaces with deep bath are used, and either high-pressure air or steam is blown into the bath to hasten oxidation. The operation is finished when all the zinc and other impurities are removed. This is clearly indicated when the sample shows the characteristic color and crystallization of pure lead.

MOLDING

In plants treating large tonnages, holding furnaces are usually provided, and the lead is mechanically molded either on the straight-line machine or on the Miller casting wheel. The latter makes a better bar and is cheaper to operate. The Thiele stacker and loader may be used with either. Where the tonnage handled is small, hand molding is cheaper.

RETORTING

Oil-fired Faber du Faur furnaces are almost universally used for this operation, which requires skill and close attention to insure a good zinc recovery. With proper dross and good retorts a cycle usually takes six hours. When a retort is charged, the new charge rapidly absorbs heat, and the attendant must constantly watch his fire, increasing it from time to time until the charge is distilling properly, after which the fire needs little attention until near the end.

Good retorts have much to do with good recovery and should be selected with a view to satisfactory conductivity and length of life. Proper seasoning of retorts is important.

Whether the retort bullion is charged into the cupels liquid or cold does not make much difference in the costs. Proper cupelling requires close attention to temperatures. If the latter be too low, the work lags; if too high, the work is slow also, as the litharge then probably breaks up into lead and oxygen as soon as formed.

REVERBERATORY BYPRODUCT FURNACE

The method of treating the skims from the softeners varies somewhat in different plants. In one plant the coppery and antimonial skims were treated together with galena and coal to produce a silver-free slag and a matte assaying 10 to 15 per cent copper. A very clean slag was made, and little of it required re-treating. The matte was worked up with other coppery material into a matte of 40 to 45 per cent copper content. Little slag was made, and what there was was re-treated with the antimonial skims.

Another method is to treat the antimonial skims with coal for a clean slag, and run the coppery skims with galena and coal to produce a matte assaying 40 per cent copper. The slag from the latter operation must be re-treated with the antimonial skims.

These two methods give silver which is free from antimonial slag.

Another process is to treat the antimonial and coppery skims together with galena and coal to produce a slag and a 40 per cent copper matte. It is impossible to produce a silver-free slag by this method.

The antimonial slag is smelted in the blast furnace to produce antimonial lead. Here also is smelted the refiner skim, or as much of it as is possible, according to the antimony content of the slag and the percentage of antimony desired in the antimonial lead.

Blue powder, which is produced in retorting, is generally shipped to a zinc smelter, where it is treated to recover the zinc. The lead and precious-metal residues are then either returned to the shipper or are sent to a smelter.

Explosives Investigations of the Bureau of Mines

An investigation is being conducted by the U. S. Bureau of Mines at its explosives chemical laboratory in Pittsburgh, Pa., with the purpose of determining definitely the solubility of organic materials used in explosives, in solvents that might be used in analyses and purification. Thus far the solubility curve of trinitrotoluene has been determined in benzine, acetone, toluene, ether, carbon bisulphide, carbon tetrachloride, and water. After the study of T.N.T. is completed the solubility of picric acid, tetryl, T.N.A., and similar compounds will be determined. At the laboratory co-operative work is being carried on with one of the large explosives manufacturing companies on the effects of the crystallizing temperature of ammonium nitrate on the safety and strength of permissible explosives.

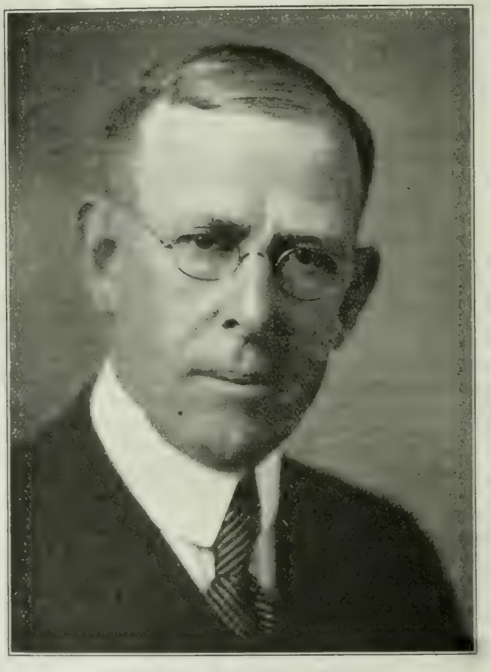
An investigation of the products of combustion of T.N.T. (Grade 1) under different conditions of loading and pressure is under way. The testing of cartridged loads at low density of loading has been completed and the testing of confined loads at low density of loading is being continued.

In the fiscal year recently ended [illegible] explosives were added to the active permissible list and [illegible] were transferred to the inactive list. The active list of permissibles contained the names of [illegible] explosives, as compared with a total of 179 explosives at the beginning of the fiscal year.

Mining Engineers of Note

Frederick Worthen Bradley

FREDERICK WORTHEN BRADLEY was born in Nevada County, Cal., and from this historic region derived the inspiration which no doubt led him into the mining industry. His father was the county surveyor, and young Bradley was his assistant. Later the assistant became a United States deputy surveyor. The methodical way in which Mr. Bradley attacks his problems is very likely due to this early association with surveying. For three years, 1882-83-84, he attended the College of Mining, University of California, where he worked his way along. He was not graduated, chiefly because necessity compelled him to seek more remunerative employment. After leaving college, he worked as assayer and general roustabout at the Eagle Bird Mine, in Nevada County, Cal. His ability soon led him to undertake larger responsibility, and in 1885 he became superintendent of the Spanish Mine, also in Nevada County. To most men, a small mine would appear not to offer very much, but to Mr. Bradley it presented a real opportunity. He succeeded in mining and milling the ore from this mine at a total cost of 60½c. per ton, the ore yielding $1.15 per ton. Here the value of publicity in helping a good man along is well illustrated. The record made at the Spanish Mine was published in an article in the *Mining and Scientific Press* and attracted wide attention, chiefly because it set men thinking. Mr. Bradley was careful to point out the favorable conditions which made this remarkable result possible in the case of the Spanish Mine. Nevertheless, his name became known and he was offered a position at the Bunker Hill & Sullivan Mine, in Idaho, in 1890, which he accepted and soon thereafter he became assistant manager of the Bunker Hill & Sullivan Mining & Concentrating Co. In 1893 he became manager, remaining in this position until 1897, when he became president of the company, which position he still holds. Thus in the comparatively short period of six years he went from an obscure property up to the management of what has since become one of the most important mining enterprises in the western states. The history of the Bunker Hill enterprise, so much a part of the achievement of Mr. Bradley, has been well told by T. A. Rickard, and need not be repeated here. Success breeds success, and it was so in the subsequent career of Mr. Bradley. From 1898 to 1905 he was president of the Tacoma Smelting Co.; 1900 to date, president of the Alaska Juneau Gold Mining Co.; 1900-1908, president of the Oneida Gold Mining Co.; 1900-1912, president Mariposa Mining & Commercial Co.; 1900-1911, consulting engineer, Alaska Treadwell group; and from 1911, president of these companies. He became president of other mining companies and director in various companies and banks. The successful operation of the Alaska Treadwell group of mines stimulated low-grade gold mining in many places and influenced large-scale mining operations to a considerable extent. Mr. Bradley did not confine his operations entirely to gold mining, but branched out into other lines. Tungsten, quicksilver, petroleum, copper, zinc, lead, and silver engaged his attention, and his success indicates his thorough grasp upon the business and technical branches of the mining industry. The low-grade ore mining and milling problem of the Alaska Juneau is the latest to engage Mr. Bradley's attention.


FREDERICK WORTHEN BRADLEY

Mr. Bradley has a warm place in his heart for the young man who works his way through college. As an expression of his desire to do his part, he has established a fund of $10,000, to be built up by his annual advancement of $1,000, in the hands of the Dean of the College of Mines of the University of California. From this fund, money is to be loaned to needy students in that college, and such loans, with interest, are to be returned by the student when he has established himself.

Mr. Bradley married Miss Mary Parks, daughter of James F. Parks, who was superintendent of the Kennedy Mine, at Jackson, Cal. Mr. and Mrs. Bradley have four sons, the oldest being eighteen years old.

Character has first of all placed Fred Bradley where he is in the topmost ranks of the mining profession. Executive ability and determination, accompanied by wisdom, have kept him there.

CONSULTATION

The Occurrence, Uses and Prices of Palladium, Iridium, and Osmium

"Will you kindly inform me through the columns of your valuable journal where osmium, palladium, and iridium are found, and for what purpose these metals are used; also what their prices are?"

Palladium, iridium, and osmium are all members of the platinum group of metals, and are exceedingly rare in occurrence. They are all of a silvery white metallic appearance and resemble platinum. Palladium may be found native or as an arsenide, and is usually associated with other rare and precious metals. The copper-nickel ores of Sudbury, Ontario, are an important source of palladium, but it is widely distributed in small amounts throughout the world. South America, Russia, Alaska, Canada, Australia, and the United States have produced it. In the United States palladium is obtained from the refining of copper. An interesting occurrence of palladium is described in *Engineering and Mining Journal* of July 3, 1920, in an article by J. B. Metrie, Jr., "The Salt Chuck Palladium Copper Mine," which is a palladium-bearing bornite ore carrying on an average of 0.253 oz. of platinum metals per ton.

IRIDIUM DERIVED FROM PLACERS

Iridium may occur native or as a constituent of osmiridium—also called iridosmine. When found native it is usually alloyed with platinum, palladium, rhodium and a little osmium. The largest production of iridium is derived from placer deposits in the Urals. It is also found in the United States, Burma, Brazil, and Tasmania.

Osmium is a hard brittle metal of a slightly bluer tint than the other platinum metals. It has not been found in the native state, but can be recovered from osmiridium, a mineral which may contain from 20 to 50 per cent osmium. Osmiridium is found in the Urals, Colombia, New South Wales, Victoria, California, Borneo, Quebec, the United States, Japan and Tasmania.

Osmiridium has also been found in India, in Rhodesia, and other parts of South Africa. The crude platinum of British Columbia from the Tulameen River is noted for its hardness, which is given the metal by the presence of iridium. The crude mineral runs 72 per cent platinum, 10.5 per cent osmium, 2.57 per cent rhodium, and 1.14 per cent iridium. Other metals, particularly iron (8.6 per cent), and copper (3.4 per cent), are present. Ontario is especially rich in the platinum metals, which are recovered from the nickel silver and other ores of the Sudbury district.

OSMIRIDIUM A USEFUL MINERAL

Osmiridium is mined more for its iridium content than for osmium. The Tasmanian metal, according to Campbell Brown, contains from 33 to [illegible] per cent iridium. If the iridium predominates, the mineral is called nevyanskite, and sysertskite if the osmium content is higher. Russian mineral shows as high as 77 per cent iridium.

For a detailed account of the location of the most important deposits of the platinum metals, the reader is referred to a booklet, "The Platinum Metals," by A. D. Lumb, published by John Murray, London.

Palladium, iridium, and osmium have limited uses. Palladium is a common substitute for platinum, and it may be used in palladium-gold alloys for use in dental ware, jewelry, and chemical ware. It is also used in the manufacture of scientific instruments.

IRIDIUM HARDENS PRECIOUS METAL ALLOYS

Iridium is chiefly used in hardening gold fountain-pen points. As the metal for this purpose is used in small grains, manufacturers pay a higher price for osmiridium that has been graded than for the ungraded material. Platinum cannot be used to take the place of iridium, as it is too soft. The osmirium or pure iridium used is handled by skilled workers who attach individual grains to the gold pen points and fuse them on. Iridium may be used for hardening platinum alloys, for standard weights, and for contact points. Iridium oxide is of value as a pigment in coloring chinaware. Gold needles with soldered iridium tips are employed in surgical work. Jewelers' platinum contains about 10 per cent iridium.

Osmium is a metal for which little use has been found. It was at one time employed in the manufacture of incandescent lamps, but other metals that are cheaper and better have superseded it. Osmic acid is used in staining anatomical preparations in microscopic laboratory work. The vapor of osmium when highly heated is poisonous, and its extraction is therefore both costly and dangerous.

The following table gives a comparative list of the amounts of palladium, iridium, osmium, and osmiridium imported into the United States in 1919 and 1920, the figures being given in troy ounces:

	1919	1920
Palladium	[illegible]	[illegible]
Iridium	[illegible]	[illegible]
Osmium	[illegible]	[illegible]
Osmiridium	[illegible]	[illegible]

It is to be noted from the table that palladium and irridium are in greatest demand. The prices of the common platinum group metals fluctuated greatly during the war, and at present are considerably above the pre-war level. However, as only limited quantities of platinum and its allied metals are produced, and as there is a growing demand for them, wide variations in price are inevitable. The following table, taken from the U. S. Geological Survey and *Engineering and Mining Journal* records, shows the average quotations for the last seven years, the prices being in dollars per ounce:

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Iridium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Palladium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

At present palladium is being quoted at from $55 to $60 per oz., iridium at from [illegible] to [illegible], and osmium at from $50 to $70.

HANDY KNOWLEDGE

Systematic Laboratory Instruction in Ore Dressing

By George J. Young
Western Editor, *Engineering and Mining Journal*

Systematic laboratory instruction for those just beginning as students in ore dressing should concern itself with important principles, which should be developed quantitatively as far as practicable. The separate experiments should be performed individually and not by groups of students except where the apparatus is too complicated to be successfully handled by a single student. Each student should make a complete report of each experiment, all of which reports should be bound in some kind of loose-leaf binder. No attempt is here made to more than incidentally describe laboratory apparatus. The order of presentation is as far as possible in logical sequence, and no claim is made for originality.

1.—*Examination of Ores*

Typical lump ore specimens of different kinds of ore are examined and the gangue and ore minerals noted. The size of the mineral aggregates is measured and the associations of the different minerals are described. A hand lens is used and the hand instrument shown in Fig. 1, the latter to secure a quantitative measure of exposed surfaces of imbedded minerals. The proportion of gangue and mineral should be approximately determined. Fragments of clean mineral in some examples should accompany the lump specimens, and specific gravity determinations should be made upon these by means of a Jolly balance. Thin sections and opaque sections of some of the typical ores should be provided, and these should be studied under the petrographic microscope and the opaque microscope. Both microscopes should be provided with eye-piece micrometers of the ruled-grating type, and the student should be required to report the sizes of the associated mineral grains. A sufficient suite of specimens should be provided, so that students can use whatever spare time is available for this work until they are well acquainted with a number of typical ores of the kind that are common to ore-dressing operations.

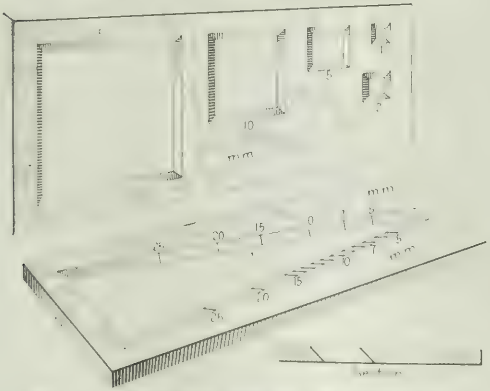


FIG. 1 INSTRUMENT USED TO MEASURE QUANTITATIVELY EXPOSED SURFACE OF IMBEDDED MINERALS

2.—*Examination of Screen-Sized Ores*

A number of typical samples of crushed ores, middlings, and concentrates should be screen-sized with standard screens, the percentage screen sizes given, and the separate sizes examined by means of the microscope and hand lens. Mineral and gangue proportions should be approximately estimated and the cleanness of the individual grains noted in each sample of a suite. Several pulp samples should be available for hand panning. Sands, concentrates, and slimes should be separated, dried, and weighed, and each respectively examined with the microscope.

3.—*Screen Sizing*

Measurements should be taken of the screen opening and wire sizes of a set of standard screens. A standard pulp should be available and a screen separation made up on this with the determination of all the weights of the respective sizes. Microscopic examination upon the different sizes can be made if time permits.

4.—*Sampling*

Several lots of crushed ore should be available, and each lot should be worked down by coning and quartering and by means of a Jones sampler. The time and quantities should be recorded and the necessary assays and analyses made.

5.—*Crushing Experiments*

Useful experiments can be made with laboratory crushers, rolls and ball mills by feeding a given size with fixed adjustments and determining the screen analysis of the product. A constant feed rate is necessary. A microscopic examination of the screen products will give information upon the degree of liberation of the mineral products.

6.—*Log-Washing Experiments*

Mixtures of iron ores and clay and sand can be made and runs made upon a laboratory log washer. The effectiveness of the washing can be determined by a careful examination of the product.

7.—*Hand Picking and Cobbing*

Standardized lots of lump ore can be used for waste picking and ore picking. By time studies and sampling the effectiveness of hand sorting can be determined.

8.—*Classification by Water*

A simple form of a glass or metal hydraulic classifier should be used and the flow conditions adjusted and measured. A run should be made with a weighed pulp, and the products obtained should be dried, weighed, screen-analyzed, and examined with the microscope. A parallel run should be made under hindered-settling conditions. Parallel experiments should also be made with the standard pulp by allowing weighed portions to fall through glass tubes of a given length. The sorted column resulting should be described in detail. By using J. M. Hyde's method of transferring the sorted column from the tube to a flat plate a satisfactory study of the resulting separation is possible.

9.—*Amalgamation Test*

In this test an amalgamated pan or bottle agitation may be used. A pulp should be prepared in three portions, one through 20-mesh, one through 50-mesh and one through 100-mesh. Three bottle tests should be run under identical conditions, with the use of a different size in each test. Sand, slime, concentrate, and mercury should be separated on each test, and the products should be dried, weighed, and separately assayed. The bottle test is the most convenient.

10.—*Use of Wet Concentration Appliances*

Preferably small-sized machinery should be used for these experiments. The table, jig, vanner, and buddle should be available, and a mechanical feeder that can be readily calibrated or adjusted to a constant rate of feeding. A weighed portion of crushed ore, 25 lb. or more, should be taken and a run made. All of the products should be caught, dried, and weighed, and each should be examined. It is often desirable to sample, analyze, and assay the products. The water flows should also be determined in each test and the rate of ore feed as well.

11.—*Flotation*

A mechanical agitation and a pneumatic laboratory machine should be available. Many experiments can be devised, but probably the best would be a run upon a given pulp crushed to three sizes, one portion 20-mesh, one 60-mesh, and one 150-mesh. The separate products should be dried, weighed, sampled, and analyzed, and the extraction computed for each size. In this experiment all the conditions should be standardized. Experiments with different flotation agents, varying temperature, and acid, neutral, or alkaline pulps may likewise be made.

12.—*Magnetizing Roasting*

Simple muffle experiments may be made upon pyrite. Temperature and time can be varied, and the resulting products tested upon a magnetic separator. By subjecting the roasted products to a fixed intensity of the magnetic field, a measure of the degree of magnetization of the roasted material can be determined.

13.—*Magnetic Separator*

Preferably a small machine of a commercial type in which the field intensities can be varied should be used. The products obtained from the roasting experiments can be made the subject of the tests or else standardized pulps of various screen sizes and content. Variation in the field intensity and rates of feed can be made. The products obtained on each test run should be weighed and examined carefully. In some tests sampling and analyzing are necessary.

14.—*Electrostatic Separator*

A small commercial machine is essential. Runs upon standardized pulps with weighing of all products can be made. Each product should be examined with the microscope, and in some instances sampling and analyses are necessary.

15.—*Pneumatic Separation*

A small Plumb air jig is useful. Weighed portions fed at a given rate and the weighing and examination by the microscope of all products are essential. Sampling and analysis are necessary in some instances. Crude experiments with a small electric fan and gold pans can be used upon mixtures of sand and lead shot. These experiments will sufficiently illustrate the principles that are involved.

16.—*Thickening of Pulps*

A six-foot Callow cone arranged to discharge the underflow and overflow to the intake of a small centrifugal pump, the discharge of which is returned to the feed of the Callow, makes an excellent arrangement. By building up to a given content of slime, the flow can be made constant. By considering the flow into the cone, also the discharges of clear water and thickened slime, the degree of thickening can be determined. By varying the thickened discharge a given proportion of slimes and clear water can be made in the feed, and thus a considerable range studied.

Individual experiments can be made with different slime mixtures in settling jars. The experiments of Clevenger can also be duplicated.

17.—*Filtration of Slimes*

Small test filters are preferable and varying conditions of slime thickness and vacuum can be studied. Samples of the pulp and the filter cake should be taken and the water-slime ratios and the percentage of water in the cake determined. A flow experiment can be arranged with the small Oliver continuous filter by recombining the slime cake and the clear water discharge and pumping the mixture back to the machine. Pulp and cake samples can be taken and quantitatively tested.

18.—*Launder Experiments*

A 10-ft. section of launder arranged so as to be adjustable to various grades should be available, together with a pump for circulating pulps. By using various kinds of pulps, the flow can be determined and the effect of grades ascertained.

19.—*Capacity and Power Required by Machines*

Rock breakers, rolls, dry screens, and other units can be used. Preferably each should be motor driven, and a recording wattmeter should be available for determining the power input. The feed to the various machines should be progressively stepped up to the point where the machines are manifestly overloaded. Samples should be taken of the product at each loading, and screen analyses made upon the samples. The rate of feed should be computed in terms of pounds per hour

---

Killing Flotation Froth

BY F. A. SUNDT

Written for Engineering and Mining Journal

A device for "killing" flotation froth that I have not yet seen described has been developed and used with some success at the mill of the Cia. Corocoro de Bolivia. It consists of a fan 4 ft. in diameter with blades 6 in. wide, which is run at 250 r.p.m. The suction produced at the entry at the center of the fan is sufficient to kill the froth, which goes out as liquid at the periphery, entirely without foam. Very tenacious froths are produced at the plant mentioned, because of the tars used, and it was impossible for the operators to use the Dorr thickener before the fan was installed. The power consumed is very little and the fan has a capacity of over fifty tons of froth in twenty-four hours. The fan blades last from four to six months. The box of the fan was made of wood in the plant shop. To increase the fan capacity only the froth was sent to it, the liquid being diverted into a launder and not sent through the fan. The machine is only 3 ft. high.

THE PETROLEUM INDUSTRY

The Diamond Drill in Oil Exploration

SPECIAL CORRESPONDENCE

Active exploration campaigns to locate new fields are now being undertaken by most of the Mexican oil companies, because of the encroachment of salt water on the present producing oil districts and the probable early exhaustion of several of the pools. Some of this exploration will be in districts relatively close to the present fields, either on the west or south, where surface indications such as seepages and favorable geological structures have shown promising possibilities for oil production.

In such investigations the question of transportation is a serious one, as many of the regions are entirely without roads, and water transportation or trails cut through unbroken jungles of tropical growth must be depended upon. The size and weight of the drilling outfit become of primary importance under these conditions, and several companies are considering the use of diamond drills for the preliminary or scout drilling, on account of the easier handling of these outfits as compared with large churn-drill or cable-tool outfits.

Another advantage secured through the use of the diamond drill is the recovery of cores of the material drilled through, making possible accurate identification and correlation of the various formations. This is especially important and desirable in wildcat drilling.

Two diamond drills are now in operation close to the Tampico district, and the International Petroleum Corporation has just purchased from E. J. Longyear Co. a heavy-duty No. 4 diamond drill for prospecting work in the State of Tabasco. This outfit has a capacity of 5,000 ft. and is especially designed for deep work, though much of the drilling for which it will be used probably will not exceed 2,000 ft. in depth. The drill is equipped with double hydraulic cylinders, which give great lifting and driving power, and has a 30-in. feed, instead of the usual 12-in. feed. The outfit can be used to rotate fish-tail bits, or other bits of similar type, and it is planned to use this method in drilling through the upper formations and soft shales, putting in the diamond bit only when hard formations are encountered or when core is desired.

Several other oil companies have under consideration the use of smaller diamond-drilling outfits to work out structures or secure further geological data where outcrops are absent. For work of this character, a portable gasoline-driven outfit is most commonly used.

Louisiana Wildcat Well Makes Big Initial Production

SPECIAL CORRESPONDENCE

A wildcat well of great interest was brought in recently by the R. O. Roy Co. in Bossier Parish, La. The well made an estimated initial production of 5,000 bbl. daily from a depth of 398 ft. Later it was choked down and was making 1,500 bbl. of 20.5 deg. Bé. oil, of good lubricating stock. The well is in the northeast corner of NW¼ of Sec. 15-19-11, and is about twenty-four miles northeast of Shreveport.

Exploitation of Oil Fields in Argentina

The annual report of the Argentine Minister of Agriculture covering the exploitation of the official fields during the year 1920 submitted to the Department of Commerce by Edward F. Feely, commercial attaché at Buenos Aires, shows that the production of the Comodoro Rivadavia fields for that period amounted to 1,540,492 bbl., an increase of 20.44 per cent as compared with the year 1919, notwithstanding the fact that a strike during the early months of 1920 considerably hampered production.

The average monthly production during the first four months of 1920 was 86,278 bbl., for the second four months 138,788 bbl., and for the third four months 160,044, from which it will be seen that had it not been for the strike above referred to the average monthly production would have been about 146,880, and the total production for the year 1,768,000 bbl. In the later months of the year it was necessary to reduce production, and in some instances to cap some of the wells temporarily.

The quality of the petroleum produced has shown a slight improvement, but in the older wells the percentage of water was somewhat above normal, and rebates were made to purchasers for that reason. The dehydrating plant at Comodoro Rivadavia is not large enough to care for the present output, and sixteen additional installations of this kind are to be made.

One of the subjects now under investigation is the installation of a refinery at Comodoro Rivadavia fields and another at Buenos Aires.

Reference is made in the report to the necessity of new legislation to govern the exploitation of petroleum in the Argentine.

The Argentine government is constantly increasing its activities in the national petroleum fields, according to George S. Brady, trade commissioner at Buenos Aires. The transport service has been increased, new storage tanks are being erected at all of the principal ports of the country, and the work of drilling new wells is being pushed at both Comodora Rivadavia and in Neuquen.

According to official figures, the Argentine government's oil fields at Comodoro Rivadavia produced 1,462,000 bbl. during the first nine months of 1921. This is only 3,000 bbl. less than the production of the whole year 1920.

Arkansas Prospectors Making Encouraging Progress

SPECIAL CORRESPONDENCE

The Walbert Oil Co. is putting down a test well on the Grigsby farm, five miles southeast of Batesville, Ark., and has reached a depth of 1,355 ft. The drill is in a favorable sand and there is a showing of gas. E. E. Bonowitz, superintendent of operations, states that there is 1,300 ft. of water in the hole and will cease operations until casing arrives.

Cave City No. 1, which is being drilled on the Cave City Leasing Co.'s block, was spudded in recently after several months' delay. Martin and Shouse, of Wagoner, Okla., have the contract to put down the hole.

The "Poverty Well" near Stephens, Ark., being drilled by the Columbia Oil & Gas Co., is making light production by bailing. It is estimated that 1,000 bbl. are in the temporary pond near the rig into which the production is being turned.

Technical Papers

Copper Leaching — A new hydrometallurgical method for copper extraction is described in *Chemical Engineering and Mining Review* for October, 1921. (Melbourne; price, 11d.). The process is being demonstrated on a laboratory scale by the Australian Minerals Recovery Co. Ltd., of Perth, which has taken over the rights of the inventors, Messrs. P. W. Nevill and H. Soanes. Briefly, the method comprises heating the pulped ore to 70 deg. C. in pachucas with a reducing agent (metallic iron) and a little free acid or a salt, and the separation from the gangue of the cement copper so obtained by elutriation or flotation. The process is a regenerative one, requiring only an addition of metallic iron with each cycle. In working the process with ferrous sulphate and iron, it was found that when the iron solution became too strong there was a tendency for the iron to be thrown down as ferrous oxide, impeding recovery of the copper precipitate. This may be averted by the addition of a little free acid or soluble chloride, such as sodium chloride.

Spanish Orebodies—The *Bulletin* of Institution of Mining and Metallurgy for November, 1921, contains a forty-four page paper entitled "The Igneous Rocks of the Province of Huelva and the Genesis of the Pyritic Orebodies," by H. F. Collins. (Cleveland House, 225, City Road, London, E. C. 1; price, 2s.) The igneous rocks of the province comprise contemporaneous lava flows, tuffs, and ash beds, as well as the granites, diorites, diabases, and porphyries described by previous writers. All the rocks contain notable quantities of copper, zinc, and pyrites as accessory constituents.

Ball and Roller Bearings—Technologic Paper 201 of the U. S. Bureau of Standards, thirty-four pages, is entitled "Friction and Carrying Capacity of Ball and Roller Bearings." It may be obtained free on request to the Bureau at Washington, D. C. The experiments were undertaken to determine the maximum safe load and the static friction under load, of ball and flexible roller bearings. Tests were made on balls of 1, 1.25, and 1.5 in. diameter, in grooved races, and on rollers 1.25 in. in diameter and 5.25 in. long, in flat and cylindrical races.

Powdered Coal—A brief survey of the use of powdered coal as a fuel is contained in a four-page article in the *O. B. Bulletin* for September-October. (Free from the Ohio Brass Co., Mansfield, Ohio.)

Ophir District, Utah — *Economic Geology* for November (Lancaster, Pa.; price [illegible]) contains a twenty-three page article on the economic geology of the Ophir mining district in Utah. The information supplements that published in *Engineering and Mining Journal* last year.

Oil Shale — Columbia University School of Mines, Engineering, and Chemistry has issued Bulletin 6, which contains a reprint of the paper "Thermal Decomposition of Oil Shales," by Ralph H. McKee and E. E. Lyder, from the *Journal of Industrial and Engineering Chemistry*. There are two papers, one dealing with the manner in which the shale decomposes under the influence of heat and the other describing a method for the determination of the heat of reaction involved when the organic material of the shale decomposes to form oil.

Alsatian Potash—*Chimie et Industrie* for October (49, Rue des Mathurins, Paris; price 10 fr.) contains an illustrated article of twenty-four pages entitled "Les gisements de potasse d'Alsace et l'etat actuel de leur exploitation."

Marble Bay, B. C. — *Economic Geology* for September-October contains a twenty-three page article describing the geology and mineral occurrence in the Marble Bay mine, Texada Island, British Columbia. This mine is the oldest producing mine in the coast section of British Columbia, having produced high-grade copper ore since 1899. Over thirty mineral species have been found. The mine is owned by the Tacoma Steel Co. of Seattle.

Soap Creek Oil Field—U. S. Geological Survey has issued in mimeographed form a report of an examination of the Soap Creek Oil field, in the Crow Indian Reservation, Montana, by W. T. Thom, Jr., and Gail F. Moulton. The area considered is situated at the foot of the slope of the Big Horn Mountains, within the drainage basins of Soap and Rotten Grass creeks.

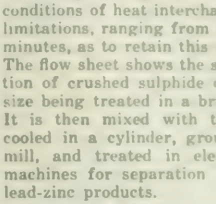
Mining in South Australia — The *Mining Review* of the South Australia Department of Mines for the half year ended June 30, 1921, is now available from the Department at Adelaide. During the period under review the most notable production was that of iron ore from Iron Knob, which was raised to 15,000 tons per week. Arrangements have been made to resume mining and smelting operations at Wallaroo and Moonta, and with this revival the other copper mines of the state are expected to produce again. During recent years there has been a notable increase in the production of high-grade barytes from South Australian sources, and large reserves of lower-grade material are known to exist. The possibility of turning this lower-grade material to account has been investigated by the government metallurgist, whose report is published in the Review.

Utah Mineral Resources—The Commercial Club-Chamber of Commerce of Salt Lake City, Utah, has issued a thirty-two page illustrated pamphlet, with a map, entitled "Utah's Mineral Wealth." The object of same is to give publicity to the vast mineral resources of the State. Copies will be sent on request to persons desiring them.

Recent Patents

Magnetic Ore Separation—No. 1,398,051. C. Thom, R. W. Diamond, and S. G. Blaylock, Trail, B. C., assignors to the Consolidated Mining & Smelting Co. of Canada, Ltd., Montreal, Que. A process for the magnetic separation of ores, which consists in heating the ore without roasting to from 800 to 1,200 deg. F., whatever temperature will give the maximum magnetic susceptibility, then artificially cooling the ore under such conditions of heat interchange and time limitations, ranging from five to fifteen minutes, as to retain this susceptibility. The flow sheet shows the screen separation of crushed sulphide ore, the oversize being treated in a brick-lined kiln. It is then mixed with the undersize, cooled in a cylinder, ground in a ball mill, and treated in electro-magnetic machines for separation into iron and lead-zinc products.

Metallurgy of Zinc — No. 1,398,006. C. E. Cornelius, Stockholm, Sweden. The patent applies to the electrothermic production of zinc. The ore is given a preliminary heating to drive off moisture before any zinc is volatilized. By so doing it is claimed that clogging of the chamber or condenser walls is prevented, and the hydrogen from the water, which would tend to dilute the zinc vapors, is practically all eradicated.



Blast-Furnace Combustion Tuyère—No. 1,393,749. A. B. Carstens, Monterrey, Mexico, assignor to the American Metal Co., Ltd., New York. A form of tuyère in which a combustible gas is mixed with air previous to its entry into the furnace, the shank of the tuyère being lined with refractory material to withstand the heat generated.

Flotation Machine — No. 1,397,815. R. Luckenbach, Philadelphia, Pa., assignor to Luckenbach Processes Co., San Francisco, Cal. A form of flotation machine comprising a tank in the bottom of which a feed tube enters. The pulp, compressed air, and the frothing reagent enter through this feed tube and rise in the tank, separate outlets being provided in the upper part of the tank for the gangue and the mineral-bearing froth.

Electrolytic Tin Refining—No. 1,39[illegible]. F. C. Mathers, Bloomington, Ind., assignor to American Smelting & Refining Co., New York. An electric current of suitable voltage and amperage is passed from tin the anode to a cathode through an electrolytic solution containing a mixture of hydrochloric [illegible] and less than 6 per cent by weight of tin.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Marshal Foch Receives Membership in Four Founder Societies

Ferdinand Foch, Marshal of France, was presented on Dec. 13 with honorary membership in the American Institute of Mining and Metallurgical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, and the American Institute of Electrical Engineers. The presentation was made in the Auditorium of the Engineering Societies Building, 29 West 39th St., New York. **J. Vipond Davies**, acted as chairman of the meeting, and introduced Col. W. Barclay Parsons, who gave the address of welcome to Marshal Foch. George S. Webster, president of the American Society of Civil Engineers, presented the certificate of membership in the four founder societies to Marshal Foch, who made a fitting reply.

The brief but impressive ceremony brought to the meeting a distinguished gathering of engineers and public men.

Copper & Brass Research Association Holds First Annual Meeting

At the first annual meeting of the Copper & Brass Research Association, held on Dec. 6, at the offices of the association, at 25 Broadway, New York, the following directors were elected to serve for the ensuing year: R. L. Agassiz, Calumet & Hecla Mining Co.; J. W. Allen, Greene, Cananea and Inspiration; H. F. Bassett, Taunton-New Bedford Copper Co.; H. C. Bellinger, Chile Exploration Co.; Edward H. Binns, C. G. Hussey & Co.; Stephen Birch, Kennecott and Braden Copper companies; F. H. Brownell, American Smelting & Refining Co.; J. P. Channing, Miami Copper So.; F. S. Chase, The Chase Companies; Carl F. Dietz, Bridgeport Brass Co.; Walter Douglas, Phelps Dodge Corporation; B. Goldsmith, National Brass & Copper Co.; E. O. Goss, Scovill Manufacturing Co., Robt. H. Gross, **East Butte** Copper Mining Co.; Charles Hayden, Chino Copper Co.; U. T. Hungerford, U. T. Hungerford Brass & Copper Co.; C. V. Jenkins, Chino Copper Co.; C. F. Kelley, Anaconda Copper Mining Co.; H. B. Paull, Calumet & Arizona Mining Co.; R. M. Raymond, United Verde Extension Mining Co.; H. J. Rowland, Rome Brass & Copper Co.; A. B. Seelig, Michigan Copper & Brass; and W. Parsons Todd, Copper Range Co.

The directors elected the following officers for the year 1922: President, R. L. Agassiz; vice-presidents, C. F. Kelley and F. S. Chase; treasurer, Stephen Birch; secretary, W. S. Eckert, and manager, William A. Willis.

Prosperity of Mining Dependent on World Conditions

"What Can Be Done To Revive the Industry" Discussed by New York Section, A.I.M.E.—C. F. Kelley Chief Speaker of Evening

An exceptionally well-attended meeting of the local section of the A.I.M.E. held at the Machinery Club on Wednesday evening, Dec. 7, had for its object the discussion of a subject in which all engineers are vitally interested: how to revive the mining industry. Prof. R. M. Raymond acted as chairman and introduced the principal speaker of the evening, C. F. Kelley, president of the Anaconda Copper Mining Co., who gave a long but eloquent and instructive address. Mr. Kelley spoke extemporaneously and immediately got to the heart of the problem by stating that America's affairs are so closely interwoven with those of Europe that he could not see any promise of a wholesome return to normal conditions before European political and industrial questions were settled. Mr. Kelley broadly visualized the copper industry's part in world commerce and showed how it was bound to be affected by European disturbances. The present world-wide readjustment must necessarily have its effect on industrial units. This he termed the pessimistic part of his speech.

That there was a brighter side, however, was made apparent by his subsequent remarks, which emphasized the greatly improved statistical position of copper since the Armistice, the increased consumption of copper in Europe, and the bright future that rapid developments in the electrical industry indicated. He decried the attitude of those who maintained that there is an overproduction of copper in the world that can only ruin the industry. Mr. Kelley vividly sketched a picture of the rapid development of copper mining and copper utilization in the United tSates, showing that consumption had more than kept pace with production. He also brought out the importance of improving the merchandising of copper and copper products.

Professor Raymond next introduced Thomas H. Watkins, president of the Pennsylvania Coal & Coke Corporation, who read a paper on the coal situation with particular reference to its problems in readjustment. Wage agreements are the stumbling block to a lowering of costs and prices in the industry. Lower transportation rates are also necessary.

Dr. Richard Moldenke, consulting metallurgist, spoke upon his recent trip to Europe and visit to Germany, where he had many consultations with Dr. Wirth, Herr Stinnes, and many of the leading capitalists and officials of that country. He stated that it was necessary to revise reparations demands upon Germany before it could be expected that German purchases of American copper, cotton, and wool would take place in great volume.

There was no discussion of the topics presented by the speakers.

American Petroleum Institute Discusses Industry's Problems at Second Annual Meeting

In his opening speech at the second annual meeting of the American Petroleum Institute at Chicago on Dec. 6, Thomas A. O'Donnell, president, stated that petroleum men need not fear a naval curtailment, as the Navy is now using less than 2 per cent of the crude oil produced.

Edward L. Doheny, president of the Pan-American Petroleum and Transportation Co., declared "fine-tooth combing of the possible oil regions of Mexico has only been done to a slight extent." Edwin B. Parker, general counsel of the Texas Company, in drawing the line between co-operative competition and combination, said that if Government interference in the form of restrictive legislation to prevent monopolies and restraints of trade and to keep competition free is not effective, then Government regulation and control of industry will follow.

Edward Prizer, president of the Vacuum Oil Co., said that Europe, with its unsound economics, bad finance, and sordid politics, needs oil if it is to continue to exist, and the European drain on American resources has instigated a world-wide search for petroleum deposits.

R. L. Welch, general secretary and counsel of the American Petroleum Institute, said in his address, "Oil—The Law of Supply and Demand," on Dec. 7: "The violent changes in oil prices, in my judgment, are due not to manipulation but to the lack of it; due not to combination but to the lack of it; due not to the control of production and consumption but to the lack of it; due to the normal operations of tne law of supply and demand—a law which is not an ideal thing from every aspect any more than is the competitive system an ideal thing from every aspect."

At the third day's session on Dec. 8, H. F. Sinclair of the Sinclair Consolidated Oil Corporation stated that there is plenty of petroleum and that the exhaustion of the world's supply is a bugaboo. He pointed out that although America is the chief consumer of petroleum products, the collective requirements of other countries will some day exceed our own.

Sir John Cadman declared himself as unalterably opposed to government control in business and said: "The open door policy is the only way to permit of the free operation of the law of supply and demand and it is unfair to charge Great Britain with attempting to close any door to honest enterprise."

Other addresses were given by Louis C. Sands, Harry A. Wheeler, Edward C. Finney and J. C. O'Donnell.

The directors of the Institute elected the following officers for the ensuing year: Thomas A. O'Donnell, president; R. D. Benson, Henry L. Doherty, and J. W. Van Dyke, vice presidents; H. F. Sinclair, treasurer; R. L. Welch, general secretary and counsel; W. R Boyd, Jr., assistant secretary and counsel; C. C. Smith, assistant treasurer.

MEN YOU SHOULD KNOW ABOUT

Jesse T. Boyd is investigating mining properties near Aspen, Col.

Edward R. Zalinski has been examining mining properties in Mohave County, Ariz.

D. L. Miller, of the Phelps Dodge Corporation at Tyrone, N. M., will leave soon for Honduras, C. A.

Paul Hillsdale recently examined the properties of the Grand Central Mining Co., at Eureka, Nev.

O. J. Egleston, chief engineer of the U. S. Smelting, Refining & Mining Co., was recently in San Francisco.

Henry A. Tobelman, metallurgist for the New Cornelia Copper Co., has resigned to accept a position in New York.

William H. Wright, mining engineer with the South American Gold and Platinum Co., sailed for Colombia on Dec. 10.

R. N. Marble, Jr., formerly superintendent of the Mahoning mine, Hibbing, Minn., is now situated in the Kansas oil fields.

Edwin J. Collins, mining engineer of Duluth, is engaged in examination work in Cuba, and will return home early in January.

P. L. Lord has gone to the Santa Barbara camp, near Parral, where he will reside permanently.

S. M. Soupcoff, mining engineer with the A. S. & R. Co., examined properties in Leadville, Col., recently, and has gone to Salt Lake City.

Harlow D. Phelps has opened an office at Room 11, Bashford Building, Prescott, Ariz., for the practice of mining and civil engineering.

C. E. Moore, general superintendent of the Pitt Iron Mining Co., Virginia, Minn., has returned from an extended business trip in the East.

H. S. Gale sailed on Dec. 13 for Colombia, where he will be engaged for three months in an oil investigation for an American company.

C. K. Leith, of the University of Wisconsin, was in New York this week to attend the meeting of the Mining and Metallurgical Society.

George B. Agnew, representing mining interests in the United States, is in the southern part of Mexico making an examination of some of the properties of D. C. Brown.

E. D. Gardner, mining engineer for the U. S. Bureau of Mines, with headquarters at Berkeley, Cal., is in Tonopah making a study of dust conditions in the mines of that district.

E. A. Ritter, of Denver, consulting engineer for the Oatman Amalgamated and Arizona Mossback mines, in Mohave County, Ariz., will visit Switzerland, after an absence of nineteen years.

Wallace Lee has been appointed Chief Geologist to the government of Siam. For the present, his address is in care of the Commissioner General, Royal Railroad Department, Bangkok, Siam.

T. H. Jenks has returned to Los Angeles from a professional visit to Sinaloa, Mexico, and is now convalescing from a severe attack of malarial fever contracted near Mazatlan.

Mining and metallurgical engineers visiting New York City last week included: **D. H. Ladd**, Wichita, Kan.; **A. N. Cole**, Baltimore, Md.; **J. H. Herron**, Cleveland, Ohio; **C. Y. Wang**, Hankow, China; **C. H. Bierbaum**, Buffalo, N. Y.; **James Lord**, Washington, D. C.; and **Louis A. Wright**, Merano, Italy.

Captain **J. P. Hodgson**, hitherto manager of the Phelps Dodge Corporation's Morenci Branch, has been appointed active manager of the mining operations of the company in the Morenci-Clifton-Metcalf district, including those of the Arizona Copper Co., recently absorbed by the Phelps Dodge Corporation. **Norman Carmichael**, long manager of the Arizona Copper Co., has joined the Phelps Dodge organization in the capacity of consulting engineer for the district, with his office in New York. **W. M. Saben** will continue as assistant manager. **P. G. Beckett** will add this district to those already under his supervision as general manager. **J. Owen Ambler**, smelter superintendent; **John Kiddie**, mine superintendent at Morenci; **W. G. Scott**, mine superintendent at Metcalf, and **Arthur Crowfoot**, concentrator superintendent, all formerly with the Arizona Copper Co. in the capacities named, will continue in the same positions. All appointments become effective Dec. 20.

SOCIETY MEETINGS ANNOUNCED

The Northwest Mining Association, of Spokane, will hold its annual mining convention Feb. [illegible]

The second annual meeting of the Society of Economic Geologists will be held at Amherst College, Amherst, Mass., Dec. 28-30. A number of important papers on economic geology will be read and discussed. A large attendance is expected.

OBITUARY

James Duane Ireland, forty-three years old, recently died in Cleveland after a year's illness. Mr. Ireland was a member of the firm, and had charge of all the mining activities of M. A. Hanna & Co., with whom he had been connected since his graduation from college.

Joseph Warner Edwards died Nov. 7, 1921, at Denver, Col. Mr. Edwards was born on April 23, 1852, at Philadelphia, the son of the late Edward Bird Edwards and Lydia Ford Edwards. He attended the Philadelphia schools from 1858 to 1865 and completed his academic course in Switzerland and Germany from 1865 to 1870. He was an ardent student of rocks from early boyhood, and chose geology and mining as his life work in 1871. He was a special student of geology at the University of Pennsylvania in 1873-74, and was an aide to Persifor Frazer in the Second Geological Survey of Pennsylvania from 1874 to 1876. He completed a scientific course at the Royal Saxon Academy of Mines, at Freiberg, from 1876 to 1879, and at Heidelberg in [illegible], taking high honors in geology, mineralogy, and allied subjects, when he entered the field of active operations in the three Americas. He became a member of the American Institute of Mining Engineers in 1876 and was an active member in the early formative days of the Institute, always intensely interested in its proceedings and loyal to its aspirations.

During the forty years of his professional career Mr. Edwards' life work was woven into the mining history of Colorado and the West. He was a man of high culture, keen analytical mind, and generous impulses. [illegible]

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

Mining litigation figures prominently in the week's news. The important Star-Federal accounting case, which was heard last week at Coeur d'Alene, Idaho, was settled during the hearing, the Federal company agreeing not to appeal. The Tonopah Extension-Cash Boy apex case, scheduled to be tried Dec. 8, was also settled. The Iron Cap-Arizona Commercial suit began during the week at Globe, Arizona. Judgment by default has been taken from the Arizona Hercules Copper Co. by the Empire Trust Co. of New York, the sum involved being over $3,500,000.

Advices from London are to the effect that the Electrolytic Zinc Co. of Australasia has started the first unit of its big plant at Risdon, Tasmania.

Recent statements, attributed in part to Edison, relative to the possibility of making aluminum cheaply with power developed at Muscle Shoals, Ala., have greatly stimulated interest in the low-grade bauxite deposits in that state.

The smelting situation in Colorado is characterized as intolerable, and it is said that the American Smelting & Refining Co. is considering plans involving the erection of a modern smelter at some central point such as Pueblo.

April 1 has been tentatively set by R. C. Gemmell in a recent speech at Salt Lake City as the date when Utah Copper will begin to resume operations gradually.

Cresson Consolidated, in addition to a 5 per cent quarterly dividend, has declared an extra 5 per cent Christmas dividend payable in January. The Park-Utah company, a newcomer at Park City, Utah, has also declared a dividend.

Another protest against the mining law revision bill has been made by the Montana Mining Association.

Management of Arizona Copper Passes to Phelps Dodge

Walter Douglas Announces New Appointments — Hodgson General Manager at Clifton; Carmichael Consulting Engineer

The Phelps Dodge Corporation on Dec. 20 will take over the active management of the operations of the Arizona Copper Co. in the Clifton-Morenci-Metcalf district of Arizona. Walter Douglas, president of the Phelps Dodge Corporation, made an announcement to this effect at Clifton on Dec. 8. As stated on the preceding page in this issue, Capt. J. P. Hodgson, who has been manager for Phelps Dodge at Morenci, will become manager of all operations in the district, including those of the Arizona Copper Co. Norman Carmichael, long general manager for the latter company, has joined the Phelps Dodge organization in the capacity of consulting engineer for the district with his office in New York. Other appointments are as given on the preceding page.

A party consisting of Walter Douglas and others of the Phelps Dodge organization, including P. G. Beckett, Gerald Sherman, and C. Legrand, has been visiting various camps in the Southwest. Mr. Douglas left for New York on Dec. 11. Before his departure he made a statement briefly reviewing the copper situation. The prospects of reopening copper mines in the United States were not bright at present, he said, and no one could decide now very well when they would open. Undoubtedly the low cost producers would be the first to open. Very few could afford to operate at present prices, according to Mr. Douglas.

Arizona Hercules Defaults to Empire Trust Co.

Judgment Against Copper Company Secured in Foreclosure Suit—Amount Involved Over $3,577,000

Judgment by default has been taken by the Empire Trust Co. of New York in its foreclosure suit at Phoenix, Ariz., against the Arizona Hercules Copper Co. The principal sum is $3,000,000, with added interest of $577,000, costs of $10, and attorneys' fees to be determined upon. The property affected, which is operated by the Ray-Hercules Copper Co., is at Ray, Pinal County, Ariz., immediately east of Ray Consolidated Copper Co.'s ground, with a modern concentrator a few miles distant, and an attached Diesel power plant. The mill was operated for only a short period. Most of the debt was incurred in building the mill, in the erection of a fine surface plant at the mine, including hoist, machine shops, concrete ore bins and railroad connections. Underground a large tonnage of low-grade copper ore has been developed.

Cash Boy Suit Settled Out of Court

The Tonopah Extension-Cash Boy apex suit has been settled by the purchase of the Cash Boy holdings by the Tonopah Extension. The property of both companies is in the Tonopah district, Nevada. The Cash Boy will receive 100,000 shares of Tonopah Extension stock, the ratio of transfer being twenty to one. At the present market quotation for Tonopah Extension stock the consideration is about $145,000.

Star and Federal Companies Settle Accounting Case

Former Gets $350,000 for Ore Removed and Option on Various Claims—Latter Agrees Not To Appeal—Both Satisfied

The Star-Federal accounting case which came up for hearing the week of Dec. 5 in Coeur d'Alene City, Idaho, has been settled. After much testimony had been taken it became known that overtures had been made and accepted with a view to settlement. On Dec. 9 the court at the request of the opposing counsel handed down a decree which stated that, as a settlement had been reached as to equity, the Court adjudged the plaintiff owner of all ore beneath the Evening Star and Mary R. fraction claims within their boundaries; enjoin the defendant from asserting title to or entering into or mining such ore; absolving the defendant from any further liability for the removal of ores heretofore mined from beneath the surface of either claim, and decreeing that no costs should be taxed. This decree was entered subject to a stipulation of the defendant to the effect that it would not appeal from that judgment, nor take any subsequent proceedings of any kind.

The terms of the settlement provide for the defendant paying $350,000 for ore removed, and the giving of an option to the plaintiff on the Iron Crown, Iron Crown fraction, the Jeff claims, and on all that portion of the Grouse claim lying westerly of a vertical plane projected downward from the westerly end line of the Morning claim, extended southerly in its own direction to the southerly side line of the Grouse claim. The consideration was $100,000 divided into four equal payments of $25,000, due March 31, June 30, Sept. 30, and Dec. 31, 1922.

This deal settles all possibilities of future apex litigation, as some of the broad lode apexes on ground optioned, and is therefore important to the Sullivan Mining Co., the holding corporation for the Hecla and Bunker Hill interests. All sides were well satisfied with the settlement.

The attorneys for the plaintiffs were John P. Gray, of Coeur d'Alene City, Wakefield & Witherspoon, of Spokane, for the defendant, Hogg, Todd & Dorworth, of Seattle, and A. M. Beale, of Wallace.

The accounting, referred back to the Federal Idaho court by direction of the Supreme Court, involved a claim by the Star Mining Co. against Federal Mining & Smelting Co., for $2,277,061 or $3,721,796 (including accumulated interest at 7 per cent), if the action of the defendant be respectively deemed "innocent" or "wilful," for a trespass already held by higher courts to have been committed by defendant upon property adjoining its Morning mine at Mullan, Idaho, such trespass having been committed from 1907 to 1909. The defendant admitted the removal of 446,967 tons of ore from plaintiff's ground during that period but maintained that the net profit from such extraction had been but 16c. per ton, a total net profit of only $71,786.

Iron Cap-Arizona Commercial Suit Begun

Case Opened at Globe, Ariz., Judge Pattee Presiding—H. V. Winchell, Albert Burch and Others as Witnesses

The apex suit of the Iron Cap Copper Co. against the Arizona Commercial Mining Co., to decide extra-lateral rights to mineral-bearing ground of large value, which has been proven at considerable depth, was begun at Globe, Ariz., on Dec. 12, in the Superior Court of Gila County. Judge Samuel Pattee, of Tucson, presided, Judge G. W. Shute, of the Gila County Court, having expressed a sense of disqualification. Horace V. Winchell will appear as expert witness for the plaintiff, as well as R. H. Hunt and W. H. Wiley, of Los Angeles. For the Arizona Commercial, expert testimony will be given by Albert Burch and G. M. Bjorge, the latter for several years geologist for the Old Dominion and Arizona Commercial companies.

Chihuahua Companies Ordered To Establish Schools

The Chihuahua State government has notified all mining companies operating within the state that they must operate schools in each camp at their own cost. This order will add about forty schools, at considerable cost to the corporations affected. Many of them already had provided schoolhouses

Poland Gets Lion's Share of Upper Silesian Minerals

By Cable from Reuters to Engineering and Mining Journal

Berlin, Dec. 8—The result of the partition of the plebiscite area in Upper Silesia gives Poland 96.9 per cent of the iron ore production; 81.9 per cent of the zinc ore; 70.9 of lead ore and 26 per cent of the output of sulphur ore. The zinc and zinc by-products, lead by-products and sulphuric acid industries fall entirely to Poland.

Superior & Boston Resumes Mining

The Superior & Boston Copper Co., of Globe, Ariz., has resumed the mining of silver-copper ore, an arrangement for reduction having been made with the International Smelting Co. at Miami. For the present, most of the ore is coming from the mine bins.

Montana Mining Association Against Mine Law Bill

Passes Resolution Recommending Congress Adopt "Hands-Off" Policy

The following resolution condemning H. R. 7,736, which proposes the revision of the United States mining law, has been passed unanimously by the Montana Mining Association:

"Whereas, for more than a half century under our present laws the mining industry of this country has developed to its present magnitude, and through physical practice and interpretative court decisions and departmental rulings our people have become familiar with the laws now governing mining; and,

"Whereas, the proposed revisions of the present mining laws contain changes so drastic that they will seriously disturb, retard and injure mining by reason of such proposed changes; therefore, be it,

"Resolved, that the Montana Mining Association protests against the passage of this proposed legislation; that its passage will work a great hardship upon the mining industry of Montana, with no resultant benefits whatever, and we respectfully recommend to the Congress that it adopt a 'hands-off' policy as affecting the laws governing mining.

"Resolved, that a copy of these resolutions be sent to our Senators and Representatives, to the press of the state and to other mining associations."

Anaconda Seeking Control of American Brass?

New York papers on Dec. [illegible] stated that officials of the Anaconda Copper Mining Co. had admitted that negotiations were in progress between that company and the American Brass Co. looking to the acquiring of control of the latter by Anaconda. The story was that Anaconda would offer to buy all American Brass Co. shares, $[illegible],000,000 par, or a majority of shares, and give $[illegible] a share in cash and three shares of Anaconda, par $50, for one share of American Brass. When asked as to the truth of the report, the New York office of the Anaconda company declined to comment.

Smelting Situation in Colorado Called Intolerable

A. S. & R. Co. May Build Modern Plant at Some Central Point—Salida Smelter May Handle Custom Ores

By Our Special Correspondent

Denver—Colorado mining men are much concerned regarding the present smelter situation as affecting the reduction of Colorado ores. Decreased production or marketing of desirable smelting grades of ore has resulted in the closing down of various smelting plants throughout the state, until at present only two plants are operating, one at Durango and the other at Leadville. Both of these plants are owned by the American Smelting & Refining Co. and are operating under serious disadvantages on account of a lack of necessary ores to make a proper charge.

These conditions have resulted in a very marked increase in smelting charges, and taken together with the longer freight haul and the general increase in operating costs, have resulted in the closing down of many mines which, under former conditions, could furnish a desirable smelting product. Prior to these increases, in many Colorado districts a $10 ore could be profitably mined and treated at the smelter, but under present conditions, ore must contain practically double this value to be commercially profitable.

Decreased production has resulted in a shortage of lead and silicious ores, and an over-supply of iron and lime ores at the smelters which has necessitated shipping into the state large quantities of lead ores, and the treatment of iron and lime ores at outside smelting plants. Antiquated smelting plants, poorly adapted to present conditions of ore supply, have further aggravated the situation, and Colorado ore producers who are obliged to market their output at the smelter are facing almost intolerable conditions.

It is understood that the American Smelting & Refining Co. is considering plans for a general readjustment of smelting conditions in this state including the construction of a modern smelting plant at some central point, probably Pueblo, and with favorable local freight rates, would be prepared to handle all Colorado smelting ores. It is also reported that the Salida smelter, formerly operated by the Ohio & Colorado Smelting Co., is to be remodeled and operated as a custom plant.

Callahan Zinc-Lead Co.'s Strike Important, Borg Says

The [illegible] of the [illegible] Callahan Zinc-Lead Co. [illegible] was [illegible] John Borg [illegible] of the company. The latest [illegible] of the [illegible]

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

Geological Survey May Gather Data for Census Bureau

Change Recommended To Lessen Demands on Smelters and Manufacturers for Production Figures

The metal producers are having their interests made a matter of special consideration in connection with the biennial census of manufacturers. Secretaries Hoover and Fall have instructed Eugene F. Hartley, chief statistician of manufacturers, and Dr. George Otis Smith, director of the U. S. Geological Survey, to recommend a plan to obviate duplication of Government effort and to prevent unnecessary burdens on smelters and other sources of information required for the compilation of the statistics. The proposal which probably will be recommended to the two Secretaries is that the Geological Survey, by reason of its constant touch with the mineral industry, act as the agent of the Bureau of the Census every two years and collect the special data desired at the time the figures of annual production are collected for the Survey's own use. It is the expressed desire of both Secretaries Fall and Hoover, each of whom knows the mining business from the inside, to make as few demands upon the accounting offices of the mining companies as is possible.

Mellon Reports on Purchases of Pittman Act Silver

Discussing the purchases of silver under the Pittman Act, the Secretary of the Treasury has submitted the following to Congress:

"Silver purchases under the terms of the Pittman Act, approved April 23, 1918, have reached a total of approximately 80,000,000 ounces up to Nov. 1, 1921, leaving about 128,000,000 ounces yet to be acquired to replace the silver dollars melted under the terms of that act. The coinage of this bullion is proceeding rapidly, $72,178,000 having been executed to Nov. 1, 1921, at which date the uncoined stock of Pittman Act silver on hand was about 25,000,000 ounces.

"The total number of silver dollars melted under the terms of the act of April 23, 1918, was 270,232,722, there having been used for subsidiary coinage during the past year 111,168 beyond what has previously been reported.

"As the new silver dollars become available silver certificates are issued against them. The issue of these silver certificates permits the retirement of the Federal reserve bank notes issued at the time silver certificates were retired in order to make silver dollars available for melting, and also permits the retirement of the certificates of indebtedness held as security for the Federal reserve bank notes, thus reducing the public debt and the interest charges thereon."

Purchases of silver by the Bureau of the Mint during the week ended Dec. 10 totaled 105,000 fine ounces. This brings the total purchases by the Government under the Pittman Act to 84,864,863 fine ounces.

NEWS BY MINING DISTRICTS

London Letter

Bisichi Tin Co. Expected To Profit From Merger—Southwest Africa Co.'s Title to Unsold Land Under Damara Concession Recognized

By W. A. DOMAN

London, Nov. 29—By the absorption of the Forum River (Nigeria) Tin Co., the Ninghi (Nigeria) Tin Co., and the Northern Nigeria Trust, the Bisichi Tin Co. (Nigeria) has become one of the most important tin-mining companies in Nigeria. Its nominal capital is 1,000,000 shares of 10s. each, of which 744,078 are in issue. The property account stands in the balance sheet at £301,838. The amalgamated holdings now consist of mining leases, 6,743 acres; exclusive prospecting licenses, 6,867 square miles; and mining rights, 32,607 yards. As so far determined, the richest ground is that held by the parent company, the Bisichi.

On E. P. L. 1,060, Forum section, exceptional ground has been discovered, and this within six months has added no less than 6,747 tons to the reserves, making them 10,833 tons. Operations were greatly hampered during 1920—this is the period covered by the report now issued—by shortage of labor, the fall in the price of tin, and high working costs. As a result there was a loss for the year of £4,467. As, however, £5,524 was brought forward from the previous year, there is a balance to the new year's account of £1,057.

From the Bisichi section the recovery was 133 tons of concentrates of an average value of 70.52 per cent metallic tin. An average price of £153 1s. 8d. was obtained, as against £242 16s. 6d. in 1919. The acquired properties were worked for only eight months and produced 128 tons.

Interest attaches principally to the report of Lake & Currie, the company's consulting engineers. A member of the firm, H. E. Nicholls, spent five months on the property in investigation. All of the benefits that it was expected would be derived from the fusion did not materialize, owing to the fall in the price of tin, but concerted action was taken to deal with the situation, so that with economies effected, and concessions made by the government in the matter of rents and royalties, future financial results will be better than could have been possible had the various companies operated separately.

Excellent results are obtained by the hydraulicking plant, 107,156 cu.yd. of ground yielding an average of 1.5 lb. per cubic foot. Working costs, that is, salaries, native wages and stores, were 4s. 9d. per lb. An important feature is the fact that much of the ground now being worked is outside the proved areas, which prospecting had not shown to be of value, up to 3 lb. per cubic yard being won where prospecting had previously given traces only.

On E. P. L. 1,060, mentioned above, it is anticipated that a further 2,000 tons of concentrates will be proved. It is pointed out that the commercial value of the discovery is largely augmented by the fact that the deposit is a continuous one, and is believed to be the biggest yet proved in Nigeria. Little work is being done on the Ninghi section. The labor position is still serious; and no great influx can be expected on the plateau, but the Bisichi company, with its water power, will be rendered largely independent of hand labor.

The South West Africa Co., whose property was in former German South West Africa, now the South West Africa Protectorate, has just issued its report for 1920. As far as the mining part of it is concerned, it is interesting to note that the Union Government of South Africa has recognized the company's title under its Damara land concession to the whole of its unsold freehold, amounting to 1,600,000 acres, and has extended until November, 1923, the period within which the company retains the sole right to prospect for minerals within the area of the Damara land concession, so far as the rights have not already been disposed of by the company. Active exploring operations are being undertaken in various parts of the company's area, but no mention of results is made in the report.

Johannesburg Letter

The Development of South West Africa —High-Grade Copper Reported in the Rechtersveld — The Pilgrim's Rest Goldfield

BY JOHN WATSON

Johannesburg, Nov. 1—A parliamentary commission has recommended that when the population of South West Africa has reached a specific figure it should become the fifth province of the Union, which would mean local legislation and representation in the Union Parliament. The Administrator of the Cape Province (Mr. Hofmeyer) recently said that Walvis Harbor and Gobabis Railway projects are to be pushed on. The Caprivi strip is to be placed under Bechuanaland Protectorate for administrative purposes. The Union Government proposes to pass legislation ceding Walvis Bay to the South West, and to give to the latter riparian rights on the Orange River. The latest census figures show that out of a total European population of 19,377 there are 7,855 Germans. The male adults total 16,875 of whom 3,150 are Germans.

A press telegram from Port Nolloth says: "A prospect or reports having found gold nuggets in the Rechtersveld, that is, the district to the south and east of the mouth of the Orange River. He also claims to have discovered a huge deposit of high-grade copper ore, and has brought in samples of the reef, which is said to extend over eight miles and to be intersected by bands of native copper. He also reports a very fine lode of molybdenite."

A paper on the Pilgrim's Rest goldfield, one of the oldest goldfields in South Africa, was contributed by H. C. F. Bell to the last meeting of the Chemical and Metallurgical Society. In 1920, this district (which is roughly 110 miles wide by 140 miles long), produced gold worth £560,821 and of this amount approximately one third was produced by small mines and diggers. The district contains nineteen different gold reefs which have been or are now worked, besides several leaders.

KOREA

Oriental Consolidated's Results in October

Unsankinko—The Oriental Consolidated Mining Co. crushed 21,424 tons of ore in October, running 160 stamps twenty-eight days. Gross receipts for the month in gold were $92,994. Operating costs were $87,726, leaving an operating profit of $5,268. Of this $3,172 was put back into development work, leaving a net profit for the month of $2,096.

CANADA

British Columbia

Coroner's Jury Finds Against Britannia M. & S. Co.—Relief from Taxation

BY ROBERT DUNN

Vancouver—A verdict of "criminal neglect" has been returned by the Coroner's Jury against the Britannia Mining & Smelting Co., Ltd., because of the loss of thirty-six lives in the flood disaster at Britannia Beach on Oct. 28. The finding of the jury in detail follows: "That W. Lonon and others came to their death on Oct. 28, 1921, at Britannia Beach, B. C. The disaster was caused by what is known as a railway fill or dump giving way, and we, the jury, declare that it was criminal neglect on the part of the Britannia Mining & Smelting Co., Ltd., under the general management of E. J. Donohue and K. B. Browning, general superintendent and mining engineer for the said company, for deliberately allowing the blocking of a natural mountain stream known as the Britannia Creek, causing a menace to persons living at Britannia Beach." More than forty witnesses were examined at the inquiry including a number of civil engineers who investigated conditions at Britannia. The members of the jury also visited the scene of the catastrophe. The Attorney-General of British Columbia has under consideration what action the Crown should take with respect to the matter in view of the verdict.

It is announced that arrangements have been completed for the construction of a new mill at Britannia Beach by the Britannia Mining & Smelting Co., Ltd. Houses also are to be erected for the employees on the bench north of Britannia Creek where there will be no danger of a repetition of the recent disaster. The mill will be of 2,500 tons capacity, according to information thus far obtainable. This will replace the one recently burned.

Victoria—While it does not appear that mine operators and others interested are likely to secure all the concessions for which they asked during the present session of the provincial legislature, it is assured that material relief is to be granted. In an "Act to Amend the Taxation Act" now before the House it is provided that mills, whether situated upon or in the vicinity of the mining property of which it is a part shall be exempt from the Land Tax. Heretofore this consideration has been allowed only where the mill actually was upon the mine property. Now it shall apply to such mill no matter where located providing the mine and mill are under the same ownership and that the latter is used for the treatment of the ore of the particular mine in question. In other words it is not proposed that this exemption shall be given custom mills. Another, and an important reduction is granted smelters and mills, however, it being the intention of the government as indicated by the same amending measure, that these shall be exempt from the personal property tax. With regard to allowances for "depletion" (of mine), "depreciation" (of plant) and "development" (mine and plant) it is conceded that if the decision of the Finance Minister is not satisfactory to the operators they may set out their case in an appeal to the Lieutenant-Governor-in-Council. A further point raised has to do with the deduction in figuring assessments of amounts that go towards the payment of interest on loans floated outside the Province. It is understood that, in this connection, the companies will be permitted to make separate returns of such sums.

Ontario

Nipissing Surprises With November Output—Teck-Hughes Ready to Run at Increased Capacity

Cobalt—Contrary to expectations Nipissing produced for November 359,000 ounces, valued at $251,253. This is the highest output for any month of the present year, and compares with 350,000 ounces in October, the previous high month. A meeting of the directors to consider the next dividend payable Jan. 20 was held Dec. 15.

Kirkland Lake—After considerable delay, due to lack of power connections, milling operations were finally started at the Ontario-Kirkland Dec. 8. On the same day, however, the main hoist broke, and it has been found necessary to ship it to Montreal to be repaired. This will cause an indefinite delay.

The mill addition at the Teck Hughes is practically completed, and it is expected that it will be running by the middle of December. This new equipment should increase the capacity of the mill by about 50 per cent. Shareholders have ratified the plans for the re-organization of the company. At the meeting the manager stated that the mill was treating 3,000 tons per month, and that the gross income since August had been $33,000 a month. During the past year operations have been carried to the 600 level, with good results. Revenues for the year, ended Aug. 31, amount to $444,806, while expenditures were $291,966, giving an operating profit of $152,840. On Aug. 31 the current assets were $202,000, and liabilities only $22,000. Ore reserves amount to 48,000 tons of an average of $9.28 per ton, and it was stated that the mine was in the best physical condition of its history.

It is understood that the November output of the Lake Shore will run about $[illegible], a new record for the mine.

Porcupine—It is stated that drifting on the [illegible] vein of the Davidson has shown an average of $16.60 per ton.

The directors of the Vipond have accepted a recent offer for 175,000 shares of treasury stock, and a meeting of the shareholders will be called for Dec. [illegible] to ratify the sale. This will permit the continuance of underground operations, but it is understood

PLANT OF ELECTROLYTIC ZINC CO. OF AUSTRALASIA, LTD., AT RISDON, NEAR

that a start cannot be made before spring, as the power company is unable to guarantee a supply of power.

A small gold brick, valued at about $17,000, was recently stolen from the refinery of the McIntyre company.

Sudbury—It is understood that the International Nickel Co. has definitely decided to refine no more nickel at its Bayonne plant in New Jersey. In the future all nickel will be refined at the Port Colborne plant in Ontario. The land on which the Bayonne plant is built is extremely valuable and will, no doubt, be sold, which should add very materially to the cash resources of the company. Work is progressing at the Monel metal rolling mills in Virginia, and two furnaces will be installed there to make the metal from the matte, which will be shipped direct from the company's plant at Copper Cliff.

Toronto—The general election in Canada on Dec. 6 resulted in a victory for the Liberal Party, which has not been in power for the last eleven years. As a general rule, elections are not supposed to be of particular interest to the mining industry, but if the Liberals carry out their pre-election promises, this particular election may have a quite important bearing. One of the most important planks in the Liberal platform is the reduction in duty on tools of production.

There is also some talk of appointing a separate Minister of Mines under the Dominion Government. Heretofore mining has been tacked on to the Ministry of Agriculture or the Department of State, or to any other Department which would take it over, with a consequent lack of co-ordination, efficiency and leadership.

Quebec

Black Lake—J. A. Jacobs, president of the Black Lake Asbestos & Chrome Co., has sent out an official announcement to the effect that with a change in the directorate he has now obtained complete control of the company.

AUSTRALIA

Electrolytic Zinc Company Starts First Unit

By Reuters Agency

The Electrolytic Zinc Co., of Australasia announces that an official cable states that the first unit of the main plant at Risdon, near Hobart, Tasmania, which will absorb 15,000 hp., started operation on Nov. 22. Everything is running satisfactorily, and in a few weeks it is expected the full output of this unit will be reached. It is added that the complete plant, absorbing 30,000 hp., is expected to be running well before the end of 1922, with an output of 40,000 to 45,000 tons of refined zinc per annum. The output of the first unit will probably be about 1,400 to 1,500 tons of zinc monthly.

MEXICO

Concession Granted for Chihuahua & Orient R.R.

Chihuahua—The concession for building the railroad line from a point near Candelaria, on the main line of the National Railways, to connect the mines in the Los Lamentos mountains has been granted by the Mexican government to William D. King. It is to be known as the Chihuahua & Orient R.R., the construction of which is to be financed by the Erupcion and other mining companies of Los Lamentos district. An additional clause gives Mr. King permission to extend the line from Los Lamentos to La Chocolata mountain and also for the construction of a branch to El Hueso mountain where some properties are being developed.

Plans and specifications are to be submitted to the secretary of public works within 180 days after date of signing the contract and active construction work must begin within sixty days after same have been approved.

All of the mines of Los Lamentos district are showing greater activity with the expectation of railroad benefits to be received by the construction of the Chihuahua & Orient line.

ALASKA

Data on Recent Operations of Alaska Juneau

Juneau—The following data regarding operations of Alaska-Juneau in September and October have come to hand:

	September	October
Tons milled	200,400	143,200
Operating costs	Per Ton	Per Ton
Mining and delivering rock to mill	18.6c.	(App.) 19c.
Milling	25 69c.	32c.
All else	1.88c	2c.
Total operating costs	46 17c	53c
Gold recovery		
In bullion	45.56c.	61.84c.
In concentrates	8 67c	13 37c
Value of lead and silver recovered in excess of all freight and treatment charges	2 20c	2 30c
Total operating receipts	56.43c.	77.51c.
Operating profit	10.26c.	24.51c.
Gross operating profit	$20,579 17	$35,000
Spent on capital account	$4,972.89	$5,000
Gross surplus at Juneau at end of month	15,606.28	$30,000

The September crushing rate required three shift work which proved too severe and too costly a strain on the facilities of the coarse crushing department. It was consequently necessary to reduce to two-shift work beginning Oct. 1. An additional capital expenditure of $150,000 on the mill would enable it to handle 6,000 tons per day, working two shifts only in the coarse crushing department, at an operating cost not to exceed 25c. per ton. Interest charges on the company's indebtedness are now totaling about $14,000 per month so that the company is compelled to make the best of present conditions.

WASHINGTON

Iron Company Organized To Operate at Tekoa

Tekoa—The Federal Iron & Steel Corporation has been organized in Spokane for the development of 1,500 acres of iron-bearing land near Tekoa. Plans include a 100-ton pig iron furnace to be erected at Tekoa. J. C. Haas, of Spokane, and F. M. Handy have been active in the promotion of the corporation.

HOBART TASMANIA THE FIRST UNIT OF WHICH HAS RECENTLY BEEN PUT IN OPERATION

OREGON

Gold Districts Active in Southwestern Part of State

By A. E. Kellogg

Applegate—W. F. Wright, of Applegate, has uncovered a 4-ft. gold-bearing vein on his farm near Applegate. The present development consists of a 100-ft. drift cutting the vein at a depth of 80 ft. The ore at this depth is free-milling and pans well in gold. Wright is seeking a small mill.

Gold Hill—The Red Oak group of gold quartz claims in the Gold Hill district has been taken over by Lon Compton, of Medford, who is reopening the property. This mine was a producer in the late nineties.

Jacksonville—The Gold Quartz & Placer Association, a new company with headquarters at Medford, has taken over the Gold Coin quartz property west of Jacksonville, also the placer ground known as the Pearce and Bowden property south of Jacksonville. A camp has been established at the Gold Coin with a crew of miners. A lower drift will be extended 800 ft. A steam shovel will be put on the placer ground this season in addition to the present giant equipment.

The Great Western Mining & Development Co., also a new company with headquarters at Medford, Oregon, has taken over the Lone Pine quartz property near Jacksonville, and is reopening it.

IDAHO

Armstead Mill Building Practically Complete

Talache—The exterior construction of the concentrator of Armstead [illegible] is practically completed with mechanical equipment arriving and being installed.

Leona—[illegible] of gold on a small scale has been underway at the placer operation of the Idaho Gold & Ruby Mining Co. Specially designed milling equipment is being installed.

MONTANA

Anaconda's Possible Relations to Brass Industry—The Copper Zinc Shingle—Tuolumne Cuts New Ore on 1,600—Gold Rush in Northern Part of State

By A. B. Keith

Butte—The Anaconda Copper Mining Co.'s attention in the direction of the merchandising of manufactures from its raw products is continuing to arouse more interest, especially in view of the reported activity of this corporation in the matter of the acquirement of shares in brass manufacturing concerns.

The Anaconda company will come close to monopolizing the western wire trade, once it has brought to fruition its plans for the installation of a plant at Great Falls, for the insulation of wires. The success which thus far has attended the rod and wire mill of the Anaconda, also at Great Falls, was a sort of an eye-opener for the Anaconda in the way of trade possibilities, and the entry into the brass field, with the company having at hand refined copper and zinc of the highest possible grade in any desired tonnage, naturally came along with suggestions of expansion, as did also the manufacture of zinc oxide for use in the manufacture of automobile tires.

The company is taking no small amount of pride in its shingle, a copper-zinc product, thin enough to be manufactured at a cost which will permit of reasonable competition with the wood article, but durable enough to last as long as time as far as the ordinary elements are concerned, with the requisite strength so that they can be handled without fear of the breakage that might be expected from a thin sheet of zinc. An interlocking scheme prevents that contraction which is [illegible] to appear in [illegible].

Oscar Rohn of the East Butte Mining Co., it is understood, will confer with James L. Bruce, manager of the Davis-Daly Copper Co., soon in regard to the future relations of the two companies. The Pittsmont smelter of the East Butte will require Davis-Daly ore or other custom ore.

The Tuolumne Copper Mining Co. has cut into what appears to be a body of commercial ore 20 ft. wide in a crosscut to the north of the west drift on the 1,600 level of the Spread Delight fissure. The ore carries lead and zinc in addition to copper and silver, with its chief values believed to lie in the silver. The showing is regarded as indicating the location of the ore zone at this depth and will afford enlightenment, it is believed, when a deeper program of development is decided upon. It is deemed the best showing of ore the Tuolumne has had with depth.

Elkhorn—Shipments of concentrates to the amount of 50 tons daily have commenced at the Boston & Montana Development Co.'s new concentrator, and it is expected to [illegible]. Experimental runs of ore have been made with minor alterations from time to time with a recovery obtained varying up to 80 per cent, which is considered good as a starter.

Shelby—[illegible] gold rush checked somewhat at the present by an intensely cold wave. The [illegible], situated in the West Sweet Grass hills, in the northern part of the state. About fifty claims, it is said, were already had staked off with Canadians forming a goodly part of the crowd of [illegible]. [illegible] closed to excite anybody is not definitely known. A party from Conrad, Mont., [illegible] the [illegible].

[illegible]—The [illegible] property [illegible].

UTAH

Gemmell Sets April for Utah Copper's Resumption—Park-Utah Declares Dividend

Salt Lake City—April 1 is tentatively fixed as the date for resumption of operations by the Utah Copper Co., as stated by R. C. Gemmell at a meeting of the mining committee of the Salt Lake City Commercial Club, the resumption to depend solely upon the continued activity of the copper market, in which there might be experienced a disappointment. Work would probably begin on a small scale, with possibly no more than 2,000 men employed this number to be gradually increased as conditions improved. At the height of the company's operations, Mr. Gemmell stated there were employed indirectly and directly about 7,000 men. The ultimate maximum now looked for is 5,000 men, with wages averaging $4 a day.

The company is planning to complete some metallurgical tests, to be continued over a period of one or two months, at the Arthur mill. These were under way when the plant shut down last April.

Park City—Shipments for the week ended Dec. 2 amounted to 2,069 tons of ore and concentrates. Shippers were: Judge allied companies, 967 tons; Silver King Coalition, 709 tons; and Ontario, 393 tons. The Silver King Coalition will on Jan. 2 pay a dividend of 15c. a share or $182,415. The last dividend—of like amount—was paid May 2, 1921. The new 450-ton mill is approaching completion, being over three-quarters finished, and is expected to begin operations around the end of January. The mine is producing from 2,500 to 3,000 tons monthly.

The Park-Utah ground in the eastern and so far undeveloped section of the camp has been proven, and the company will pay a dividend of 5c. a share or $50,000. The Park-Utah, starting work from the Ontario drain tunnel, has opened a strong fissure, which it has followed several hundred feet, the fissure showing ore over the entire distance. Raising and drifting has been done in various directions, and shipping ore opened; also a large tonnage of milling ore. Shipments thus far are entirely from development, the company working in different directions from the center of the property. About 2,000 tons monthly are being shipped. The property is controlled by the Judge interests. The bringing in of a new dividend payer in a new section is one of the important developments of the Park City camp during the year.

Eureka—Shipments from the Tintic district for the week ended Dec. 2 amounted to 166 cars. Shippers were: Tintic Standard, 52; Chief Consolidated, 42; Victoria, 17; Dragon, 14; Eagle & Blue Bell, 10; Iron Blossom, 8; Colorado, 4; Empire Mines, 4; Centennial-Eureka, 1; Swansea, 3; Gemini, 8; Alaska, 2; Bullion Beck, 1; Gold Chain, 1; Sunbeam, 1.

NEVADA

Simon Silver-Lead Mill Operating Successfully on Small Tonnage—West End Cuts Wages Dec. 16

Mina—The flotation plant of the Simon Silver-Lead Mines Co. is said to be operating successfully after many small mechanical adjustments have been made. The test is not yet complete, however, and only 50 tons per day is being treated.

At the Mabel mine, adjoining the old Garfield, the shaft is down 70 ft. and good progress is being made. Crosscutting to the veins will be done as soon as the 100-ft. point is reached. This work is being done by the West End Consolidated Mining Co., of Tonopah, the property being under option.

Tonopah—The latest bullion shipments reported, representing cleanup for the last fifteen days of November, are Tonopah Belmont $149,000, West End $57,000. The West End has notified its employees that, beginning Dec. 16, wages will be reduced to conform to the scale paid by other Tonopah companies. This means a reduction of 75c. per day for all classes of labor.

Divide—The Tonopah Divide shaft has reached a depth of 1,200 ft. and a station is being cut at this point. As soon as the station is completed shaft sinking will be resumed, the final objective being water level. Development work on the 1st, 3rd and 8th levels is satisfactory and regular daily shipments of 50 tons are maintained. The Gold Zone reports favorable developments above the 500 level. A shipment of 50 tons of $50 ore was made recently from development work.

Goldfield—The shaft of the Goldfield Deep Mines Co. is now 1,100 ft. deep. Leasers in the Florence are reported to be doing well. Donald and Giles have shipped two cars of $60 ore. Steedman and Dreyer have a 3-ft. face of ore which shows free gold across the entire width. This ore is above the 209 level and 80 ft. north of the Little Florence shaft.

Pioche—Ore shipments from Pioche for the week ended Dec. 3 were up to the recent average, totaling 765 tons, all of which came from the Bristol and Jackrabbit sections. The greater part of this came from the Bristol section, which is more active than for some time. Though no small leases shipped during the week, a number have ore ready, and others are waiting in anticipation of lower freight rates on their product. More small leases are being operated in the Pioche district than at any time since the increase in freight rates reduced shipments to a vanishing point.

Ely—Sixteen cars of blister copper from the Nevada Consolidated smelter at McGill were shipped recently. This leaves a balance of about forty-five cars of the original 10,000 tons of blister copper on hand. The entire amount should be forwarded soon. An increased force of men is now working in the Ely district.

CALIFORNIA

Bandits in Hold-up at Argonaut Mine Get $60,000 in Amalgam

San Francisco—The wave of banditry which has appeared in many localities in the United States has at last touched the Mother Lode region. Six men with sawed-off shot guns as visible accessories, held up the mill employees of the Argonaut mine, blew open the amalgam safe and departed with about $60,000 of gold in the form of amalgam. This amount weighed 455 lb. and the bandits made their escape in automobiles. At most Mother Lode mines, amalgam and bullion are placed in safes until shipped to the Mint at San Francisco. As employees are trustworthy, there is seldom need for armed guards and hold-ups are of rare occurrence. Apparently greater precautions are now necessary at all gold mines and gold-mining companies will find it the part of wisdom to reduce their carry of amalgam to a small limit and keep in touch with strangers and unknown visitors. In the smaller communities this can sometimes be effectively accomplished. Very likely the Argonaut gold will be recovered as it is extremely difficult to dispose of any quantity of gold without diligent inquiry as to its source.

Redding—Mining has been resumed at the Gladstone mine near French Gulch, Shasta County. The wire rope tramway cable from the Hornet mine to Mathewson is being placed in position. Increasing activity is noted in the small districts of Shasta, Siskiyou and Trinity counties. At Hayford a five-stamp mill has been installed on the Layman Bros.' mine. A rich gold vein has been reported about twelve miles from Yreka on the Shasta River. The Lorenz gravel mine is soon to be operated as sufficient water is available for hydraulicking. The electric smelter at Heroult on the Pit River, idle for over two years, is reported about to be sold.

Quincy—The Jamison gold mine near Johnsville, Plumas County, is reported to be operating fifteen stamps.

Downieville—Reports from Nevada County state that plans are being made to reopen in the spring a number of small properties, the Oro, the Oxford, the Big Boulder and the Finney. The Alleghany district is continuing its activities.

WISCONSIN

Wage Scale in Zinc-Lead District

Platteville—The wage scale now in force in the Wisconsin zinc-lead district approximates the following: Shovelers, $3 at day wage; $3 to $4.50 on contract; drill men, $3.50 at day wage; $3.50 to $4.50 on contract; trammers, $3.50 at day wage; $3.50 to $4.50 on contract; hoistmen, $3.50 to $4; grizzlymen, $3; crusher feeders, $2.50 to $3; ground foremen, $125 to $140 per month; millmen, $4.50 per day. Wages are based on the nine-hour day.

ARIZONA

E. P. & S. W. Cuts Rates on Ore to Douglas and El Paso—Most of Jerome-Verde Stock Exchanged —Silver Hills Co. Acquires Sunbeam

By JAMES H. MCCLINTOCK

Phoenix—Many impending railway changes are based on the transfer of the Arizona Copper properties to the Phelps Dodge Corporation. The Arizona & New Mexico Railroad Co. is to cease existence, its affairs to be administered from the El Paso offices of the El Paso & Southwestern system. The Morenci narrow-gage may be abandoned, this maintained heretofore mainly for the Phelps Dodge Detroit mines, and there may be a combination of all traffic service on the Coronado railroad, up Chase Creek canyon, with resultant economy.

The El Paso & Southwestern has made a material cut on ore rates to smelters at Douglas or El Paso, and will take less than carload shipments, above 4 tons, at 20 per cent above carload ton rates. Heretofore the rate on small shipments has been considered prohibitive.

About 88 per cent of Jerome-Verde stockholders have turned in their stock for exchange for the issue of Jerome-Verde Development Co. stock. The property has been transferred to the Development company. Outstanding mortgage notes of the Jerome-Verde have been called in, for payment, and United Verde Extension is startling a drift into Jerome-Verde ground from its 1,700 level.

Kingman—Rich gold ore has been brought from the Secret Pass section, where Robinson & Sands are working a 2-ft. vein. High assays have also been obtained from a vein of silver ore recently located by E. J. Welch in the Wallapai mountains.

L. D. Adams and associates plan to erect a large reduction plant at the old McCracken mine, in southern Mohave County, to handle a large tonnage of low-grade silver-lead ore developed above the 600 level.

Valuable borax deposits are reported to have been found by J. S. Porter, north of White Hills.

Katherine — In general, the mining properties of the new Katherine district appear to be of exceptional size. The Katherine, a developed bonanza, has a broad ledge, little change in assays being noted in a crosscut driven on the 500 level. In the Adams property, it is claimed, milling ore has been cut for about 50 ft. in a crosscut on the 100 level.

Two 75-ft. ledges are reported to be covered by the claims of the Sunbeam property, on which a shaft will be sunk halfway between the outcrops. The Sunbeam has been taken by the Silver Hills Co. of Nevada, at the head of which is W. J. Loring, president of the American Mining Congress. Report on the claims was made by C. C. Merritt.

COLORADO

Coal Stocks in State Large—Cresson Producing Heavily; Declares Extra Christmas Dividend

By Our Special Correspondent

Pending the required notice to the Colorado Industrial Commission of a 30 per cent wage reduction, a large number of the independent bituminous coal operators in the southern field have ceased operations. The operators claim that the reduction in wages is necessary in order that they may compete with the Colorado Fuel & Iron Co., since that company cut the price of coal $1 per ton following a 30 per cent reduction in the wages paid to its employees.

The Moffat Company, operating in the northern field, has closed down and it is believed that all northern operators will be forced to follow the lead of the southern operators, and that a 30 per cent reduction in wages will soon be effective in all Colorado coal mines. An exceptionally mild winter has seriously affected consumption and unusual stocks of coal are held in all parts of the state.

The Cresson Consolidated Gold Mining Company of Cripple Creek, has resumed the payment of quarterly dividends which were suspended in June, 1920, and has announced a 5 per cent quarterly dividend with an extra, or Christmas disbursement of 5 per cent, both to be paid on January 10. The payments total $122,000. The mine is producing heavily, and according to present indications, it is said, can easly maintain the 5 per cent quarterly dividend and set aside an equal amount for surplus.

Buena Vista—The Gladstone Mines Co., which is operating about fifteen miles southeast of here, has recently completed its 140 hp. hydro-electric power plant, and is now pushing to completion its fifty-ton concentrating mill. This property, until last year, had been idle for almost twenty-five years. Since resumption, the tunnel has been extended and a raise driven to connect with the old workings. Large bodies of ore are said to have been blocked out awaiting the completion of the mill.

MINNESOTA

Plantiffs in Hibbing Suit Ask Modification

Plaintiffs in the suit involving the moving of the village of Hibbing, Minn., have filed an appeal in the Supreme Court of Minnesota. Recently the court affirmed the decision of the St. Louis county district court in which the latter decided that no damages were allowable and that the defendants had not conspired in the moving of the village. The plaintiffs in the present appeal ask for a modification of the decision or for a re-argument of part of it. It is said that they may appeal to the U. S. Supreme Court, if this petition is denied.

ALABAMA

Republic Iron & Steel Co. Reported in New Merger—Talk of Making Aluminum at Muscle Shoals Stimulates Interest in Bauxite Deposits in State

BY GEORGE HUNTINGTON CLARK

Birmingham — Announcement just made of the fact that the Republic Iron & Steel Co. is included in one or the other of the two indicated new steel mergers has aroused much interest in the Birmingham district as to what use may be made of the blast furnaces, ore and coal mines, limestone quarries, and other property belonging to the southern branch of that company, situated in Alabama, in the event that the rumor is confirmed.

The recent visit of Mr. Ford and Mr. Edison to Muscle Shoals, and their assurances of widely diversified development in the event of favorable Congressional action on the Ford proposition as presumably amended, has had the effect of drawing the attention of capital for mining development to that immediate section of the state as well as apparently to the whole Alabama mineral district. These assurances are generally received as dependable, and local opinion is that the Ford proposition will be accepted.

Recent statements, attributed in part to Mr. Edison, relative to the possible manufacture of aluminum at Muscle Shoals by the use of the hydro-electric power available there, have greatly stimulated the opening of bauxite deposits which have hitherto been considered of too low a grade to be an economic source of that metal.

An active investigation is at present being made by the Alabama Geological Survey of the bauxite-ore deposits of the state as well as of the rock-asphalt deposits, in order to make available all information on the subjects with a view to assisting development.

For about thirty years Alabama has been a steady producer of high-grade bauxite ores derived mainly from the mines of the Republic Mining & Manufacturing Co., situated near Rock Run, Cherokee County. A recent study of this group of mines, numbering twenty or more, disclosed the fact that the total output of this one group to date has been approximately a quarter of a million tons of bauxite.

Two of the Republic mines, the Klondike and the Burst Up, are at present running [illegible], putting out about 1,000 tons per month, from a deep open pit, not a feasible or economic operation under extreme winter conditions.

An [illegible] and possibly a large amount of ore still remains in these properties. No attempt has been made to prospect them systematically, the output of the existing and active mines there having been constantly found sufficient for current requirements in connection with other active mines in Georgia, Arkansas, and Tennessee belonging to the same company.

THE MARKET REPORT

Daily Prices of Metals

Dec.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
8	13.50	31.375	31.625	4.70	4.35@4.40	4.85
9	13.50	31.625	32.125	4.70	4.35	4.80@4.85
10	13.50	32.125	32.375	4.70	4.35	4.80@4.85
12	13.50	32.875	33.25	4.70	4.35	4.80@4.85
13	13.50	32.375	32.75	4.70	4.35	4.80@4.85
14	13.50	32.50	33.00	4.70	4.35	4.80@4.85

*These prices correspond to the following quotations for copper delivered: Dec. 8 to 14 inclusive, 13.75c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Dec.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
8	67⅛	68⅛	75	166	168	25½	24¾	26⅜	26⅞
9	66¾	67¾	75	168¼	169¾	25½	24¾	26½	26⅞
10	...	...	...	...	...	...	...	...	...
12	66⅞	67⅞	74	171¼	173	25¾	25⅛	26⅝	27
13	66⅝	67⅝	74	169¾	171½	25½	24¾	26⅝	26⅞
14	66⅝	67⅝	74	170	171¾	25⅝	24⅞	26⅞	27¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Dec.	Sterling Exchange "Checks"	Silver			Dec.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
8	408½	99⅝	63¼	34½	12	420½	99⅝	66¾	35¾
9	410¼	99⅝	64¼	34¾	13	418	99⅝	65½	34⅞
10	412	99⅝	65¼	35½	14	417½	99⅝	66¼	35¾

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Metal Markets

New York, Dec. 14, 1921

Conditions have been dull in the local metal markets during the last week, with no price changes of importance.

Copper

There was somewhat of a lull in domestic business during the week, though export demand remained satisfactory. Most of the larger producers are now quoting 14c. delivered for shipment within the next three months, but they are not selling any copper. One of the larger producers and several of the smaller interests are still willing to sell at 13.75c., the demand not being sufficient to make them think an advance advisable. Some copper was sold on Monday and Tuesday at 13⅝c., but this could only be done where delivery charges were small, so that 13.50c. would be realized at the refinery. Sentiment among producers is distinctly bullish, and after selling well in excess of 400,000,000 lb. during the last three months, they are willing to rest on their oars until after the holidays, taking the export business and such domestic orders as can be obtained without cutting prices.

Lead

The official contract price of the American Smelting & Refining Co. remains at 4.70c. A fair amount of business has been done by this company and others at this level, but trade has been considerably less active than in recent weeks. In the Middle West a considerable amount of chemical lead is pressing for sale, and prices have been somewhat depressed as a result. Any amount of this grade of lead for December or January shipment can be obtained for 4.35c., and several sales of lots of from 100 to 200 tons have been made. We have had no reports of sales in which this figure has been shaded, despite the fact that offerings are very free at this level. Desilverized is without doubt selling at a premium both in St. Louis and Chicago, 4.55c. having been paid at Chicago for this grade by a careful buyer.

Lead is strong in the European markets, particularly for spot delivery, and with the advance in sterling, computations on Monday indicated that lead from producers in the Northwest might be shipped through the Panama Canal to London with approximately the same return as if sold in this country. Of course all Mexican lead has gone abroad for some time.

Zinc

The zinc market has been quiet. Practically all producers are willing to sell at present prices, but there is no wild scramble to market the metal. The market is improving for high-grade zinc, demand coming not only from brass makers but also from galvanizers who wish to improve the quality of their product, especially where it must resist bending. The price remains as for the last three months or so, at 6c., with freight allowed.

The American Zinc Institute issues the following statistics, expressed in tons: Stock on hand, Nov. 1, 1921, 70,824; produced in November, 21,135; total, 91,959. Shipped in November, 24,910; leaving stock on hand, Nov. 30, 67,049. Stored for account of customers (not included in stock on hand), 2,188. Total retort capacity, 155,656. Number of retorts available, 137,712. Average number of retorts operating during month, 46,567. Number of retorts operating at end of month, 46,444.

Tin

The price of tin has been at the mercy of a violently fluctuating sterling exchange market and consumers were timid. The 99 per cent grade continues scarce. Tin for March delivery was quoted as follows: Dec. 8th, 31.625c.; 9th, 32.00c.; 10th, 32.375c.; 12th, 33.25c.; 13th, 32.625c.; 14th, 33.00c.

Arrivals of tin, in long tons: Dec. 7th, Straits, 500; 8th, London, 25; 10th, Straits, 25; 12th, Straits, 275; Liverpool, 265; 13th, Liverpool, 25.

Gold

Gold in London: Dec. 8th, 100s. 11d.; 9th, 100s. 3d.; 12th, 98s. 10d.; 13th, 98s. 2d.; 14th, 98s. 9d.

Foreign Exchange

European exchanges, led by sterling, have been much stronger. Sterling gained 9c. during the week, and at one time was quoted at $4.25. The tone is distinctly strong as a result of the work being done towards a righting of the unsettled international financial situation. On Tuesday, Dec. 13th, francs were 7.96c.; lire, 4.56c.; and marks, 0.5475c. New York funds in Montreal, 8⅛ per cent premium.

Silver

Silver has been highly speculative the last week, with China operating as both buyer and seller. Purchases by the Indian bazaars and large sales of silver from the Continent have been opposing factors influencing the price. Add to this the fact that sterling exchange has registered a net advance of nine points during the week, fluctuating eight to ten points in one day, and it is not surprising that silver prices in London, New York and San Francisco have shown a wide range.

Mexican Dollars—Dec. 8th, 48¼; 9th, 48⅞; 10th, 50; 12th, 50⅞; 13th, 49⅞; 14th, 50½.

Other Metals

Quotations cover wholesale lots unless otherwise specified

Aluminum—20c. per lb. for 99 per cent grade; 19c. for 98@99 per cent; 18c. for 94@98 per cent. Outside market nominal at 17@18c. for 98@99 per cent virgin grades.

Antimony—Chinese and Japanese brands, 4.50c.; W. C. C. brand, 5.25@5.75c. per lb. Cookson's "C" grade, spot, 9c. per lb. Chinese needle antimony, lump, nominal at 4c. per lb.

Iridium—Nominal, $150@$170 per oz.

Palladium—Nominal, $55@$60 per oz.

Platinum—$75@$78 per oz. Market quiet.

Quicksilver—$49 per 75-lb. flask. San Francisco wires $47.50. Market better.

The prices of the following metals remain unchanged from the figures published in these columns on Dec. 3: Bismuth, Cadmium, Cobalt, Molybdenum, Monel Metal, Nickel, Osmium, Rhodium, Selenium, Thallium and Tungsten

Metallic Ores

Manganese Ore—23@24c., per unit, seaport; chemical ore, $55@$60 per gross ton, lump; $75 per net ton, powdered. Nominal.

The market is generally exceedingly quiet, and prices on the following ores remain unchanged from the figures published in the Market Report in the Dec. 3 issue: Chrome, Iron, Magnetite, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, Zircon, and Zirkite ores.

Zinc and Lead Ore Markets

Joplin, Mo., Dec. 10—Zinc blende, per ton, high, [illegible]; basis 60 per cent zinc, premium, [illegible]; Prime Western, [illegible]; fines and slimes, [illegible]; average settling price, all grades of blende, [illegible].

Lead, high, [illegible], basis 80 per cent lead, [illegible]; average settling price, all grades of lead, [illegible] per ton.

Shipments for the week: Blende, [illegible]; lead, [illegible] tons. Value, all ores the week, [illegible].

The demand for zinc ore was around 2,000 tons less than in the preceding week, with prices remaining unchanged. Production of lead is increased upward of 500 tons per week over the mid-summer period, and with this increased lead output a small increase of zinc was unavoidably made on account of the close association of the two ores. The lead market is particularly active on account of outside demand.

Platteville, Wis., Dec. 10—Blende, basis 60 per cent, $29. Lead ore, basis 80 per cent lead, $53 per ton. Shipments for the week, none. Shipments for the year: Blende 10,719; lead ore, 1,763 tons. Shipped during the week to separating plants, 600 tons blende.

Non-Metallic Minerals

Feldspar—No. 1 pottery grade, $6.50 per long ton; soap grade, $7.50, f.o.b. North Carolina points. A North Caroline producer reports the market very good and consumers willing to pay these prices and to contract for tonnages up to next summer. No. 1 Canadian, ground, $23, f.o.b. Ohio points.

Fluorspar—Gravel, guaranteed 85 per cent CaF_2 and not over 6 per cent silica, $20 to $22.50 per ton, f.o.b. Kentucky and Illinois mines. Acid, glass, and enamel grades, $32.50 to $50.

Sales of gravel fluxing spar have been made at $15 by smaller producers in Kentucky. Largest operators are holding at higher prices. One producer reports prices cannot be reduced without paying less than $3 per day for miners and other labor in proportion. Tonnage in 1921 has moved at the rate of 15 per cent of last year for this producer and consisted of acid and ground lump. Practically all the mines in the Kentucky field are closed. As all the fluorspar in the west Kentucky field has to be hauled to the railroad over poor roads, sometimes from three to twelve miles, it is doubtful whether more than 2,000 tons will be moved to the railroads before June 1, as no provision has been made to store the mineral for the winter. Increased demand for fluxing grades is looked for. Plentiful stocks are reported.

Fuller's Earth—16 to 30 mesh, $20 per ton; 30 to 60 mesh, $20; 60 to 100 mesh, $17; 100 mesh and over, $15, f.o.b. Pennsylvania points. Market quiet.

Graphite—Ceylon lump, first quality, [illegible] per lb.; chip, [illegible]; dust, [illegible]; No. 1 flake, [illegible]; amorphous crude, [illegible] per ton. All f.o.b. New York.

Talc—[illegible] mesh, [illegible] per ton, f.o.b. Vermont; [illegible] f.o.b. [illegible] Georgia.

Generally dull markets exist for the non-metallic minerals, and there is no appreciable change in the following from the prices published in our Dec. 3 issue: Asbestos, Barytes, Bauxite, Borax, Chalk, China Clay, Emery, [illegible], Kaolin, Limestone, Magnesite, Mica, Monazite, Phosphate Rock, Pumice Stone, Pyrites, Silica and Sulphur.

Mineral Products

Arsenic—7@7½c. per lb., f.o.b. New York.

Potassium Sulphate—Powder, domestic, 90c.@$1 per unit, basis 90 per cent, f.o.b. New York.

Sodium Nitrate—$2.50 per cwt. ex vessel, Atlantic ports.

The price of Sodium Sulphate and Copper Sulphate is unchanged from the quotations published Dec. 3.

Ferro-Alloys

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 12c. per lb. of chromium contained; 4 to 6 per cent carbon, 13c., f.o.b. works.

Ferromanganese—English and German, $58.35@$54, c.i.f. Atlantic seaports. Other quotations unchanged.

No quotable changes have taken place in the following ferro-alloys from the prices quoted in the Dec. 3 issue: Ferrotitanium, Ferrocerium, Ferromolybdenum, Ferrosilicon, Ferrotungsten, Ferro-Uranium, and Ferrovanadium.

Metal Products

Copper Sheets — Current New York list price, 21.25c. per lb.; wire, 15@15.25c.

Yellow Metal — Dimension sheets, 17.75c.; sheathing, 16.25c.; rods ⅜ to 3 in., 14.75c.

Lead Sheets, Nickel Silver, and Zinc Sheets unchanged from Dec. 3 quotations.

Refractories

Prices on the following are unchanged from the figures published in the Dec. 3 issue: Bauxite Brick, Chrome Cement, Chrome Brick, Fire Brick, Magnesite Brick, and Silica Brick.

The Iron Trade

Pittsburgh, Dec. 13, 1921

Production of steel ingots in November was at about 33 per cent of capacity, or at approximately the same rate as in October.

Operations appear poor when stated in percentage, but much better when stated in tonnage, as a 48 per cent operation [illegible] the same tonnage as was produced in 1915.

The Steel Corporation's unfilled obligations decreased by only [illegible] tons during November, but shipments, at about 675,000 tons, were the heaviest since last March, so that the bookings were about [illegible] tons, probably the largest since September, 1920.

Finished steel prices are practically stationary. [illegible] active competition, with [illegible] disposition to [illegible]. When the market broadens, [illegible] may [illegible]. [illegible] for the [illegible] with a light demand.

Pig Iron—[illegible]

Coke

Connellsville—Furnace, [illegible]@$3.50; foundry, [illegible] per ton.

The Copper Market Continues To Improve

Copper Prices Advancing Close to Level Permitting Resumption of Mining—Surplus Stocks Greatly Decreased—Position of Metal Becoming Sounder Than for Several Years—European Buying Maintains Its Importance

EDITORIAL MARKET STUDY

COPPER is finishing the year with a remarkable spurt, one that has already regained much of the ground lost earlier in 1921 and that bids fair to place the metal in a position which will allow American producers to view the reopening of their copper mines much sooner than anticipated a few months ago. Last August—the bluest month of the year for copper—saw the metal freely offered at 11.75c., with but few buyers. In the middle of December it is selling for 13.75c. to 14c., a rise of almost 20 per cent. The year is ending with copper selling at its highest point.

The rise, although gratifying to copper producers, has not been without criticism from consumers, some of whom have felt that the rise has been too sudden and may be overdone. It is easy to forget, after seeing copper selling for months at 12 to 12.50c., that the present improvement in the market has not even brought the metal back to a pre-war average price. Copper is still at an unusually low level.

The record for the last part of 1921 is especially pleasing when compared with a similar period last year. Then copper dropped steadily from 18.50c. in July to 12.375c. at the end of 1920. The present behavior of the market is a complete reversal of last year's record.

The patient is being cured by bitter medicine—an almost complete closure of American mines and some financial surgery which has alleviated the pressure of surplus stocks. These drastic measures have so improved the copper situation that a revival of the industry is not far off.

Indulged in prematurely resumption will not be beneficial. Starting operations has its difficulties as well as closing down. The answer to the question, When should copper mining be resumed? may be found in the address of C. F. Kelley, of the Anaconda Copper Mining Co., before the New York section of the A.I.M.E., in the emphasis he placed upon the dependence of the copper-mining industry upon European affairs. He looked for no sustained improvement until European difficulties of a political and financial nature had been removed.

Surplus stocks of copper which have long been a serious factor in the situation are now of secondary importance. At the beginning of the year almost one billion pounds of copper was available, a surplus which is now estimated at 600,000,000 lb. When it is recalled that 400 000,000 lb. of the surplus was earmarked for export by the Copper Export Association early this year, through the medium of a bond issue, and that thus the quantity of copper has been substantially reduced by export sales, present stocks do not appear formidably large.

It is to be noted from the table given below that exports of American copper have been equal to or heavier than domestic production plus imports for several months, so that domestic business of the copper producers is almost a direct measure of the reduction in surplus stocks. Should domestic deliveries of copper continue at 80,000,000 lb. monthly, exports at 50,000,000 lb. and production from all sources at 50,000,000 lb., not exorbitant figures, in from four to five months surplus stocks will be reduced to a more normal figure.

Resumption when it does occur will probably take place with a rush. Although ideally the lowest-cost producers should first begin to operate, and later the higher-cost operators, it is difficult to believe that this course will be taken, as after much "watchful waiting" by directors and stockholders there will be a natural eagerness to pay dividends and share in the improved market.

One of the encouraging features of the recent domestic buying movement is the participation of all classes of buyers. It is not believed that consumers are being forced to anticipate their requirements in order to make purchases at present low prices; the buying appears to be dependent on improved industrial conditions. Much copper has been sold to large electrical manufacturers for delivery as far ahead as next June, copper that would not have been contracted for unless the manufacturers were confident of the course of business during the next six months.

It is to be noted that during July, August, September, and October heavy shipments of brass entered the United States. Brass imports for the first ten months of 1921 are given in the following table:

	Brass (Fit Only for Remanufacture) In Pounds		Brass (Fit Only for Remanufacture) In Pounds
January	1,195,408	June	891,194
February	1,594,996	July	1,701,685
March	539,068	August	2,563,467
April	612,939	September	3,488,787
May	984,628	October	5,785,639

This scrap brass will be reworked in the United States for its copper and zinc content. It is held largely by producing interests that will handle its disposal carefully so as not to disturb the market unduly. This scrap will not have the importance the heavy imports would seem to indicate.

Export business in copper continued to be surprisingly good, considering the unsettled conditions still reported in Europe. Germany and Japan are the best purchasers. Adverse exchange rates have had little effect on this class of foreign trade, as the imported raw copper is worked up into some exportable manufacture and hence does not find permanent residence in the importing country.

Viewed from all angles, the copper situation is better than it has been at any time since the Armistice, discounting the inflation which carried the metal, in company with other commodities, to unhealthy high levels in 1919. Developments in the last ten weeks have placed copper in a much sounder position than it has been in for years, and although its position is not entirely satisfactory, should present developments continue, unemployment and the passage of dividends will no longer be troubles of the copper industry.

COPPER MOVEMENTS TO AND FROM THE UNITED STATES
In Pounds

	Average Monthly Pre-war	Jan., 1921	Feb., 1921	Mar., 1921	April, 1921	May, 1921	June, 1921	July, 1921	Aug., 1921	Sept., 1921	Oct., 1921
EXPORTS											
United Kingdom	5,583,000	8,668,000	18,970,100	7,407,000	7,976,600	6,765,000	2,826,300	1,597,100	1,234,400	2,688,600	449,000
France	11,530,000	15,012,000	10,243,000	2,926,000	10,800,000	4,455,000	7,310,600	4,710,400	6,091,400	7,100,200	8,463,500
Germany	18,366,000	18,802,000	20,725,000	19,021,000	15,838,000	7,074,000	22,485,400	23,687,800	16,428,100	24,999,400	15,455,100
Total (all countries)	67,266,000	54,855,399	62,480,000	38,720,000	41,495,000	35,378,000	50,169,400	51,771,800	42,891,000	63,717,700	52,486,500
IMPORTS											
Total (all countries)	28,350,000	31,136,000	30,056,000	12,808,000	29,569,000	12,689,000	20,967,100	32,095,800	23,126,000	19,168,600	24,122,000
U. S. Production (domestic)	95,610,000	90,586,000	86,633,000	91,046,300	46,946,500	41,072,000	24,623,700	22,034,000	23,248,400	23,855,300	23,231,600

Copper Before, During, and After the War*

By J. Parke Channing

THE STATEMENT is often made that the copper companies profiteered at the expense of the country during the war. I wish most emphatically to object to this statement. In 1914, just before the outbreak of the war, the price of copper was 14c. per lb. It gradually went up until in 1916 and 1917 it reached 31½c. per lb. Soon after we entered the war the copper producers voluntarily stabilized the price of copper at 23½c., a reduction of 8c. from the market price, and this price continued until the middle of 1918 when the cost of smelting and refining increased so much that the price was raised to 26c. Had a free market been left I have no doubt that all of the copper produced could have been sold at over 30c. per lb.

During the war period there was a marked increase in the cost of putting copper on the market; labor went up and its efficiency fell off; material, freight and taxes went out of sight, and if to these costs had been added the extra copper lost in the waste or tailing from the concentrator the margin of profit would not have been above normal.

Because, during the war, the mines in the United States increased their production from approximately one billion pounds to two billion pounds, the claim has lately been made that we are over-equipped for the production of copper. While there may be some truth in this, I believe the statement is not sound. During the war this tremendous production of copper was obtained by mining the richer portions of the orebodies and also by forcing the concentrators beyond their economic capacity. A mill which economically could treat 5,000 tons a day was forced up to 7,000 tons or 8,000 tons a day, the ore was not ground fine enough, and the result was that the loss in the tailing, or rejected material, was way above normal. In other words, during the war we were using the cream. I believe that the capacity of the United States today for normal production is about equal to what should be the normal consumption in the United States, plus its exports.

It is always difficult to predict the future. If we had all of the factors at our disposal pure logic would give us the result. Unfortunately, we have not. We know the capacity for production in the world and we, of course, in a general way, know the capacity of the world for consumption. There is before us a great era of development of hydro-electric power, both in the United States and in Europe. France and Italy are both developing their power in the Alps. It is a vital question with Italy, for she has no coal. France is determined to build a new industrial center protected from Germany by the Alps. Japan is going in for the development of electric power and its distribution, and in the United States the recent Congressional action permitting the development of water power, under the supervision of the Federal Power Commission, has resulted in the application for rights aggregating many millions of horsepower. A great number of these projects undoubtedly will be installed and they will all need enormous amounts of copper.

The surplus of copper in the United States left over from the war is being rapidly reduced and it is quite possible that in the early part of 1922 we may find it entirely gone. It will take time for the mines to gather together their workmen and get up to production, and even after they get going it will take from three to four months before the copper is in the final form for consumption.

My opinion is that the price of copper will stabilize itself at somewhere in the neighborhood of 16c. As a whole, taking into consideration the limited supplies of copper in the world and the enormous potential uses for it, I feel optimistic on the situation. We all must realize, however, that in pre-war times Germany was one of the largest consumers of copper, not only for herself but also in the manufacture of various articles which she shipped abroad, and unless industrial conditions in Germany become normal this former big customer of ours cannot take her regular supply. But when the time does come not only will she need it for current purposes but also to replace the large amount of copper which, during the war, she used up for munition purposes. We must realize that the world is one industrial unit and that until this unity is restored production and trade will not reach its full fruition.

In the first days of copper mining, with which I am acquainted, that is, back in the early eighties, a large proportion of the copper in the United States came from the Lake Superior district in Northern Michigan. Here copper occurs in native form and all that it is necessary to do is to stamp the rock and by water concentration get out the fine particles of copper, which are then melted into merchantable form. Montana was just about beginning to produce and was mining rich sulphide ores which at first were shipped abroad and smelted and later treated on the ground. Arizona was also producing copper from comparatively rich oxidized ores in the Clifton and Globe districts.

In the middle eighties the price of copper was particularly low and the uses of it were not great. In the late eighties the electrolytic development in the United States and the world began and there was a gradual increase in the demand for copper, which was met by a more rapid exploitation of the mines. About 1900 the supply of copper ore in the United States seemed extremely limited and the question was from whence her supplies of copper would come. Fortunately about that time there were discovered and developed what are known as the "porphyry" mines, large irregular masses of material lying comparatively flat and near the surface of the ground.

We cannot strictly say that these "porphyries" were *discovered* in the early part of this century. They had, in a vague way, been known to exist but had not been considered as of value. Finally, however, with improvements in mining and in the treating of ore, it was realized that material even as low in grade as 1½ per cent was of value. There thus was rapidly developed such "porphyry" mines as the Nevada Consolidated, Utah, Miami, Ray, Chino and Inspiration. In these properties millions of tons of ore were developed by putting down churn drill holes which delimited the area underlain by ore, gave its thickness and enabled one to calculate with reasonable accuracy the amount of ore available. With these figures in hand and after preliminary experiments in the treatment there was no difficulty in raising the necessary capital to develop and equip these properties.

The orebodies of the Nevada Consolidated, the Utah Copper, and the Chino were so near the surface that all that was necessary was to strip off the overburden with steam shovels and mine the ore by the same methods. In the case of the Miami, Inspiration, Ray and part of the Nevada Consolidated, underground, or so-called caving methods of mining were resorted to, these methods having been developed in the Lake Superior iron ranges.

In the early days of "vein" mining the mine that produced 1,000 tons of ore a day was considered a good-sized property, but today some of the "porphyry" mines have a capacity of from 5,000 to [illegible] tons a day. This of course necessitated the construction of large mills beside which the old concentrator of 1880 could be hidden and lost.

The "porphyry" mines have been worked for very nearly fifteen years and at present are the main source of production in the United States. In the meantime, there have been discoveries of some large deposits in South America and also in Central Africa but, as a whole, I think we can safely say that the copper resources of the world are extremely limited, in fact they are more limited than any other of the baser metals, and unless new deposits are found we will be threatened in fifteen years with another shortage of copper.

---

*Abstract from an address before [illegible] of the American Legion, Dec. 11, 1921.

MINING STOCKS

Week Ended December 10, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Ahmeek	Boston	62	58	60	Sept. '20, Q	$0.50
Alaska-Br. Col. new.	N. Y. Curb	3	2¼	2⅝	....	
Allouez	Boston	23	23	23	Mar. '19	1 00
Anaconda	New York	49⅛	46½	48⅝	Nov. '20, Q	1.00
Arcadian Consol.	Boston	3⅛	3	3	....	
Ariz. Com'l	Boston	9¼	8⅞	9	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*30	*25	*25	....	
Bingham Mines	Boston	13	13	13	Sept. '19, Q	.25
Calumet & Arizona	Boston	58	54½	58	Sept '21 Q	50
Calumet & Hecla	Boston	260½	253½	260	June '20, Q	5 00
Canada Copper	N. Y. Curb	*30	*28	*29	....	
Centennial	Boston	9½	9½	9½	Dec. '18, SA	1 00
Cerro de Pasco	New York	35¼	33½	35¼	Mar. '21, Q	.50
Chile Copper	New York	[illegible]	[illegible]	12¼	....	
Chino	New York	28¼	26⅞	28¼	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*10½	*10½	*10½	....	
Con. Arizona	N. Y. Curb	....	....	*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1⅜	1¼	1½	....	
Copper Range	Boston	40	39	39¼	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*51	*38	*49	....	
Davis-Daly	Boston	6¾	5⅞	6⅛	Mar. '20, Q	.25
East Butte	Boston	10½	9⅞	10⅜	Dec. '19, A	.50
First National	Boston Curb	*89	*80	*80	Feb. '19, SA	.15
Franklin	Boston	1⅞	1¾	1⅞	....	
Gadsden Copper	Boston Curb	*45	*45	*45	....	
Granby Consol.	New York	29½	26½	29½	May '19, Q	1.25
Greene-Cananea	New York	28	25⅝	28	Nov. '20, Q	.50
Hancock	Boston	2⅛	2	2⅛	....	
Howe Sound	N. Y. Curb	2¾	2½	2½	Jan. '21, Q	.05
Inspiration Consol.	New York	40	37½	40	Oct. '20, Q	1.00
Iron Cap	Boston Curb	7	7	7	Sept. '20, K	.25
Isle Royale	Boston	24	23	24	Sept. '19, SA	.50
Kennecott	New York	27	25⅛	27	Dec. '20, Q	.50
Keweenaw	Boston	1¾	1⅝	1⅝	....	
Lake Copper	Boston	3	2¾	2¾	....	
La Salle	Boston	1¾	1¼	1½	....	
Magma Chief	N. Y. Curb	....	....	*8	....	
Magma Copper	N. Y. Curb	22	21	22	Jan. '19, Q	.50
Majestic	Boston Curb	*5	*5	*5	....	
Mason Valley	Boston	†2	†1¼	1¾	....	
Mass Consolidated	Boston	2½	2	2½	Nov. '17, Q	1.00
Miami Copper	New York	27	25⅝	26½	Nov. '21, Q	.50
Michigan	Boston	†3	†2	2	....	
Mohawk	Boston	58	55⅛	58	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	5⅝	5	5⅝	....	
Nevada Consol.	New York	15	13⅞	15	Sept. '20, Q	.25
New Cornelia	Boston	17	16½	17	Aug. '20, K	.25
North Butte	Boston	12⅜	12⅛	12¾	Oct. '18, Q	.25
North Lake	Boston	†*50	†*15	*24	....	
Ohio Copper	N. Y. Curb	*13	*10	*13	....	
Old Dominion	Boston	25	23½	25	Dec. '18, Q	1.00
Osceola	Boston	32	31	33	June '20, Q	50
Phelps Dodge	Open Mar.	†185	†175	...	Oct. '21, Q	1 00
Quincy	Boston	46	41	45½	Mar. '20, Q	1.00
Ray Consolidated	New York	15	14⅜	15	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*20	*18	*18	....	
St. Mary's Min. Ld.	Boston	44½	42½	44½	June '20, K	2.00
Seneca Copper	Boston	....		24½	....	
Shannon	Boston	1¼	1½	1¼	Nov. '17, Q	.25
Shattuck Arizona	New York	8	7¼	8	Jan. '20, Q	.25
South Lake	Boston	*60	*60	*60	....	
Superior & Boston	Boston	1½	1¼	1⅜	....	
Tenn. C. & C. cfs.	New York	10¼	10	10¼	May '18, I	1.00
Tuolumne	Boston	*79	*63	*65	May '13	.10
United Verde Ex.	Boston Curb	29¾	28	28½	Nov. 21, Q	.25
Utah Consol	Boston	2⅛	1¾	2	Sept. '18,	.25
Utah Copper	New York	65	59⅜	64¼	June '21 Q	.50
Utah Metal & T.	Boston	1½	1¼	1¾	Dec. '17,	.30
Victoria	Boston	1⅞	1¾	1⅞	....	
Winona	Boston	*45	*45	*45	....	
Wolverine	Boston	11	10¾	10¾	....	
		NICKEL-COPPER				
Internat. Nickel	New York	12	11½	12	Mar. '19,	50
Internat. Nickel, pf.	New York	69½	69	69½	Nov. '21, Q	1.50
		LEAD				
National Lead	New York	86	80¼	85¾	Sept '21, Q	1 50
National Lead, pfd.	New York	107	105¼	105	Sept '21 Q	1 75
St. Joseph Lead	New York	13½	13¼	13¼	Sept. '21, Q	.25
		QUICKSILVER				
New Idria	Boston	†*50		*50	....	
		ZINC				
Am. Z. L. & S.	New York	13¼	11¾	13	[illegible] '20,	1 00
Am. Z. L. & S. pfd	New York	39¼	35¼	38	[illegible] '20, Q	1 50
Butte C. & Z.	New York	5¼	5	5½	June '18,	50
Butte & Superior	New York	18¼	16¼	18	Sept. '20,	1 25
Callahan Zn-Ld.	New York	6¼	5¼	6½	Dec. '20, Q	50
New Jersey Zn.	N. Y. Curb	125	124	[illegible]	[illegible] '21 Q	2 00
Yellow Pine	Los Angeles	*37½	*37½	*37½	Sept. '20, Q	03

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil; Colorado Springs, The Financial Press, N. Y.

Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	½	⅜	½	....	
Alaska Juneau	New York	⅞	¾	¾	....	
Carson Hill	New York	12¼	11¾	12¾	....	
Cresson Consol. G.	N. Y. Curb	2 11/16	2 9/16	2 9/16	June '20, Q	$0.10
Dome Extension	Toronto	*71	*71	*71	....	
Dome Mines	New York	19¼	18⅝	18⅞	Oct. '21, Q	.25
Florence Goldfield	N.Y. Curb	*36	*30	*33	....	
Golden Cycle	Colo. Springs	*76	*73	*73	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	.		*3	Dec. '19,	.05
Hollinger Consol.	Toronto	7.85	7.77	7 84	Dec. '21, 4 wks.	.05
Homestake Mining	New York	56	55	56	Nov. '21, M	.25
Kirkland Lake	Toronto	*33	*31	*32½	....	
Lake Shore	Toronto	1.22	1 19	1.21	Nov. '21, K	.02
McIntyre-Porcupine	Toronto	2.01	1.96	2 00	Sept. '21, K	.05
Porcupine Crown	Toronto	*14½	*12½	*13	July '17,	.03
Porcupine V. N. T.	Toronto	*18	*15¼	*17	....	
Portland	Colo. Springs	*42	*40	*42	Oct. '20, Q	.01
Schumacher	Toronto	*29	*24	*28	....	
Silver Pick	N. Y. Curb			*7	....	
Teck Hughes	Toronto	*16½	*15¼	*15¾	....	
Tom Reed	Los Angeles	*39½	*37	*39½	Dec. '19,	.02
United Eastern	N. Y. Curb	2 7/16	2 5/16	2⅜	Oct. '21, Q	.15
Vindicator Consol.	Colo. Springs	*23½	*22½	*23	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*4	*4	*4	....	
Yukon Gold	N. Y. Curb	1 1/16	1 1/16	1 1/16	June '18,	.02½
		SILVER				
Batopilas Mining	New York	⅝	⅝	⅝	Dec. '07, I	.12½
Beaver Consol.	Toronto	*25	*22½	*24½	May '20, K	.03
Coniagas	Toronto	1.50	1 15	1.30	May '21, Q	.12½
Crown Reserve	Toronto	*10	*8½	*8½	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3½	3⅜	3½	Oct. '21, Q	.12½
La Rose	Toronto	*33½	*32	*32½	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*17	*14	*17	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.15	1.00	1 14	Sept '20, Q	.12½
Nipissing	N. Y. Curb	6⅜	6⅛	6⅛	Oct. '21, Q	.03
Ontario Silver	New York	4⅛	4⅛	4⅛	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb		.	*12	Jan. '12,	.10
Temiskaming	Toronto	*27	*25	*26	Jan. '20, K	.04
Trethewey	Toronto	*10½	*8	*9	Jan. '19,	.05
		GOLD AND SILVER				
Boston & Montana	N. Y. Curb	*85	*78	85	....	
Cash Boy	N. Y. Curb	*8	*6	*6	....	
Dolores Esperanza	N. Y. Curb	1¼	1¼	1¼	....	
El Salvador	N. Y. Curb	*10	*9	*9	....	
Jim Butler	N. Y. Curb	*6	*5	*6	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*2	*2	*2	June '16,	.05
Louisiana Con.	N. Y. Curb	...	...	¼	....	
MacNamara M.& M.	N. Y. Curb	*13	*10	*11	May '10.	.02½
Tonopah-Belmont	N. Y. Curb	1⅝	1 7/16	1½	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*62	*55	*61	....	
Tonopah-Extension	N. Y. Curb	1⅝	1 7/16	1 7/16	Oct. '21, Q	.05
Tonopah Mining	N. Y. Curb	1 7/16	1 5/16	1 5/16	Oct. '21, SA	.05
West End Consol.	N. Y. Curb	*85	*80	*82	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N. Y. Curb	*7	*6	*7	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	†1 00	†*85	*92	Dec. '20,	.15
Chief Consol.	Boston Curb	2¾	2½	2¾	Aug. '21, Q	.05
Consol. M. & S.	Montreal	19	18	19	Oct. '20, Q	.62½
Daly Mining	Salt Lake	..	†1 00	...	July '20, Q	.10
Daly-West	Boston	†3½	†1½	1½	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†3	†2	2⅛	Apr. '21, K	.05
Electric Point	Spokane	*3	*3	*3	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*33	*26	*28	....	
Federal M. & S.	New York	9	7	8½	Jan. '09,	1.50
Federal M. & S., pfd	New York	33½	29¼	33½	Sept. '21, Q	1.00
Florence Silver	Spokane	*17	*13	*17	Apr. '19,	.01½
Grand Central	Salt Lake	*36	*35	*36	Jan. '21, K	.01
Hecla Mining	N. Y. Curb	4½	4 5/16	4½	Sept. '21, Q	.10
Iron Blossom Con.	N. Y. Curb	*20	*18	*18	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	2 70	2 50	2 50	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*3	*3	*3	June '21, I	.02
Prince Consol.	Salt Lake	*6½	*6	*6	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*4	*3½	*3½	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*9	*7	*7	....	
South Hecla	Salt Lake	†*50	†*20	....	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*10	*10	*10	Oct '17,	.05
Stewart Mining	N. Y. Curb	*3	*3	*3	Dec '15	.05
Tamarack-Custer	Spokane	2 25	1 95	2.10	Jan. '21 K	.04
Tintic Standard	Salt Lake	1 97½	1 95	1 95	July '21, Q	.05
Utah Apex	Boston	3	2½	2½	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	....	....	*1	Nov. '17,	.01
		VANADIUM				
Vanadium Corp.	New York	35	31½	32½	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	59	52	53	Oct. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	78	75¼	76½	Oct. '21, Q	1.75
		SULPHUR				
Freeport Texas	New York	15½	14	14½	Nov. '19, Q	1 00
Texas Gulf	New York	34¼	32¼	32¼	....	
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	46½	43⅛	46¼	Mar. '21, Q	1 00
Amer. Sm. & Ref. pf	New York	89⅛	88	88¼	Dec. '21, Q	1.75
Am. Sm. pf. A	New York	87¼	87¼	87¼	Oct. '21, Q	1.50
U. S. Sm. R. & M.	New York	36½	34	36½	Jan. '21, Q	.50
U.S.Sm R & M. pf.	New York	43¼	42½	43¼	Oct. '21, Q	.87½

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor.
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

A Weekly Journal of the Mining and Mineral Industries
METALS NON-METALS PETROLEUM

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, December 24, 1921 *Number* 26

Stand by the Federated American Engineering Societies

THE Federated American Engineering Societies have had a year of trial. It has been a year of experiment and adjustment. American Engineering Council, as the executive committee of the Federated Societies is confusingly called, has had its troubles. The Civil Engineers, a fine body, have not come in. A great many Western organizations of lesser type have come in, swelling the numbers who clamor for representation and diminishing the attention which the "founder societies" may expect. American Engineering Council has not been entirely clear what it was it was expected to do, or how to do it. The societies which compose this league have expected star performance from the new broom, but have no idea what should be done or how it should be done; and they have not helped much with their guidance.

Our own American Institute of Mining and Metallurgical Engineers has suffered a relapse into indifference as to the Federated Societies. The mining industry has received scant and doubtful attention from the Washington organization. Such general work or investigation or propaganda as the Federated Societies have undertaken for engineering in general or the world at large (as in the report of the Committee on the Elimination of Waste in Industry) have not appealed to some of the mining engineers as being thorough, or carefully considered, or wisely decided. They have expected expert and satisfactory leadership, and they do not sense it. They feel that they are not getting their money's worth.

We must get on a plane a little elevated and detached to solve this problem. Distinguish, first, between the advancement of the mining industry and the advancement of the engineering group or class. The Federated American Engineering Societies can never—will never—properly or adequately represent the mining industry. Your mining and metallurgical engineer has two sides—first, he is interested in the mining industry; second, he is a member of the engineer class. He accordingly desires the protection and advancement and extension of influence of both. For the mining industry the mining engineer will depend on the American Institute itself and on the independent mining press for his technical progress, on the Mining and Metallurgical Society of America and the independent mining press for his information concerning policy problems, and on the American Mining Congress and the independent mining press for the representation of the industry at the seat of government.

For his interest and ambition and loyalty as a member of the great engineer class, however, he has no group representation if he abandons or helps to scrap the Federated Societies. Regardless of what has been done, whether you approve its first halting and tentative steps or not, stay with it! The idea of its organization was excellent and necessary; and the details can be arranged. Guide it, lecture it, help it, quarrel with it; but stay with it. Rome wasn't made in a day. We sympathize and agree in the main with the adverse criticisms as to the ineffectiveness during the past year of the Federated Societies. Nevertheless, it would be foolish to abandon the good ship because we do not like the course or the weather.

Freight Rates on Farm and Mine Products

THE PRESSURE of the farmers' "bloc" in the Senate, and the representation that the prosperity of farmers is being seriously affected by reduced price for their products, while costs, such as those of transportation, remain disproportionately high, has resulted in a voluntary proposal by the railroads to make a 10 per cent decrease in freight rates on agricultural products, and this proposal has been accepted by the Interstate Commerce Commission.

We congratulate the farmers on this much reifef in the pressure of operating costs; but why is not the same cut made for all raw materials produced? Why does it not extend to the raw materials produced by mines, which furnishes the bulk of all freight and is the basis of the bulk of our manufactures? Surely the argument for the farmers holds good for the miners, for they are far from prosperity, to the extent that many plants are inoperative; and the fact that there has been no decrease in transportation charges is one of the elements of the existing situation that prevents them from operating. High transportation charges and excessive taxes are among the chief obstacles to their return to prosperity.

The railroads hold one of the important keys to industrial activity. The higher they make their charges, the less business they are likely to get. As they can reduce, mines as well as farms will see their way clear to operate. If we look on the whole country as one gigantic industry, certainly we could afford to run the railroads at cost—and at as low a cost as possible—in order that transportation, without which there can be no mines or factories, might be made easily available.

Conditions are changing for the better, however, and rates have already been materially lowered in individual cases. The Southern Pacific, for example, has made general reductions; and on the tenth of this month the rate on metal from St. Louis to New York and other Eastern points was reduced approximately 25 per cent.

The railroads have taken the desired steps largely as a result of wage decreases, allowed and expected. The first one, of twelve per cent, went into effect last July; another of ten per cent has been asked. These wage decreases, if made gradually and in accord with the declining cost of living, seem just and the best way to effect the desired reduction in rates. A revision of the working rules, allowing a man to do more and different kinds of work in his eight hours, is also possible, and a substitute for part of the wage reductions that existing conditions have made inevitable.

Strike threats need cause little worry now. Recently we were interested in hearing Mr. W. G. Besler, president and general manager of the Jersey Central, speak of the preparations made for handling the strike called for Nov. 1. It is altogether likely that had the order of the unions stood, the walkout would have been a complete failure. There were more than enough men, most of them experienced, ready to accept the jobs of any so foolish as to strike, and there would have been little disruption of traffic. Most of the jobs on a railroad are not highly skilled and most of the employees in all branches have not had more than a grade-school education. A young man possessed of common sense and an ordinary amount of latent intelligence can be taught to fill almost any railroad position in from one to two days, according to Mr. Besler.

The American Zinc Institute Pioneers

OUR READERS are possibly not all aware of the monthly publication in these pages of valuable and timely statistics covering zinc production, shipments, and retort capacity, figures which we are permitted to use through the kindness of the American Zinc Institute, whose able secretary, Mr. Stephen S. Tuthill, compiles them. The issuance of this statistical information marks a distinct step forward in the dissemination of compilations which private research and business associations generally have held and do hold as strictly confidential and only for their own eyes.

The American Zinc Institute is young and virile. Already it has brought a spirit of co-operation among its members that has largely dispelled any distrust and enmity that formerly existed. It is probable that much internal persuasion and discussion preceded the decision to make public these statistical figures; and, now that it has been done, have the zinc producers found that it affects their pocket-books? Will it affect competition with their fellow producers? Will it have any undesirable effects? Assuredly not. It is far better to acquaint the public of the true status of any metal situation than to have it influenced by guesswork and fly-by-night rumors. The joke of it is that private statistical organizations are usually unable to prevent leaks, so that their statistics are generally freely published by the press.

There is another point that perhaps ought not to be overlooked. During the last year many so-called statistical bureaus, particularly those having to do with the building trades, have fallen into ill repute because of nefarious practices in the collecting and dissemination of price statistics, bids, and other matter. Although ostensibly formed for the purpose of collecting harmless statistics, some vicious activities were shown to be concealed. By making their statistical information public, as the American Zinc Institute has done, statistical organizations cannot help but merit the confidence of the public in what they are doing.

That the zinc industry, which has often been criticised for its secretiveness, should be the first to take this forward step is deserving of especial commendation. We hope the movement will spread to other metal groups.

German Economics and German Propaganda

AT A RECENT MEETING of the New York Section of the American Institute of Mining and Metallurgical Engineers, Dr. Richard Moldenke gave some account of German conditions and their relation to American industrial prosperity. Dr. Moldenke pointed out, what we all know, that the purchase by Germany of our raw materials, as of old, would promote our prosperity. The trouble was (which we also all know) that Germany has no money to buy with. Dr. Moldenke had visited Europe and talked with President Ebert and Hugo Stinnes, the Teuton financial octopus; and it was to be inferred accordingly that he had big news, straight "from the inside"; was, indeed, the bearer of an important message.

Did the United States wish again for the boom days of prosperity, which could only be obtained by German buying? Let the United States supply the raw materials without money, but on credit—two, five, or ten years—so that Germany could manufacture, and sell her manufactures—not in America, in competition with American goods. Oh, dear, no—in Russia. Only German culture could revive the vanished civilization of Russia.

Of course, the reparations conditions must be amended, so that Germany could pay. One thing more, also, America must do, if she is to be prosperous. She must see that the Treaty of Versailles is changed. She must see at once that Germany gets back Alsace-Lorraine, Upper Silesia, and Danzig. This is the only thing that will prevent the next war, for which the Germans are already planning, to achieve their revenge, and win back their lost territory. The next war, said Dr. Moldenke, will not be a naval war, a war between armies, a submarine, or an airplane war; it will be a chemical war, and at the proper moment Hell, he implied, would break loose. If we would purchase immunity, we gathered (for were we not and are we not allies of France and of England?), we must immediately get busy to see that the Treaty of Versailles is abrogated, goods for Germany's factories are supplied without pay, and the exploitation of Russia turned over, as a compensation for her wrongs, to Germany.

All of which sounds astonishingly like the crude and insistent propaganda with which we were bombarded before the war and in the early stages of it. Can the leopard change his spots? Dr. Moldenke unwittingly portrayed an unregenerate, treacherous and vindictive Germany, the same Germany that broke her faith with Belgium, systematically wrecked the industries of France, and torpedoed passenger ships—the Germany of efficient frightfulness. And if we should take the implied message from Ebert and Stinnes at what it appears, our obvious reaction would be to cease blaming Briand for his plea for retaining a strong French army of defense; and to advise him at once to march to Berlin and operate under a receivership a country bankrupt, not only in finance, but also in the possibilities of reform and regeneration.

Most Christian German gentlemen: We of the United States have just finished helping to save the world from your undesirable domination. The price you ask as a return for taking our copper and cotton without pay—that of betraying Europe again, and incidentally ourselves, into your power—is too great. Keep your paper marks at home—and your propaganda. You have to deal with a new and wiser America.

L. V. J. Kimball, Romantic Geologist

A CORRESPONDENT sends us a clipping from the Lordsburg (N. M.) *Liberal*, of Nov. 10, being a published report on the properties of Pierce-Hardin & Co. in Frio County, Tex. In this report is given very cheering news concerning the property of the company:

"This tract of land—3,327 acres, on the Brown holdings is indeed a veritable treasure-house of oil, of the best grade known to commerce. It is located on one of the larger rivers of the Carboniferous Age; one of the western rivers of the great Mississippi Valley. These rivers of the Carboniferous Age are the oil depositories of the world. . . . In about the 300-ft. level you will strike sufficient gas to run all your machinery, and about the 600-ft. level you will strike lubricating oil in paying quantities. In about the 2,000-ft. level you will strike gusher oil."

Our correspondent writes:

"'Scientific Geologist' L. V. J. Kimball, for the enlightenment of the mining fraternity, will tell you in this article that the rivers of the Carboniferous Age are the oil depositories of the world. While Mr. Kimball was in Lordsburg getting up a tremendous enthusiasm in oil, out of which was born the Pierce-Hardin Oil Co., he gave some extremely interesting lectures and demonstrations with his magnetic-galvanic-static-electro oil finder, showing that great rivers of petroleum flowed across the land, draining the Mississippi Valley in Carboniferous times and draining into Texas, with one branch draining into New Mexico near Lordsburg, as the Kimball electro-galvanic-static oil detector 'proved.' It was described how, later, these petroleum rivers became covered up by dust storms, but were still flowing beneath the soil into Texas and forming lakes underground there, and under Lordsburg, and thence overflowing and streaming on to Tampico and connecting up there with the lower strata of the Gulf Stream. So great was the enthusiasm generated in Lordsburg when it was learned and proved by the 'detector' that a Carboniferous river flowed under Lordsburg, that $50,000 was subscribed for immediately in the town and the Pierce-Hardin Oil Co. was formed, headed by Mr. Hardin, the present postmaster of Lordsburg, and drilling was started at once near Lordsburg. A number of subsidiary companies were formed, one of which is incorporated as the Hardin Oil & Gas Co. and another the Buffalo Bull Oil Co., which also has a rig west of Lordsburg and is down 300 ft. now. The most reliable citizens of Lordsburg are directors of the electro-galvanic-static syndicate. Mr. Hardin, the honorable postmaster, is president, while R. Spann, well-known attorney, is attorney; while C. Schaber is prominent in the activities of the concern. . . . I forgot to add that I understand that a syndicate is now forming in Lordsburg, whereby it is aimed to devise a long extension tube to which extensions can be added to let this down into the lower strata of the Gulf Stream from a chartered barge off the coast of Florida. A compressor will force the air out, when it is the expectation of the syndicate that the lower strata of the Gulf Stream, which is rich in oil, will rise to the top, making an inexhaustible well, thereby, smoothing and oiling the financial waters of the syndicators. The Carboniferous Rivers of Petroleum, it has been proved by the 'detector,' are flowing from Texas and Lordsburg to Tampico, where they empty subterraneously into the ocean, thereby being one of the fundamental causes of the Gulf Stream. It is the same Kimball who a year or so ago went to California and demonstrated blindfolded with his 'detector' and attracted some attention at that time, but failed when, blindfolded, he was led on top of a large oil tank and the 'detector' showed no activity. Know that this galvanic-electro-static 'detector' will not only tell to the foot how deep the oil is, but it will tell the quantity and the grade as well as which direction the stream is flowing (which is generally Tampicoward) and the speed of the stream flow and whether or not it is dammed up into a lake or merely a river (Carboniferous)."

These are very remarkable claims which Mr. Kimball puts forward. It is, moreover, interesting to note that he is a "scientific" geologist, recording the swing of the pendulum of nomenclature. For twenty years the tendency among geologists has been to become "practical" geologists, and accordingly various special societies have arisen, among them a thriving and numerically strong association of petroleum geologists, in Texas. From these "practical" geologists of Texas Mr. Kimball plainly wishes to be distinguished. He desires it to be understood that he is a scientific geologist, just as the barber loves to hang out his sign that he is a practical hair cutter. The precaution is unnecessary, in either case. Certainly nobody would suspect Mr. Kimball of being practical nor the barber of being scientific. But there are also among our readers those who would challenge Mr. Kimball's claim that he is scientific, and petition that his designation be changed to Romantic Geologist. And the romance-spinner always has the larger audience, and runs to best-sellers. Down the Carboniferous rivers of Texas a sucker slips every minute.

The Mission of the Business Press

THE TECHNICAL, business, or industrial press, with which class of publications *Engineering and Mining Journal* is to a degree affiliated, since it serves the mining industry, is assuming an increasing responsibility in giving to its great mass of intelligent readers sound facts respecting political, civic, and industrial conditions and problems, and pointing out the logical conclusions and the indicated trend of events and necessary course of individual action.

At a recent annual meeting of the Canadian National Newspapers and Periodicals Association, the Lieutenant Governor of Ontario, Colonel Henry Cockshutt, a prominent business man and financier, said:

"I make a distinction between the business newspapers and the daily press because I believe that your papers—the business newspapers of Canada—exert a greater influence than the daily press because of the greater confidence your readers have in them. People read daily newspapers to satisfy their desire for excitement or interest or entertainment. But this is not the case with the business newspaper. Business men need the service of these papers in the conduct of their everyday business life.

"In these days when there is disorganization, dissension, disruption in all walks—business, politics, and religion—there is a great place for the business paper to bring out more complete information, to assist in making us all realize we must work for a common cause, the upbuilding of our country. The business men of this country need your assistance. They are looking to you for information and advice, and are expecting it. On your shoulders, therefore, perhaps more than on the shoulders of any other single agency, rests the obligation to meet the needs of these trying days, with a sane and sound presentation of the case as it exists at the present time, a presentation free from private bias, or the desire to serve a popular demand."

It is interesting to note the last sentiment, and pleasant to report that there seems to exist a great and growing purpose among industrial journals, not only not to cater to public taste or demand, and also not, of course, to the taste and demand of any private interest, but, moreover, to set up the lofty and sound principle that they will not campaign for any benefit for the industry they individually represent if that special benefit be not for the interests of the whole nation. Adequate principles are thus developing, proportionate to the growing influence and responsibility of this type of scientific journalism, so especially devoted to sober truth telling.

WHAT OTHERS THINK

Electrical Prospecting for Gold

In the Oct. 8 issue of *Engineering and Mining Journal*, in response to an inquiry by a correspondent, appeared the statement that no system of prospecting by electricity for gold ore had ever proved successful. Specific mention was made of the article abstracted from my translation of Professor Schlumberger's book which appeared in the *Engineering and Mining Journal* of May 7 and 14 of this year.

I have been carrying on experiments with Professor Schlumberger's method in several mining districts of the United States and Canada, among others the gold camps of Timmins and Kirkland Lake. The system was in the main successful. At Timmins I obtained good results on auriferious pyrite veins impregnating the country rock in the neighborhood of quartz stringers. Where the mineralization was confined to the quartz, not extending to the wall rock, the results were negative. This was to be expected, for where the mineralization is in quartz the individual grains of sulphide are electrically insulated one from another and oxidization is negligible. This prevents the generation of an electrical current through the chemical process of oxidization, described under the head of "Spontaneous Polarization" in the article mentioned.

At Kirkland Lake, where the mineralization is auriferious pyrite disseminated in vein-like zones of siliceous porphyry, the electrical situation is analogous to that of pyrite disseminated in quartz, and the results with electrical prospecting were equally negative. However, on one property the mineralization was rather heavy in schistose graywacke. Here the conditions for spontaneous polarization were ideal, and excellent results were obtained.

Incidentally, I may remark that excellent results have also been obtained by this method on other deposits of copper sulphide, nickel sulphide, and cobalt sulphide.

Obviously, from the theory of spontaneous polarization, bodies of native gold will give no reaction whatever, and to such deposits this method of electrical prospecting is absolutely inapplicable.

From the foregoing it will be seen that Schlumberger's method may be expected to work on certain types of orebodies carrying gold values. SHERWIN F. KELLY.

Lawrence, Kan.

He Speaks From Experience

Your editorials in the Nov. 26 number of the *Journal* concerning the revision of the present mining law give me the inspiration to make the following remarks:

The abolition of extralateral rights is the most important point in the new bill. When two mine operators conclude that a suit is necessary to determine their rights under the present apex law, the procedure is as follows:

In the first place the law is based on geology, which is not an exact science. The mine operators send out calls for geologists who will be expert witnesses, and these witnesses view the same conditions and have altogether different conclusions. One geologist says that two and two make four, as in surveying or in other exact science. The others have conclusions ranging all the way from one to ten. One operator finds he can secure the services of four geologists whose conclusions are that the answer to the problem is one. He decides to use these four geologists, and, as in poker, when you have four aces, it is useless to try to draw the joker, but in this case he finds that it would be well to have the joker, so he engages another geologist to give a discourse on general geology and surround his four aces with a barbed wire entanglement that will make it difficult for his opponent to attack the testimony of his four aces.

The other operator is unable to get geologists who agree on the principal points that are in his favor. However, he secures one geologist whose conclusion is four; one whose conclusion is five; one whose conclusion is six; one whose conclusion is seven; and one whose conclusion is eight. As this testimony is all on his side, it is all of one color, and hence he goes into court with a straight flush and with the idea that his straight flush knocks the four aces for a row of tin ash cans.

Up to this time, the operators have both had poker in mind, but it now develops that the judge is a pinochle player, and he judges the hands from a pinochle standpoint. The result is general dissatisfaction all around.

The above remarks are not intended to be a slam at geologists, but they are results of my own personal observations. For three years I was engaged entirely in apex litigation, and during that time came in contact with many of the best experts in geology in apex litigation and with some of the widely known attorneys who specialize in this business. All of the geologists agree that these trials are a farce, and they are the ones who are endeavoring to have the present law changed.

The absurdity of a law based on geology is at once apparent, when we can just as well have a law based on surveying, where all witnesses would agree that two and two are four.

If we abolish the present apex law, we must give the prospector a square claim or at least a wider claim in order that he may be sure of some of the benefits from his location. These two points, the abolition of the apex law and a larger claim, are the only two points upon which everyone is agreed. Why not, therefore, cut out everything from the present bill except these two points and secure the united support of the mining industry for the bill? If later some of the other provisions seem to be advisable, they can be introduced as a separate bill, but they are of small importance as compared with the apex law, and we should not allow them to be tacked on to the present bill and cause opposition from many sources.

Some of the objections to the bill, as voiced in this district, are as follows:

1. There is no provision in the bill to designate when the law will take effect, and it is assumed that it would

be in effect as soon as signed by the President. It will take several months at least after a law goes into effect to inform prospectors in the field, especially in Alaska, of the provisions of the entire bill. If the new law goes into effect immediately, there will be an untold number of invalid locations made in accordance with the old law.

2. The provision for doing location work on placer claims in Alaska is out of line. A claim staked on June 30 would have to have $200 worth of work done on it before July 1, which is evidently a physical impossibility.

3. The new bill states that locations shall be filed in the Land Office within ninety days. In many instances, especially in Alaska, this is not practicable, because of the remoteness of the prospector from points where he could mail his location notice and the uncertainty of the mail in those districts. Why make it necessary for a prosecutor to go all the way to Juneau to record his location? This savors very much of the Pinchot conservation program, and will meet with strenuous objection from Alaska.

4. There are approximately twenty cases of boundary litigation pending in the Portland Canal district of British Columbia. Attorneys point to the fact that there are twenty cases pending in the Portland Canal, and they use this as an argument to the effect that the British Columbia law using vertical side lines causes more suits than we have in this country. These attorneys neglect to mention, however, that these are boundary suits which could be obviated by making the provision for marking the boundaries of the claim more stringent. At any rate, these suits can be decided on the basis of surveying, which is an exact science and much easier to work with than geology.

5. The regulation that a patent must be completed within seven years would necessitate starting application for a patent four years after location, in order to be sure that the patent would be complete within seven years. This is the experience of prospectors in Alaska. It would be manifestly unjust to require a man to patent a claim four years after discovery, when in ninety-nine cases out of a hundred he has nothing of value to patent.

I give an outline of the above objections to show some of the opposition that will be lined up against the bill, and to support my contention that in order to assure the passage of the present bill everything should be dropped from it but the abolition of the apex law and the provision for a larger claim. J. G. MURPHY.

Seattle, Wash.

Concerning an Optical Illusion

In his article "Rail Linings for Ball Mills," in *Engineering and Mining Journal* of Dec. 3, Mr. Hardinge calls attention to a peculiarity in the picture on page 900.

The mortar seems to protrude from around the rails, and when turning the magazine upside down we get just the reverse.

May I suggest the following cause: Our eyes are accustomed to see objects and pictures from objects with the light falling from above; in this way protruding parts obtain a shadow at their lower side.

In the picture on page 900, however, the light has been coming from the bottom of the cut, as there are several bright spots at that side; therefore the shadows fall from the rail cutting on the mortar that is just above it.

As the border lines of the rails are not distinct, it appears as if the shadows are on the rail itself and are thrown there by the mortar, which in that case ought to protrude.

By turning the page upside down we get the light from the top, as we always get it, and therefore the effect is reversed; the shadows are now thrown on the mortar by the protruding rail cuttings.

I hope I have thrown some light (from the right side this time) on this peculiar phenomenon.

Des Moines, Iowa. J. C. SEELIG.

Prevention vs. Cure

Referring to your editorial "The Origin of Apex Litigation" in the issue of Nov. 26 wherein you quote from Mr. Winchell's article in Professor Peele's handbook, it seems proper to forestall the drawing of an inference that there had been in British Columbia much extralateral right litigation and that *therefore* the law had been changed.

As a matter of fact, up to the time that the old law was repealed in April, 1892, lode mining had barely been commenced and our courts had had before them not a single extralateral-right case.

In the summer of 1891 I had several conferences with the Minister of Mines of that day, the late Col. James Baker, made plain to him the evils which could be expected from a continuance of the extralateral privilege, and induced him to get the consensus of opinion of the several mining districts active at the time concerning desirable changes in the law. The result was that petitions to the Minister from the miners themselves, notwithstanding some opposition, were largely signed and presented, asking that the law be amended to provide for vertical limitation.

As stated, the new law became effective in April, 1892. Before that year our total production from lode mines was about $264,000. Since then, to the end of 1920, it has been more than $384,000,000 and there is still no evidence that we have suffered from the change. In the meantime our courts have tried only two extralateral-right cases of any importance and thus we may be said to have "flourished peaceably under a sensible law."

Riondel, B. C. S. S. FOWLER.

Discovery of New Nitrate Lands in Chile

The Chilean government has sent a mining engineer to Iquique to investigate the report of the discovery of a new nitrate zone, according to Consul Homer Brett, at Iquique, in *Commerce Reports*. A prospector claims that he has found nitrate beds underlying a district of about 2,000 sq.km., where no nitrate was previously known to exist.

This region is in the Province of Tarapaca, to the east of the fields now being worked. It is said that the results of about forty blasts, put in at distances of from 3 to 4 km. apart, show that beds of caliche from 2 to 3 ft. thick and containing from [illegible] to [illegible] per cent of nitrate of soda underlie the region at a depth of 11 ft. below the surface.

The government has signed a contract with the discoverer, granting him a tract of nitrate land [illegible] km. square to be selected by him in the new district, as a reward for his efforts, if his assertions are correct.

As the nitrate industry at present is prostrated because of overproduction, the reported discovery, even if true, possesses only eventual importance.

Traveling in Morocco

Transportation Facilities Poor—Some Districts Unsafe, but Carrying Of Arms Is Inadvisable—The Selection of Outfit—An Interpreter Needed—Mining Laws Favorable to Investigation and Exploitation

BY J. P. HUTCHINS

Written for Engineering and Mining Journal

THERE ARE COMMERCIAL IRON ORES, galena, manganese and manganiferous ores, phosphate beds, petroleum, zinc ores, coal, mercury ores, copper ores, and nickel ores in Spanish and French Morocco. It is the opinion of men who are familiar with the mineral deposits of southern Spain, and who have been to Morocco, that deposits similar in extent and richness to those of southern Spain will be found in northern Morocco. This conclusion is based upon the belief, apparently well founded, that the geological features of southern Spain and northern Africa are similar.

MARKET PLACE IN TETUAN

These countries have laws favorable to exploration and exploitation that seem certain to attract investigators. Inasmuch as there are large areas that have been little studied, and as it is likely that engineers will be sent to determine the value of mineral deposits, some data as to the conditions affecting travel in Morocco should be of interest.

The winters, with about 20 to 30 in. of rain, are mild, but the summers are hot, with a maximum shade temperature over 100 deg. F., though with slight humidity. Malaria exists practically everywhere along the coasts, and as houses are not properly screened, infection from mosquitoes is to be expected, both in summer and winter. In other respects the climate is healthful.

TRANSPORTATION FACILITIES POOR IN INTERIOR

The ports of French and Spanish Morocco can be reached by steamers from southern France, southern Spain, and from Gibraltar. No particular suggestions are necessary as to traveling to Morocco by steamer.

Internal communications depend largely upon automobile service, which varies inversely in quality with its need by the traveler. There are some well-established and efficiently operated routes, especially in French Morocco, but frequently the service on the routes usually traveled by engineers is most deficient and with automobiles badly out of repair. This circumstance, combined with the general badness of the roads, scarcity of bridges, and carelessness of inferior chauffeurs, usually takes all the joy out of travel by auto in Morocco.

It is strongly recommended to anyone anticipating much traveling in Morocco that he take his own automobile and chauffeur to that country. Otherwise loss of time may be serious. I have had a local Moroccan chauffeur drive off during a heavy rainstorm, late in the afternoon, without caring in the slightest how I, who had paid well for the hire of the debilitated automobile, was to find shelter and food. This occasioned a loss of two days, besides much mental anguish.

ADVANTAGEOUS TO HAVE OWN AUTOMOBILE—ROADS POOR

In traveling by auto in Morocco one should have a light but powerful car. With a Ford one can probably get about best. There is always a market for second-hand automobiles in Morocco, and a car can be easily sold after the completion of an investigation, and without great sacrifice.

It is considered that the possession of one's own car is a matter of importance in Morocco and well worth the trouble and initial expense of importing it into that country. Thus one may avoid the numerous difficulties which are inevitable if one relies upon the inferior local garages and lazy, dishonest, and unpunctual local chauffeurs.

In the event of hiring the local cars, it must be remembered that it is wise not to pay in full in advance. One should try to put off payment until the service has been completed. Examination of and a short test run of the car, to prove its condition, may save delays later. Assurance as to there being a sufficient supply of gasoline to make the projected trip is essential. These precautions and warnings should be more particularly kept in mind by those who come from countries where one may rent good automobiles without risk of being cheated. The degree of inefficiency of automobile service in some parts of Morocco is almost unbelievable.

The road system is not well developed, and existing highways are generally bad, except where there are strategic roads, although these, too, are often poor. Mineral deposits in Morocco, having for the most part the customary unfortunate characteristic of being situated at a distance from the roads, must often be approached on horseback. Roads that are good enough for automobiles in the dry season become bogs of black adobe mud in wet weather, impassable for wheeled vehicles. Therefore one should take to Morocco a saddle, a bridle, and plenty of saddle blankets to use on

STREET IN ALKAZAR KEBIR

the underfed, undersized horses or mules that must be used.

One should have a simple camp outfit, with the usual articles, and also a mosquito net. Such equipment had better be got abroad and taken to Morocco. No particular warnings as to clothing are necessary. Winters are mild and about 20 to 30 in. of rain may fall from October to June. Summers are hot and usually rainless.

It is not necessary to import food, as such supplies can be bought at the larger seaports. Everything except simple fare had better be brought from abroad, as the stocks of the shops do not include even what may be considered the commoner tinned goods found in the smaller towns in other parts of the world. The standard of living in Morocco is rather low, as compared, for instance, with that of the miner in the western part of the United States, and this is reflected in the poor variety and inferior quality of the goods for sale in the shops in Morocco as compared with those of the American mining town.

SOME DISTRICTS UNSAFE FOR TRAVELERS

As has been well shown by the recent developments near Melilla, in Spanish Morocco, the Moors are not by any means pacified everywhere in Morocco. There are considerable areas that are not safe, and the adventurous engineer, particularly, must be warned to ascertain from one of the numerous police posts whether or not the particular region he wishes to visit is safe. There will be constant incentive to minimize the importance of this warning, with the object of saving time, and also the temptation to ignore the advice of the police and to go unaccompanied or unguarded into a district where the Moors are in control and unfriendly. Such procedure may be decidedly dangerous.

On the other hand, I was most hospitably treated when caught in a hailstorm of positively frightening intensity and marrow-congealing coldness and penetration and compelled to ask for shelter in a huddle of Moorish huts, not far from where active fighting was going on. Nothing could have been kinder than the reception I received and the efforts of the simple Moors to warm and dry my frigid exterior and to cheer the inner man with hot mint tea and specially baked bread, in the traditional Arab fashion of hospitality. Some simple gifts of lead pencils and matches and a superfluous note book delighted these simple souls. It is suggested that the intending investigator of Morocco have some extra lead pencils for distribution. It may be found that the lead pencil is mightier than the sword or the automatic pistol.

I have never been an advocate of carrying arms in the field. I have found it preferable to carry a cane, heavy enough to knock over a man in case of need. A cane, even a heavy one, does not convey a bellicose significance. Much trouble is encountered by the other fellow thinking, often mistakenly, that one is looking for trouble. A large pistol in a conspicuous holster is likely to cause this mistake. Therefore, if one goes to Morocco and also believes in having firearms, he should keep them out of sight. Not only are they provocative, but they may even be the objects of covetousness. Carrying arms in Morocco is honorable among the Moors, and the Moor, usually a good shot at 300 yards, who carries arms is considered to be a fighting man, a battler for the Prophet. It is quite logical for a Moor to consider a peacefully penetrating engineer to be a fighting man, battling against the Prophet, if he goes about with a large weapon dangling from his belt. Fights, otherwise avoidable, may conceivably occur, either because some Moor may desire to gratify the apparent belligerency of the armed engineer or because the Moor may wish to add the arms of the engineer to his stock of weapons.

MALARIA AND VERMIN ABOUND

As noted, malaria is prevalent, and medicines to combat it should be provided. Like other countries of the older civilizations, water pollution is general, and care should be taken to drink none but boiled water. What may be called domestic insects, fleas, bedbugs, and lice, infest the Moorish houses and huts. Insect powder is, therefore, desirable. Smallpox is likely to be epidemic. The Moor, like all true followers of the Prophet, scorns chairs and sits on the floor. A portable camp chair, for use in the field, will be a source of much comfort.

A camp table will be a great convenience, for tables do not exist in the purely Moorish towns and villages. The remarkably ingenious camp devices made in America had best be purchased in America by those leaving there for Morocco, although they can often be bought in Europe, as, for instance, in Madrid. It must be remembered that mining tools and materials are not stocked in Morocco.

Usually, the Spanish and French officials met in Morocco are polite and obliging, and the rather extreme and often tedious civilities should be reciprocated by

STREET SCENE IN CEUTA

similar vein. It is preferable not to discuss religion or politics. It is a mistake to try to hurry matters faster than the slow and dignified pace, sanctified by centuries of usage and custom, that is common to business transactions in Morocco. Time devoted to courtesies extended to officials and others, even to the lowly, is undoubtedly well spent. The customary democratic attitude of Americans should not be left behind when entering Morocco.

Information Hard to Obtain—An Interpreter Generally Needed

It is exceedingly difficult to get accurate information from anyone in Morocco. Information such as concerns the arrival or departure of steamers or post is usually of not the slightest interest to the hotel managers of the seaport towns.

It is necessary to have an interpreter who can talk the language, a corrupt Arabic. Apparently, linguistic facility, reliability, and honesty, as in some other countries, seem to be characteristics hostile to the mental attitude of the natives of Morocco. Although many can be found who know Arabic and French, Spanish or English, it is difficult to obtain an interpreter who is also honest and trustworthy. It is not wise to engage the first glib-tongued applicant that one may meet in Gibraltar, Tangier, or in some other seaport. Care must be taken to be sure that the interpreter can be trusted to some degree, and then he should be trusted no more than is absolutely necessary, at least until one has tried him out enough to be assured as to the degree of his trustworthiness. It is easy to get into difficulties if one is not very careful in this regard. One can usually find an interpreter through his banker or consul. The French language is generally understood by Spanish officials.

Suspicious Actions To Be Avoided

If the investigator be patient and courteous and if he make an effort to comport himself as do the people he meets in Morocco, he will have no other difficulties than are usually encountered in other backward countries and will leave Morocco with the satisfaction of having had an enjoyable stay in an interesting region. One must remember, however, that he is in a country where there is active warfare. One must not carry on any investigation in such manner as may be considered suspicious by the officials.

Unfortunately, and, probably, quite without good reason, there seems not to be good feeling between the Spanish officials in Spanish Morocco and the French officials in French Morocco. This circumstance should be kept in mind, particularly, should it be necessary to investigate areas near the boundary between Spanish and French Morocco. In the international zone about Tangier this distrust is rather stronger than elsewhere.

Identical laws and regulations for exploration and exploitation apply both in Spanish and French Morocco. Interpretation, however, differs greatly in the two protectorates. In Spanish Morocco it seems to be more the policy to encourage those not of Spanish nationality to become interested than is observable in French Morocco toward those of other than French nationality. According to the laws, anyone can get as many prospecting permits as desired, in claims not larger than 1,600 hectares each, of prescribed form and orientation. These permits are good for three years and cost 20 *centimos*, or 20 *centimes*, per hectare per year.

Exploitation concessions can be obtained, but only after the receipt of prospecting permits. One person or company cannot get exploitation concessions for more than an aggregate of 60,000 hectares, and the cost of getting and holding concessions varies with the kind of mineral to be exploited from 1 peseta or 1 franc to 3.50 pesetas or francs per year per hectare. In addition, a tax of 3 per cent ad valorem, except in the case of gold, for which the tax is 10 per cent, must be paid on minerals and metals exported. There is no obligation to give back any claims, or parts of claims, to either the Spanish or French governments after the discovery of commercial deposits, and there are no requirements as to prescribed expenditures, or amount of work, to keep prospecting permits in effect and valid.

A MARKET NEAR TANGIER. TYPICAL MOROCCAN MOUNTAINS IN BACKGROUND

With the present feeling of acute nationalism, resulting from the Great War and observable everywhere, it is easier to work, either in Spanish or French Morocco, under the auspices of Spanish or French syndicates or individuals, respectively.

Tube Milling in South Africa

In his inaugural address, F. Wartenweiler, the new president of the Chemical, Mining and Metallurgical Society of South Africa, made some interesting remarks on the present status of gold metallurgy on the Rand. Speaking of tube milling practice he states that the tube mills are called upon to grind to a finer degree of communition than ever, one plant delivering a final product of which 90 per cent passes the 90 linear mesh screen. Good practice now demands a coarse feed, the newer installations feeding ½-in. maximum size.

Scoop discharges of varying effective lift, with screen openings of ample size to permit free discharge of the spent pebbles, are generally adopted, except on old plants where the use of small motors does not permit the resulting high power load. Shell liners of the Osborn and El Oro type find general favor. These are keyed and require no holding bolts. End liners are either cast or forged from discarded stamp-mill shoe shanks or dies.

No recent data have been published of the merits of the short 6 ft. diameter by 16 ft. length tube in comparison with the orthodox size, 5 ft. 6 in. diameter by 22 ft. There are also a few 6 ft. diameter by 20-ft. mills in operation whose performances have yet to be compared.

The French Creek Iron Mine

Pennsylvania Property, Now Ready for Production, First Worked Almost Two Hundred Years Ago—Orebody Is a Magnetite Lens—Crushing and Sintering To Precede Furnace—Mining Method Novel

By A. H. Hubbell

[illegible] Engineering and Mining Journal

AT THE PRESENT TIME there are only two iron-mining projects on a production basis in Pennsylvania—namely, the French Creek mine, about a quarter-mile from the village of St. Peters, and the open-pit workings of the Cornwall Ore Bank Co. at Lebanon. The former property, which is about an hour's ride from Philadelphia, is seven miles west of Pottstown and five miles east of Elverson at the end of the French Creek branch of the Philadelphia & Reading R.R., and is owned and operated by the E. & G. Brooke Iron Co., whose furnace, crushing and sintering plants and general offices are at Birdsboro, [illegible] miles by road from the mine. The mine is at present shut down owing to the market situation and high freight rates.

The ore deposit is said to have been worked as early as 1725, and it is considered that the property is one of the oldest iron mines in the United States at which operations are in progress today. About [illegible] years ago the E. & G. Brooke company undertook to reopen the mine and to provide modern equipment, and the property has been brought to its present stage of development and the sintering plant erected under the direction of the superintendent, M. T. Hoster, who has been in charge from the start.

According to the Pennsylvania State Geological Survey and the company engineer, J. [illegible], the area reaching westward from the orebody to Elverson consists of the so-called French Creek granite, which is really a dike of hornblende diorite. The orebody lies on the north side of the diorite dike. It is a replacement of Pre-Cambrian limestone. North of this area lie red sandstone and conglomerate. Near the mine a stream, French Creek, has cut a small valley. The general topography consists of small, low, rolling hills. The elevation of the property is about [illegible] ft. above sea level.

ORE MAGNETITE—FOUR YEARS' SUPPLY BLOCKED OUT

The ore is magnetite, and lies in a lens or [illegible]. An average analysis of [illegible], or [illegible] tons [illegible], is as follows: Iron, [illegible] per cent; phosphorus, [illegible]; sulphur, 2.52; silica, 7.48; alumina, 1.80; lime, [illegible]; magnesia, 1.56; manganese, [illegible]; and copper, [illegible]. Fine crushing (to 3 in.) and sintering by the Dwight & Lloyd process, which removes all the sulphur, are the only treatment the ore receives before going to the furnace.

There are two parallel orebodies about [illegible] ft. apart, but only one has been worked on an operating basis. The main orebody strikes east and west, dipping at [illegible] deg., and is about 800 ft. long. At [illegible] level it [illegible] into the hanging wall.

The main incline had sunk its limit, but when the mine was reopened it was decided to sink a new one, which is the present main hoisting shaft. This is situated 60 ft. in the foot wall and is a [illegible] incline to a point 500 ft. from the collar ([illegible] ft. vertical depth), flattening at this point to 60 deg., which slope continues to the [illegible] level at 1,[illegible] ft. on the incline, or [illegible] ft. vertical plus a 20-ft. sump. The curve at a point 500 ft. from the collar has a 200-ft. radius, the chord being 56 ft. long. The shaft has three compartments and is 20 x 6 ft. inside the timbers. The two skipways are 6 ft. x 6 ft. 4 in. inside and the ladderway is 6 ft. x 4 ft. 4 in. Ninety-pound rails are used in the shaft.

In sinking this shaft a section of 200 ft. was sunk in eighteen weeks at a cost of $44.74 per ft. for breaking, mucking, and explosives only. The drilling was done by working one eight-hour shift, sinking in hard, fine-grained diorite. Mucking was done on night shift.

The orebody has been opened on seven levels, and it is claimed that about 400,000 tons is fully blocked out, or about four years' supply, if [illegible] tons is taken as the present consumption. Development for blocking out present tonnage is to be finished as soon as the mine begins operating again. About 2,000 ft. of diamond drilling has been done.

GENERAL VIEW OF HEADFRAME AND HOISTING PLANT [illegible]

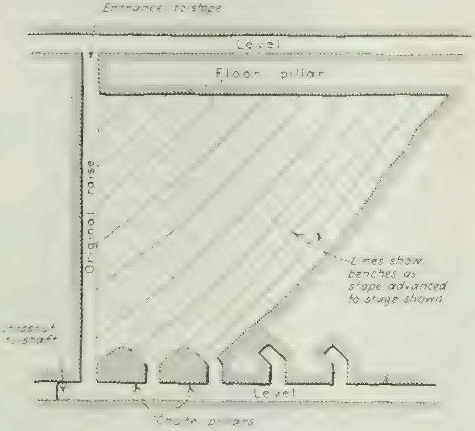
MODIFIED METHOD OF UNDERHAND STOPING USED

The system of mining employed is indicated in the accompanying sketch, and is a modified method of underhand stoping which is thought to be different from any other method previously adopted. It is described as follows by M. T. Hoster, the superintendent, who is responsible for its adoption:

"In opening a new level, a crosscut is driven to the foot wall of the ore and drifting done in both directions, following close along the foot wall. Stopes are started 25 ft. on each side of the center of the crosscut by driving a 6 x 8-ft. raise in the ore and on the foot wall to the level above. In order to leave a 20-ft. floor pillar, stoping is started [illegible] ft. from the top of the raise by cutting a [illegible] to take the full width of the ore and then carrying the stope forward along the raise in the ordinary manner of underhand stoping. At 25-ft. intervals along the drift, beginning from the [illegible], other raises are driven [illegible] ft. [illegible], with the last

10 ft. sloped off at 45 deg. toward the original raise and provided with chutes for future extraction of broken ore from the stope. As the underhand stope bench advances, these stub raises automatically connect with the stope, and the chute pillars remain directly above the level formed by the blocks of ore between the stub raises.

"This method of mining takes the place of the regular underhand open-stope method previously used, and instead of the ore from the stopes being shoveled by hand from the level and from under the high and often dangerous level (or floor) pillars above the stope, the ore now is loaded direct from chutes, and trammers are free from danger.



SKETCH ILLUSTRATING MODIFIED METHOD OF UNDERHAND STOPING

"This method has the advantage over shrinkage stopes in that the development cost is less, less broken ore is tied up, and no ore is left on either foot or hanging, as frequently happens with the latter method on account of becoming covered up. For steep veins or where the ore is very soft and the walls are very poor, the shrinkage stope or other method is no doubt superior, but for a vein lying 50 deg. or less, with ore adaptable to open stope work, this method is far the safer and cheaper. The level floor pillars can be recovered by breaking them down on to the chute pillars and extracting the ore through the chutes as before. The chute pillars can be recovered by retreating toward the shaft."

EQUIPMENT AMPLE FOR NEEDS

The drills for development work in rock and ore are 248 Leyners. For stoping, I-R Jackhamers, mounted and unmounted, are used. One Waugh Turbro is also employed. The steel used is 1¼-in. hollow octagon for the Leyners and ⅞-in. hollow hexagon for the I-R Jackhamers.

One and a half-ton Easton side-dump mine cars have been selected for tramming on an 18-in. gage track with 20-lb. rails and a one-half of 1 per cent grade. The cars are dumped into a seventy-five-ton shaft pocket at the station of each level. From these the ore is loaded into three-ton skips working in balance. The solid ore runs 8 cu.ft. per ton; the broken ore 15 cu.ft. per ton.

There is little water in the mine. It is all pumped to a sump 760 ft. from the collar (on the incline), and from this sump it is lifted by a Dean triplex pump to the surface.

The surface plant includes a hoist and compressor house, a change house, and a hospital, housed together with the foreman's office in one building; also a blacksmith shop and main office, railroad ore bin and powder house. At the shaft is a 75-ft. steel headframe erected by the Lackawanna Bridge Co.

The hoist house is equipped with a double-drum geared electric hoist made by the Nordberg Manufacturing Co. The drums are 6 ft. in diameter, with a 60-in. face. The rope speed is 1,000 ft. per minute, and the total load 13,300 lb. The hoist is driven by a 200-hp. Westinghouse motor. The compressor is an Ingersoll-Rogler Class P.R.E.-2 duplex, direct-connected, 22 x 14 in., with a 16-in. stroke, driven by a 2,200-volt self-starting synchronous G.E. motor.

The blacksmith shop is equipped with two Ingersoll-Rand drill sharpeners, one for the hexagon and one for the octagon steel; one coke furnace for heat treatment; two coke forges for miscellaneous blacksmith work; a hand press drill, and an emery wheel.

Power is purchased from the Metropolitan Edison Co., of Reading, Pa. It is received at 19,000 v. and stepped down to 13,200 and 440 v. for motor purposes and to 110 v. for lights; three 200-kva. transformers are employed for this purpose.

As stated, the property is at present shut down. When operations are resumed it is estimated that a force of sixty-one men will be needed for a production of 400 tons per day of one shift only. This force probably will be distributed as follows: Nineteen miners; twenty-three trammers; two timbermen; two shaft chute men; one nipper; one hoist man; four on the surface inclined hoist and on loading railroad cars; one compressor man; one mechanic; two blacksmiths; one change-house man; and four laborers.

TRAMWAY PLANNED TO LESSEN TRANSPORTATION COST

The company is considering the construction of an aërial tramway between the mine at St. Peters and the crushing and sintering plant at Birdsboro, seven and one-half miles away, and survey work for this is already under way. This should reduce the transportation cost from $1.12 per ton to under 35c. per ton. Buckets of 7-cu.ft. capacity will probably be used, carrying 1,050 lb. of ore, spaced 200 ft. apart, and traveling 400 ft. per minute. One 75-hp. motor will be required, as the tramway will be electrically operated.

The ore hoisted by skips is dumped into a thirty-five-ton pocket built in as part of the headframe. From here the ore is loaded into a five-ton hopper-bottom side-dump car operating over a 4 per cent inclined track 900 ft. long to a 250-ton bin, from which railroad cars are loaded direct for transportation to Birdsboro. This surface car travels from the shaft headframe bin to the railroad ore bin by gravity and is pulled back by an electric hoist situated near the shaft. This method of transferring the ore to the railroad has proved satisfactory and cheap.

Radium Ore in Belgian Congo

A discovery of radium-bearing ores at Shinkolow, in the Belgian Congo, is reported to the Department of Commerce. Prof. Alfred Schoep, director of the Institute of Mineralogy at Ghent, is credited with the discovery.

Some Aspects of the Revenue Act of 1921

Excess Profits Tax Repealed Beginning 1922—Corporate Income Tax Increased—Surtax Rates Reduced—New Class of "Capital Gains" Created—Advantageous Provision Will Govern "Closed Transactions"—Losses May Offset Gains Within Two Years

BY ROBERT MURRAY HAIG

Contributing Editor, Engineering and Mining Journal

AMONG THE NUMEROUS CHANGES made by the new tax bill signed by President Harding on Nov. 23, five stand out as of great importance from the point of view of the business man and the investor. These are:

1. The abolition of the excess profits tax as of the beginning of next year, coupled with an increase in the income tax on corporations at that time from 10 per cent to 12½ per cent.
2. The reduction in the surtax rates on individual incomes which comes into effect at the same time.
3. The establishment, with the beginning of next year, of a new class of income to be known as capital gain, which will be subject to a maximum rate of 12½ per cent.
4. The broadening of the definition of the "closed transaction," effective for the current year, which makes possible many exchanges of property for property without subjecting the gain to taxation.
5. The recognition, beginning this year, of a net loss from one year's operation as an offset against any profits which may accrue in the two following years.

The first two changes, the repeal of the profits tax and the changes in the rates, have been the subject of wide comment, but the other changes, being of a somewhat more technical character, have been less discussed, and their significance has been less fully appreciated.

CONGRESS REPEALS EXCESS PROFITS TAX

In spite of great pressure, Congress finally declined to repeal the profits tax for 1921, but did agree to abolish it thereafter. With it disappears the "personal service corporation," a special class established to care for certain corporations which it was desired to exempt from profits taxation. When the profits tax goes, the income tax rate on all net income of corporations rises from 10 to 12½ per cent. The change in the rate will cause corporations which make only moderate profits to pay slightly heavier taxes, but the total tax burden on corporate income will be much lighter, the official estimates of revenue under the new bill calling for $1,030,000,000 from this source (ignoring back taxes) this fiscal year and only $695,000,000 for the next fiscal year, when the changes will be in force.

SURTAX REDUCED

The surtax rates on individual incomes are scheduled for reduction beginning with the first of next year. A comparison of the new scale with the old is difficult to make. It should be made clear, however, that the change affects small taxpayers as well as large ones. The maximum rates remain very high—50 per cent as compared with 65 under the old law. The 50 per cent rate applies to all income in excess of $200,000. The old rate which applied to the increment of income above $200,000 income was 60 per cent. Surtaxes in the future will not begin until the $6,000 point is reached and will be 1 per cent for income between $6,000 and $10,000. Under the old law, the surtaxes begin at $5,000 and mount by more rapid steps. There are also slight changes in the personal exemptions, effective at once. According to the revenue estimates, these changes will not provide much relief for the individual taxpayers, for the Government expects to get $780,000,000 next year with the changes in effect, as compared with $850,000,000 this year.

"CAPITAL GAINS"

The most revolutionary section in the new act is Section 206, which sets up a new division of income. After the first of next year money made by individuals by selling or exchanging property "held for profit or investment" is subject to a maximum rate of 12½ per cent, instead of the regular rates, which range as high as 58 per cent (normal plus surtaxes). This is hedged about by several restrictions. The individual may not take advantage of the permission to use the 12½ per cent rate unless he is willing to pay at least 12½ per cent on his other income as well. The property "held for profit or investment" must have been so held for more than two years and may not include property "held for the personal use or consumption of the taxpayer or his family," or property which properly is subject to inventory. It is not necessary, however, that the property be connected with his trade or business.

The reason for the adoption of some such section as this is plain, whatever one may think of the wisdom of choosing this particular method of meeting the situation. As everyone knows, many sales of property have been postponed or entirely blocked by the unwillingness of prospective sellers to take their profits when they would immediately become subject to heavy surtaxes. This, of course, handicapped business. The solution adopted was practically to wipe out the offensive surtaxes on profits from this class of transactions.

One anomalous result of the selection of this solution, however, is that under the new arrangement a dollar of profit made from property which has grown in value is taxed at the maximum only 12½%, whereas a dollar made otherwise may be taxed as much as 58%. For example, in the case of a bond bought at a discount and sold at a profit, every dollar of interest on the bond may pay a tax nearly five times as great as every dollar of appreciation in the value of the bond, a fact which is likely to affect profoundly future methods of corporate financing.

Much more could be said regarding the effects of this new section from the points of view of equity and of administration, but what is of particular interest here is to point out the very substantial relief granted by it to investors in property which appreciates in value.

The advantage to the investor in property which is gaining in value conferred by the section just described is accentuated by the liberal provisions governing the "closed transaction" (Section 202). This has long been a troublesome portion of the field of income tax procedure. When one exchanges property for cash, no question arises. The transaction is "closed," and one accounts for his gain to the tax collector. But when one barters instead of sells, receiving other property instead of cash for his property, very serious questions arise. There are sometimes differences of opinion as to the value of the property received which lead to disputes and litigation. The old law went so far as to say that, in the case of such trades, the property received was to be treated as cash "to the amount of its fair market value, if any" (with certain exemptions in the case of a corporate reorganization—1918 law, Section 202). The new law goes much further. It now states positively that no gain or loss on trades shall be recognized unless the property received on the trade "has a readily realizable market value." The phrase, "readily realizable" adds a new and liberalizing element.

Even more important, however, are the exceptions made to the general rule. Even though the property received has such a "readily realizable market value," one need not account for the gain in certain cases. This is one:

> "When any such property held for investment, or for productive use in trade or business (not including stock-in-trade or other property held primarily for sale), is exchanged for property of a like kind or use."

How the Treasury will interpret this section is, of course, as yet unknown, but it would be a very narrow interpretation which would exclude exchanges of bonds for bonds or real estate for real estate. In other words, so long as one "barters" or "trades" his property for other similar property, instead of selling it for cash, he need not account for his gains to the Treasury for tax purposes. Even if he does sell for cash, as has been noted above, he is subject to a tax of only 12½ per cent.

The provisions governing corporate reorganizations and sales of property to corporations are also greatly liberalized, so as to make it unnecessary to report many gains for taxation.

With one minor exception included in the 1918 law, it has been the practice since the beginning of income taxation in this country to treat each year as a unit and to refuse to permit the fact that one has lost money this year to affect the amount of profit he must report the following year. Each accounting period has been carefully "insulated" from other accounting periods. This practice has worked much hardship, and the new law breaks away from the old precedents by inserting a provision, effective for 1921 (Section 204, with a restriction on mines), which permits a net loss suffered in one year to be offset against any net income realized in the two next succeeding years. In other words, losses may be used to blot off subsequent gains, but losses are "outlawed" for this purpose after the expiration of two years.

The new law contains many other new provisions which it would be interesting to discuss did not the limits of this article prevent it. Such changes include the new rule regarding gifts, which makes the recipient, if he sells a gift, account for the gain in the value of the gift before he received it [Section 202 (*a*) (2)]; the section aimed to prevent "wash-sales" to establish losses [Section 214 (*a*) (5)]; the provision covering cases where property is involuntarily converted into cash [Section 234 (*a*) (14)] and the modifications in the various special taxes.

It has been possible to stress here only the most important departures in the new statute. Careful examination by the business man and the investor will reveal the fact that it contains provisions, aside from the repeal of the profits tax and the changes in the rates, which will yield him very substantial relief from the burdens of war taxation under which he has been struggling for the last five years.

Cyaniding Practice on the Rand

No fundamental changes have been effected in cyaniding in South Africa in the last few years, according to F. Wartenweiler in *The South African Mining and Engineering Journal*. Considerable experimentation, however, has been conducted quietly, resulting in gains here and there. The practicability of collecting sand and its treatment in the same tank is well established at one of the most recently erected plants. Careful classification is a corollary. The importance of close classification and the advantage of fine grinding of the pyritic portion of the ore is receiving constant attention.

Cyanide solution strengths have been on the down grade, and with the adoption of de-aëration of solutions prior to precipitation they will continue on this course. The saving of cyanide and zinc resulting from this constant pressure of experimentation with lower and lower cyanide strengths and with improved precipitation technique has been considerable. On one group alone it has amounted to a quarter-million sterling in five years.

Precipitation has received due attention, and on some of the plants a feed rate per diem of 2.3 tons of slime solution per cubic foot of zinc shaving in extractor boxes is current practice. The Chamber of Mines financed extensive trials on the de-aëration of cyanide solution, and, resulting from these, mechanical de-aëration has been decided on at five reduction works, of which three installations are in operation. The expectation of direct and indirect economy promises to be fulfilled.

Precipitation research has not been lacking within recent years; the margin of possible improvement, however, is small, and any new process calling for a new installation with heavy capital expenditure is severely handicapped by economic considerations.

Oxidizing reagents, by reason of rapidity of reaction and expense, do not find favor. Their effect is evanescent and likely to be harmful. The economical and satisfactory supply of oxygen continues to be derived from free air. Experience with de-aëration has shown how readily air dissolves in solution and how watchful one must be to prevent this at certain stages of the cyanide process.

Vacuum filters are now accepted by the majority as standard slime-washing equipment for new plants. Their washing is controllable, depending so much less than the decantation process on ratio of dilution and on the weather. Many installations maintain a consistent daily capacity rate of 3.5 tons dry slime per leaf.

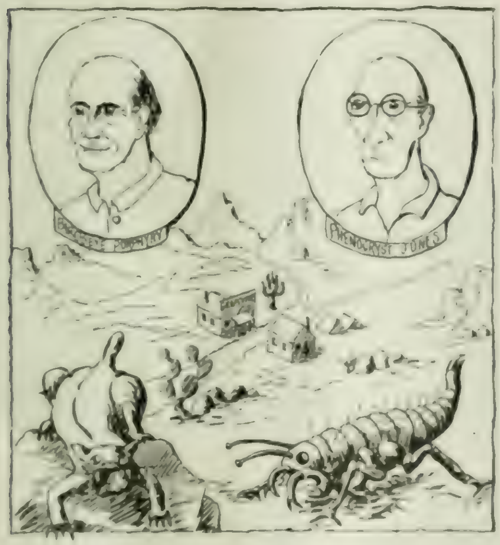
Copper Lengthens Boiler Tubes' Life

It is said that the life of a locomotive boiler tube, if made of copper, is about three times that of one of steel. A life of from 240,000 to 360,000 miles has been obtained with copper tubes, as against 80,000 to 120,000 miles with steel, it is claimed. It is also stated that by the addition of approximately 0.2 per cent of copper to steel and iron plates the corrosion rate, where the iron or steel is alternately wet and dry, is greatly lessened.

BY THE WAY

The Wildcat and the Doodlebug

"Say, Phenocryst, what's a wildcat?" asked Birdseye Porphyry as he scratched a match on the porch post of the combined store and post office at Grapevine Crossing. "A wildcat!" drawled Phenocryst. "A wildcat, Birdseye, is a forlorn hope togged out in a dress suit and wearing a coon's diamond in its shirt front. It looks like $1,000,000. It oozes optimism and sweeps down the street, whirling its cane like a bandmaster's staff. It gathers in plain ordinary dubs and makes them feel like Rockefellers for a while. It acts like a shot of hootch. It produces 'delirium riches' whenever anyone gazes too long at it. When the Roman candles are all gone and the sheriff has the tool house, it's just a hole in the ground or a duster. It keeps a certain kind of a gent, Birdseye, in clover, and it keeps some of us poor. Now, you smart Aleck, what's a doodlebug?"



Birdseye sucked at his pipe and sat down on the store step and threw one leg over the other. Drawing a toothpick back and forth in the sand by his side, he gazed at the distant line of brown hills. Removing his pipe and spitting, he looked up at Phenocryst. Phenocryst shifted his weight from foot to foot and [illegible] the [illegible].

"A doodlebug," said Birdseye slowly and like a judge sentencing a prisoner for life, "is a human organism of unknown pedigree. It carries a little more avoirdupois than us poor desert rats can afford. It dresses a darn sight better. It has a tongue as roller bearings swimming in whale oil. You can distinguish it from surveyors, engineers, and geologists by the strange instruments and little vials of minerals, metals, and oils it sports about with. Phenocryst, you and I prospect in the orthodox fashion. We go out and use our eyes and feet and bust up the rock with our picks. When we get some promising colors we get busy with single jack, drill, and windlass. We buy our powder and grub, and we sink our shaft with honest sweat. The doodlebug you mention just sets up his contraption of wires and batteries and bits of jimcracks. He looks wise and walks in a figure eight and says: 'It's down there 250 ft. 6½ in. and contains 300,065 tons of 6.3 per cent copper ore, averaging an ounce of silver and 0.07 oz. of gold per ton.' Now that's short-circuiting the prospecting game, isn't it? A doodlebug, Phenocryst, thinks that he has this prospecting game by-passed on the dynamite, grub, and honest sweat, but let me tell you in confidence, he's just a plain fraud. It can't be done."

"Well," said Phenocryst, squatting down and looking squarely at Birdseye, "a wildcat and a doodlebug are two of a kind. They're unsafe critters to have around. We've had the wildcat with us for a long time, and he's been here long enough to be remotely respectable, but this new bug ought to be smashed. A wildcat is like a roulette game, but this doodlebug is a packed deck."

More About "The Engineer"

The first time we meet Lord Riddell we are going to ask him what he thinks of Mrs. Whitney's statue, "The Engineer." Recently at the annual dinner of the Washington Society of Engineers, His Lordship said that it would reflect more favorably on the progress of our civilization if there were more statues to engineers and fewer to soldiers. Since the world could not live on wars, said he, engineers were furnishing a most effective cure for the after-effects of war in the setting up of great wage-producing works. We feel sure His Lordship had not seen "The Engineer" or else he would have qualified his remarks. His conception of the engineer and that of Mrs. Whitney are as far apart as are the views of Messrs. de Valera and Collins on certain aspects of the Irish free fight.

"Perhaps Mrs. Whitney merely intended her piece of sculpture to be symbolic of the dominant trait of the engineer, who has a penchant for digging in," writes M. W. Y. from the Michigan copper country. "And, figuratively speaking, he strips for action when he does that, which may account for the figure in underwear. I am fond of Chiclets. Please send them along."

Not too fast—not too fast—Mr. M. W. Y. The Chiclets will keep until others have had a chance to win the valuable prize.

W. I. Schmidt, of Los Angeles, says: "Why not call the creation 'A Miner at Work After Drinking Home Brew'? Two things are plainly apparent—the abnormal posture of the individual shows that he is laboring under pain, and the fact that he is wearing a hat and boots without the proper supply of other wearing apparel clearly shows that his mind is not functioning properly."

Another writer is less inclined to object to Mrs. Whitney's conception of the engineer. "She doubtless had in mind the engineer before he woke up and undertook to play his part in public life. Some technical men are still asleep, and these she is not wrong in representing as she has."

We foresee that this controversy will help the Chiclet* manufacturers a whole lot. Anything to make business pick up, especially in such a basic industry.

---

*[illegible]

Scraping and Loading in Mines With Small Compressed-Air Hoists—III*

With Little or No Modification, Present Mining Systems Are Applicable to Slushing, Which Offers Distinct Advantages Over Hand Methods—Suggested and Actual Uses in Surface Operations and Coal Mines—The Scraper a Factor in Operation

By Ward Royce

Written for *Engineering and Mining Journal*

THE USE OF SCRAPERS has also produced good results on the Gogebic Range. Here the mines are deep, and the sublevel caving system of mining (Fig. 32) is employed. This method of mining differs little from the top-slicing system in general layout. The ore is removed from the top down, as in top slicing, the principal difference being that the sublevels are spaced further apart vertically, and in removing the ore a pillar is left above the slice, which is removed by caving on the retreat from the slice limit.

The usual method is to carry the slice across the pillar, as in the other system; then to blast down the timbers one set at a time, cleaning up the ore from the caved pillar as it falls to the floor of the slice. There is some difference in the sequence of the operations, and the mining is probably not quite as clean as in top slicing. This method has been succeeded by the top-slicing method on the Mesabi Range for the reasons noted.

The sequence of operations, in removing the blocks of ore one after another, is not especially efficient in straight and continuous hauls for the scraper in the principal extraction openings. This factor is being studied, with an object of arranging the work for the scraper in somewhat the same manner as has been done on the Mesabi. In removing ore from many of the development openings, and in some places on the sublevels, the scraper has conclusively demonstrated the benefits that may result from its wider application.

At one property a 4H "Little Tugger" and scraper was used in mucking the ore from three development headings, all the material being handled to the same pocket in a small transfer winze, as shown in Fig. 33. Up to a distance of 75 ft., this was said to have been the fastest development in ore that had been done in this mine. The openings were fully timbered and lagged.

Use of Slide in Car Loading

Good results have been obtained at this same property in loading cars with the scraper. A sheet steel slide about 12 ft. long and 40 in. wide is set so that the scraper travels up the side and over a pair of rails extending about 5 ft. behind the slide, under which the cars are run. The hoist is set up at one side of the drift, and the ropes are led to a pair of snatch blocks hung from the caps above the end of the slide so that the ropes clear the slide. (Figs. 34 and 35.) In this work a car containing approximately 40 cu.ft. is loaded in from six to eight minutes, the distance hauled being 50 ft. It is advisable in using a slide in this manner to set the slide so that the foot of the incline is from 25 ft. to 30 ft. back from the breast. This assures a correct rope angle and insures the scraper centering on the foot of the slide when returning with the load.

On one occasion a 6H "Little Tugger" was set up in this manner. The distance from the breast to the dump was 50 ft., the air pressure 50 lb., the scraper used was that shown in Fig. 24, and the actual loading time was six minutes per car. This compares favorably with the work of one of the standard underground shoveling machines used at this place when operating under similar low air pressure. The latter machines, working under 60 lb. of air, loaded cars of the same size in eight minutes, or about five cars to the scraper's seven, counting actual loading time.

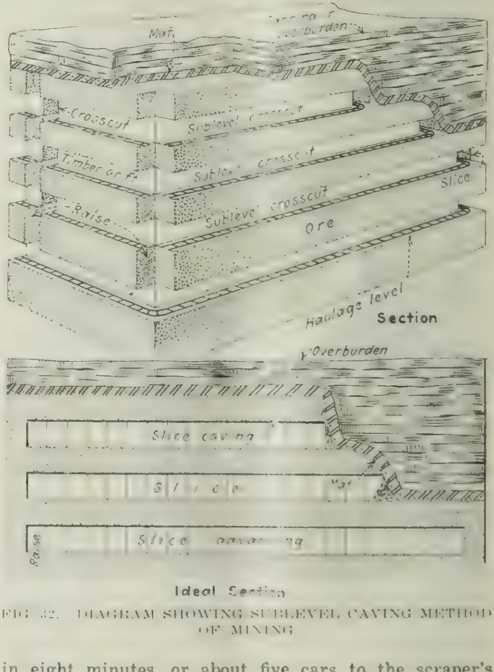


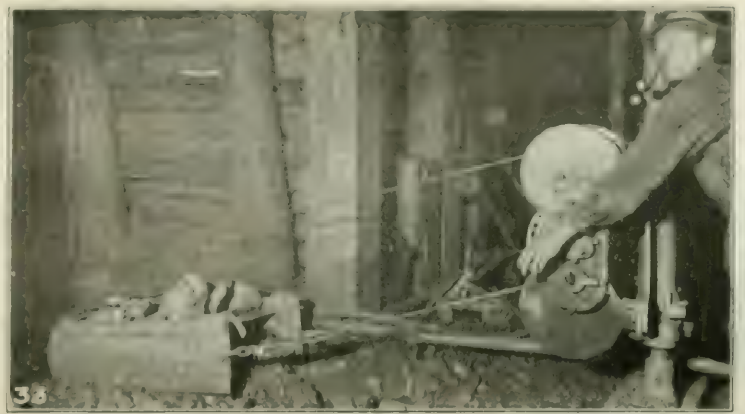
FIG. 32. DIAGRAM SHOWING SUBLEVEL CAVING METHOD OF MINING

This comparison should not be assumed as being too favorable to the scrapers, as the mechanical loader will make a much better showing, loading nearly twice as fast as the scraper under the most favorable conditions of high air pressure and other propitious circumstances. However, when it is considered that the scraper has to go 50 ft. after a load and that the loader is at the pile, the comparison is not unfavorable.

At another mine in the same district one of the 6H "Little Tuggers," operating under only 38 lb. of

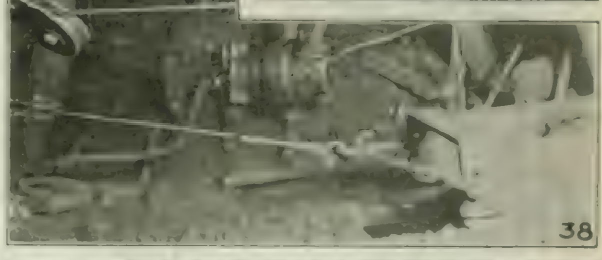
---

*This is the third and last of a series of articles, the first and second of which appeared in the issues of Dec. 10 and Dec. 17, 1921.


33

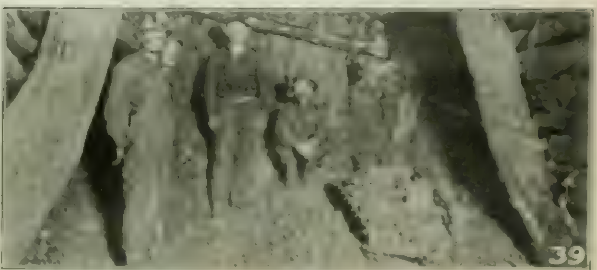
34

35


38

36

37


39

UNDERGROUND APPLICATIONS OF SCRAPERS IN IRON ORE MINES

Fig 33—Scraping ore into a winze.
Fig 34—Loading car with scraper, showing slide placed over chute for dumping.
Fig 35—Loading car with scraper showing snatch block.
Fig 36—Drilling and scraping with three-man gang.
Fig 37—Riding a scraper in chunky ore.
Fig 38—Scraping from a set-up at one side of opening.
Fig 39—Tail rope snatch block hung from timber sprag across breast.

air, handled ore at the rate of twenty-seven tons an hour, in scraping to a raise.

Car loading by means of the inclined slide is necessarily slower than operations where the ore may be scraped directly to an opening in the floor, but results are far above those produced by hand loading. When the length of tram is 300 ft. or more, the men will load the cars about as fast as they will tram them. In places where the tramming distance is great, or in which the cars are handled by a motor, the time lost in tramming and switching decreases the efficiency. By using a small, easily handled platform in addition to the slide, somewhat as is done in the Michigan copper country, this condition might be greatly improved.

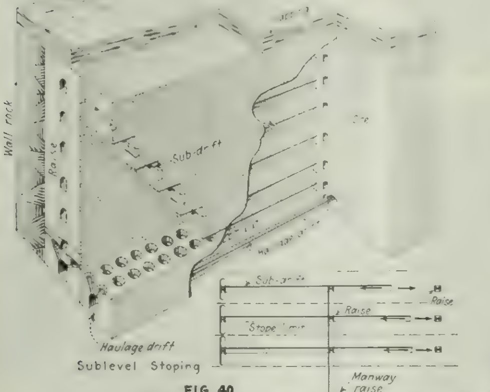


FIG. 40

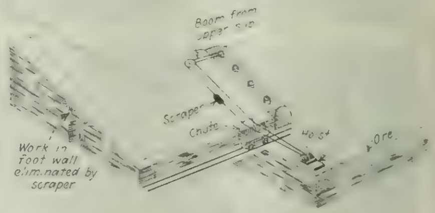


FIG. 41

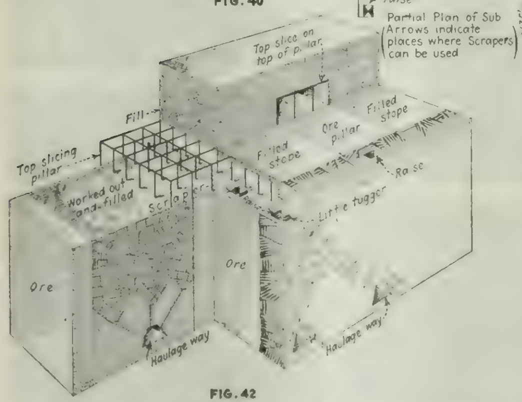


FIG. 42

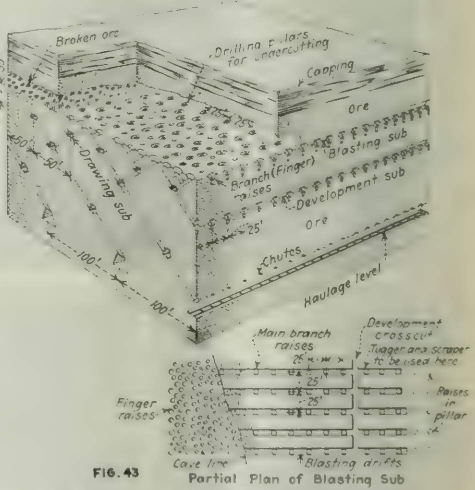


FIG. 43

APPLICATION OF SLUSHING TO VARIOUS MINING SYSTEMS

Fig. 40—Diagram showing "substoping" method.
Fig. 41—Diagram showing sublevel stoping on inclined foot wall.
Fig. 42—Top-slicing pillars, room-and-pillar method.
Fig. 43—Branch raise caving method at Inspiration Copper Co.

Speaking generally, in practically all the underground operations where the small-type hoists and scraper have been used, production has been raised to about double that shown by hand-shoveling methods.

APPLICABILITY OF METHODS TO SCRAPING SYSTEM

Present mining methods and labor arrangements may require modifications to accommodate the scrapers to the various operations. At Ishpeming, Mich., operators have tried arranging the work so that three men on a shift constitute a contract gang and the gang has two openings in which to operate. This permits one man to keep the two faces drilled and blasted while the two other men handle the mucking and timbering. This arrangement has worked out well, and the three men have produced about twice as much ore as four used to do previously. Fig. 36 shows a typical working place under such conditions.

Cost comparisons are practically useless, because of the great variation in wage scales, methods, and other operating factors employed in different districts, but the application of the scraper system can be counted on to reduce mucking time from one-half to one-fourth the time consumed by hand-shoveling methods.

THE SCRAPER AS A FACTOR IN OPERATION

The natural question that arises in considering the use of a new method is how and where it may be applied to any particular operation. Experience has so far shown that the small-power scraper unit is most valuable in handling the iron ores and that it should have a wide field of usefulness in mining operations employing similar methods in ore of similar character. Barring the few exceptions where material is broken in exceedingly large and heavy peices, all mining has at least a few working places to which the scraper is applicable.

Underground operations in many of the mines in the Southwest are very similar to methods employed in the Lake Superior iron and copper districts. Many operations conducted on slightly different methods are working ore that the small scrapers could handle more efficiently than is now being done by hand, and in many instances the use of such an inexpensive means of increasing efficiency might be the deciding factor in continuous work.

In those mines employing so-called "gravity methods," the small-power scraper will, of course, have little application except in development. In some of these methods the amount of development is necessarily large, especially in the larger orebodies, and the scrapers could there be used to advantage.

The "substoping" method, employed in some operations on medium stiff ore (Fig. 40), requires considerable development, especially in wide orebodies where several stopes are opened parallel to each other, as in some of the iron mines on the Menominee Range. This requires opening several drifts through the centers of the stopes on each sublevel, and such workings should be a good place in which to use scrapers.

In this same method of mining on an inclined foot wall (Fig. 41), it sometimes becomes necessary to do a great deal of work under the foot wall in the country rock to draw off the broken ore. It would seem that this could be handled by the scraper at a considerable reduction in expense for dead work. By hanging the return rope pulley from a boom in the upper subdrift and mounting the "Little Tugger" on the haulage level, the broken ore could be scraped down off the foot wall without trouble and without exposing any of the workmen to danger by working in the open stope. In many other of the so-called "gravity systems" there are places where scraping might be employed to advantage.

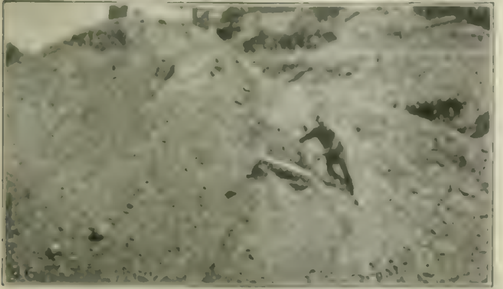
SCRAPING AS APPLIED TO GRAVITY SYSTEMS

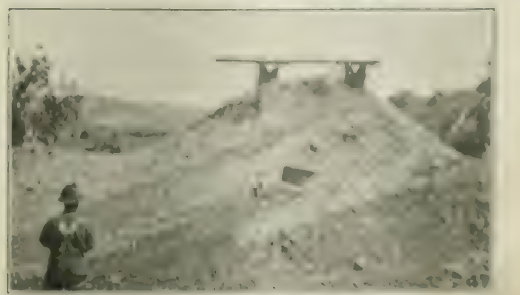
In some of the room-and-pillar shrinkage-stope systems, the pillars are removed by top slicing after the stopes on each side are worked out and filled. The pillars are usually narrow, generally not more than 25 ft. or more than two or three sets wide. Raises are put up at one end of the pillar, and the ore broken in the slices is trammed to them. Most of the ore broken here could be handled by scrapers. (Fig. 42.)

The branch-raise block-caving combination such as is employed at the Inspiration copper properties at Miami, Ariz., and other mines offers many opportunities for the use of the scraper. Much of the development work is done after the raises are up, making short hauls necessary to get the ore from the breast of the sublevel opening into the raise. Especially in the blasting sublevels is this true, the blasting drifts being driven on 25-ft. centers, with raises coming up into the floor of the drifts at about the same interval as shown in Fig. 43.

Many other examples of the application of the scraper for use in underground operations could easily be found. The possibilities for the use of these machines by contractors and others handling the smaller grading and excavation jobs were recently demonstrated at a mine on the Gogebic Range where grading was considered necessary in enlarging the area of the stockpile ground. It was decided to fill in the depressions in the area affected rather than level it by the usual method —i.e., with teams and scrapers.

A small loading pocket of about 1 cu.yd. capacity was





THE USE OF SCRAPER SYSTEMS ON SURFACE

Fig. 44—Hauling scraper for loading wagons.
Fig. 45—Scraper bringing load to dump over loading pocket.
Fig. 46—Scraper in operation.
Fig. 47—[illegible] empty scraper. [illegible] method of hanging sheave blocks from scaffolding [illegible] has been [illegible] the edge of embankment.

erected at the foot of one of the waste dumps, and arranged so that an ordinary wagon could pass under the chute apron. A 6H "Little Tugger" was mounted on a weighted frame set up about 30 ft. in front of the pocket, the ropes being led through guide sheaves hung from a frame above the chute. (Figs. 44, 45, 46, and 47.)

The tail-rope sheaves were carried on a frame set up in the dump at a point about 75 ft. to the rear of the pocket, and additional sheaves were hitched to ropes attached to points on the bank, making it convenient to change the path of travel of the scraper, which was one of those used in the underground workings. Rails were laid over the top of the pocket for the scraper to ride on, and air was furnished through one of the water lines which passed close to the water pile.

Six men were employed on the job. Two men worked at the stockpile ground, spreading and leveling with shovels the material dumped from the wagons, and two teamsters and teams, and two men at the waste pile handling the hoist and scraper. The scraper haul averaged about 50 ft.; the wagon haul about 1,000 ft. Results showed that the men handled an average of 100 yd. of the material daily at a cost of a little less than 33c. per yd.

Although this showing is not remarkable as compared to similar operations on a larger scale, it is still a great improvement over work done by hand labor, and serves to indicate the possibilities in other operations such as gravel pits, small excavations, grading jobs, and the like.

In the coal fields the larger scraper units are already established. Their rather high first cost and excessive bulk and weight are the principal disadvantages which preclude their use in many properties. This indicates that there should be a demand for the smaller unit.

COAL MINING OFFERS FIELD FOR SMALL-UNIT SCRAPER SYSTEM

In mining the thin coal beds, a common method is to break roof or bottom rock to make room for the passage of the mine cars through the rooms or chambers, as shown in the section *A-A*, Fig. 48. In a block of coal 1,000 ft. square, with entries spaced at 300 ft.—the usual distance—and the rooms spaced on 50-ft. centers, this method requires breaking and stowing away the material from about 24,000 linear feet of rock work.

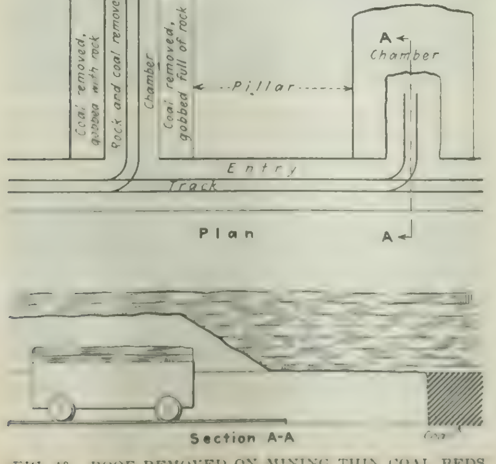


FIG. 48. ROOF REMOVED ON MINING THIN COAL BEDS

The system of "buggy mining" is employed in many of the mines working thin beds, to avoid doing so much rock work. Here a small low car or "buggy" is run on a light temporary track laid on the floor of the rooms. Bottom rock is taken up in the entries only, the coal is shoveled into the buggy at the face of the room, and the load pushed to the entry and transferred to the mine cars as shown in Fig. 49.

In visiting a number of mines where the buggy mining system is employed, I saw only one place where arrangements were made to permit dumping the buggy directly into the car. The usual practice seemed to be to shovel from the buggy into the car. In some mines the buggy was dumped so that the coal fell on the entry floor at the side of the car and was then shoveled into the car. In another mine a clever dumping device was placed at the mouth of the room, the buggy was hoisted and lowered over the inclined floor of the room, by means of a 1H "Little Tugger" hoist, and the load fell on the entry floor, so that it had to be handled all over again to load it into the mine cars.

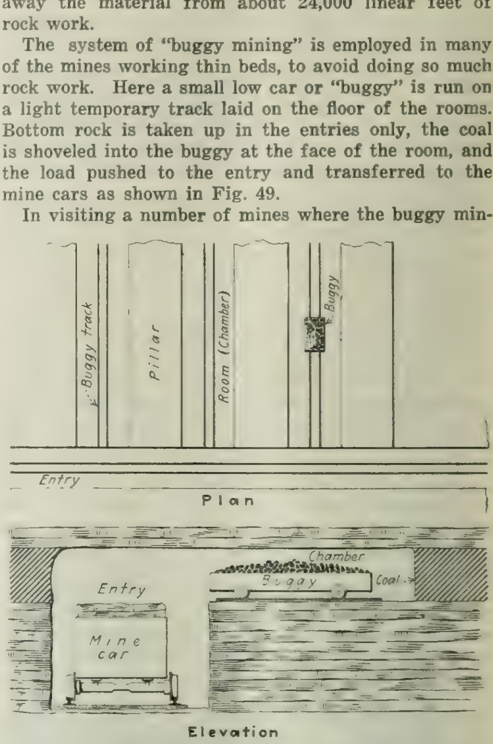


FIG. 49. "BUGGY" MINING ON A THIN COAL BED

DISADVANTAGE OF LONG TRAVEL

By this method of mining the operators have stopped the rock work in the rooms, thereby reducing by about 80 per cent the amount of rock work required by the old method. The inefficiency of the buggy mining as conducted is apparent, and undoubtedly could be improved upon by the scrapers. The principal disadvantage is the amount of traveling the men are compelled to do in constricted quarters. That a scraper will go in and get the coal faster than men can shovel it has already been proved. The main disadvantage in the use of the large scraper units lies in the fact that the layout requires that the rooms be of great length, and the men have to crawl through them on their hands and knees. At one of the mines which I visited, it was noticed that rooms were lying idle after having reached considerable length because men could not be found to take the contracts under the conditions mentioned.

Though modification of the system would be required to some extent to permit the use of the small scraper units, it is believed that this could be done profitably.

The present method is to start a series of rooms off an entry, and as the rooms reach the required length a parallel entry is driven to intercept them. By driving the two entries simultaneously, and opening the rooms in both directions from the entries connecting them in the center of the pillar, as shown in Fig. 50, it is probable that efficiency could be greatly increased. The length of room through which the men would have to travel would be decreased 50 per cent; one of the small scraper outfits could be set in the entry to handle the coal from two opposite rooms, and the number of points of attack would be increased. This should not interfere with ventilation, nor with the requirements for a layout that would protect the surface. Furthermore, cutting down the working length of the rooms would have a valuable psychological effect on the men.

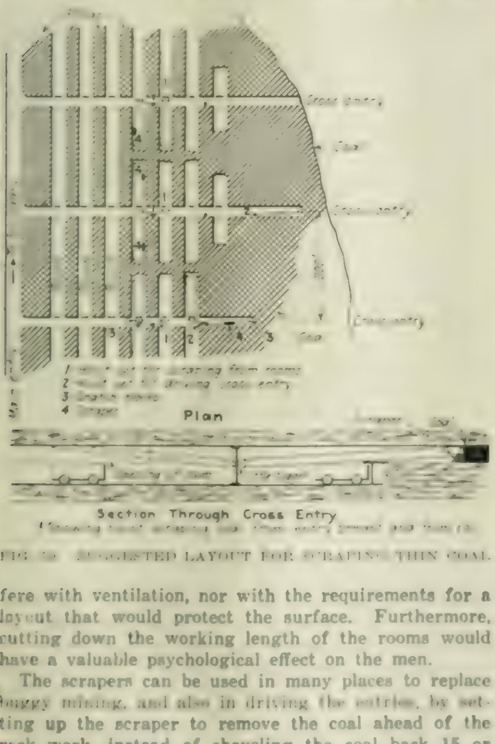


FIG. 50. SUGGESTED LAYOUT FOR SCRAPING THIN COAL

The scrapers can be used in many places to replace buggy mining, and also in driving the entries, by setting up the scraper to remove the coal ahead of the rock work, instead of shoveling the coal back 15 or 20 ft. and handling it at least twice, as is now the custom.

Scrapers for use in handling coal most efficiently will undoubtedly have to be markedly different from those handling ore and rock. The problem in handling coal will be in the disposing of bulk rather than weight. Such a plan must be developed at the particular mine involved, although it should present no great problem. The box scraper slightly modified should do the work in a satisfactory manner.

The use of the scraper has not reached such a stage of perfection that it can be termed a "cure-all," but it offers distinct advantages over hand methods. These advantages are so obvious and so well demonstrated that the wide-awake mine operator cannot well afford to overlook the possibilities provided by such a simple and inexpensive means of increasing the efficiency of his operations.

Mining Properties in Mexico

Few countries in the world have such extensive mining properties as Mexico. According to the latest statistics published in the *Boletín Minero*, the official organ of the government, the number of mining properties in Mexico up to July 31, 1921, was 27,350, with a combined acreage of 906,910.2. This amount is 0.0017 of the whole area of the country. The mining properties are distributed in the various states of the republic, as shown in the following table. Sonora, Chihuahua, and Durango have the largest proportion of mining properties.

EXTENT OF MINING PROPERTIES IN MEXICO UP TO JULY 31, 1921

States	Number of Properties	[illegible]
Aguascalientes	[illegible]	[illegible]
Lower California	[illegible]	[illegible]
Coahuila	547	[illegible]
Colima	[illegible]	[illegible]
Chiapas	[illegible]	[illegible]
Chihuahua	4,153	[illegible]
Federal District	2	[illegible]
Durango	2,689	[illegible]
Guanajuato	[illegible]	[illegible]
Guerrero	[illegible]	[illegible]
Hidalgo	[illegible]	[illegible]
Jalisco	[illegible]	[illegible]
Mexico	[illegible]	[illegible]
Michoacan	[illegible]	[illegible]
Morelos	[illegible]	[illegible]
Nayarit	[illegible]	[illegible]
Nuevo Leon	[illegible]	[illegible]
Oaxaca	[illegible]	[illegible]
Puebla	[illegible]	[illegible]
Queretaro	[illegible]	[illegible]
San Luis Potosi	[illegible]	[illegible]
Sinaloa	[illegible]	[illegible]
Sonora	[illegible]	[illegible]
Tabasco	2	[illegible]
Tamaulipas	[illegible]	[illegible]
Tlaxcala	4	[illegible]
Vera Cruz	[illegible]	[illegible]
Zacatecas	[illegible]	[illegible]
Totals	[illegible]	[illegible]

Smelting of Gold Precipitates on the Rand

In a review of gold metallurgy in South Africa, F. Wartenweiler, the new president of the Chemical, Mining and Metallurgical Society, makes the following comments:

"No innovations have been introduced in recent years into refining and smelting on the individual mines. The large refinery erected near Germiston by the Chamber of Mines for the purpose of refining the gold output of the Witwatersrand by the chlorine process is about to operate, and will be interesting to technical men.

"Acid treatment of the gold-zinc slime from precipitation remains general practice, although with the precipitation improvements referred to this will possibly be discontinued. Subsequent calcination and pot smelting or reverberatory lead smelting is the [illegible], according to preference or works convenience. Small blast furnaces are found useful for smelting byproducts on the larger mines. For others the Witwatersrand Co-operative Smelter, a most excellent institution, fills all requirements. The treatment by cyanide of the 'black sand' or pyritic byproducts from amalgamation has received considerable attention and is now established.

"Periodically, schemes for utilizing the zinc sulphate liquor, now wasted, are brought forward. Many of them are ingenious and have undoubted merit, and I confidently look forward to an economical utilization of this liquor."

CONSULTATION

Ability of Explosives To Withstand Low Temperatures

"Please give me the most complete information you can in regard to the following questions: What is the lowest practical temperature for the use of various grades of mining explosives known as low freezing, extra gelatine, gelatins, extra, blasting gelatin, Judson and permissible powders?"

To obtain first-hand information from specialists in the use of these explosives, we have communicated with a powder manufacturer, who informs us that it is impossible to state accurately to how low a temperature high explosives can be exposed without becoming insensitive. This is because of the peculiar behavior of nitroglycerine, the active constituent of dynamite. Sometimes, according to this informant, an ordinary high-freezing nitroglycerine will not freeze when subjected for weeks to 0 deg. F. or lower temperatures, and another lot made in exactly the same way, as nearly as the manufacturer is able to judge, may freeze in half an hour at 47 or 48 deg. F. No one has been able to find out just why this condition should maintain.

Low-freezing nitroglycerines, according to the same manufacturer, are not susceptible to cold, and when on their worst behavior do not freeze on their first trial at temperatures higher than 32 deg. F. and are not likely to freeze for several days at that temperature. Their weak point, however, is that after they have been frozen and thawed, they may freeze on the next test at about the same temperature as the high-freezing members of the explosives group congeal.

The same facts apply generally to the high explosives that contain nitroglycerine, although the low-freezing gelatins usually do not freeze either as quickly or at as high a temperature as the low-freezing "straights" and "extras." Low-freezing gelatins, low-freezing blasting gelatins, and low-freezing extra gelatins rank together in this respect, and are followed by the permissible explosives, the straight dynamites and the extra dynamites in the order given.

Although the nitroglycerine in Judson 5 per cent powder may freeze, it is such a small part of the explosive ingredient that even if it does the powder is not insensitive, and can really be classed as non-freezing. The Judson 10, 15, and 20 per cent powders, however, rank in resistance to cold with the low-freezing permissibles.

Time is as important a factor as temperature in considering the freezing properties of explosives containing nitroglycerines. Whereas some varieties may freeze in a relatively short time after being subject to a temperature of, say, 20 deg. F., others resist this temperature for a week or more without freezing. The manufacturer consulted claims that the use of his non-freezing explosives is the solution to these difficulties. Although they are not as water-resistant as the gelatins, and give off more fumes on detonation, they are equal to the extras in both properties and are superior to the straights in the quality of fumes evolved.

Chemical Manganese Ore

"Will you please inform me what specifications are required of manganese chemical ore suitable for battery use? I would like to have a typical analysis."

The requirements that must be met by manganese ores used for the manufacture of dry batteries are exceedingly rigid. The important constituent is manganese dioxide, and the available oxygen is the important part of this constituent. Theoretically, manganese dioxide contains 63.21 per cent manganese and 36.79 per cent oxygen. Half of the oxygen, or 18.38 per cent, is termed available oxygen. Occasionally very pure manganese dioxide is found in nature, but in most occurrences there are various impurities, some of which are injurious and others inert. The limiting percentages (maximum) placed upon the substances classed as injurious impurities are: Copper, 0.025; nickel and cobalt, 0.10; silver, 0.04; total iron, 1.50; magnetic iron, 0.50; lead 0.06; nitrates figured as nitrogen, 0.005; carbon dioxide, 2. The total iron includes the magnetic iron.

Usually the ore is required to contain a minimum of 70 per cent manganese dioxide. Good ore contains from 92 to 97 per cent manganese dioxide. Lead sulphide (galena) and iron sulphide (pyrite) are very objectionable, and must be picked out by hand or removed by washing. Phosphates, unless in soluble form, are not objectionable. Too much iron lessens the amount of available oxygen, and if the iron is in magnetic form it causes gassing in the batteries. For these reasons limits are placed on the total iron and the magnetic iron. Silica is inert, and its presence merely serves to cut down the amount of available oxygen.

An example of an analysis of Montana ore follows:

	Per Cent		Per Cent
Available oxygen	13.78	Nickel	None
Manganese dioxide	74.90	Nitrates	None
Iron	0.764	Chromium	None
Copper	0.005	Lead	0.04
Phosphorus	0.06	Carbon dioxide	1.20
Water	8.05	Silica	11.3

Chemical manganese ores are shipped in closed cars to prevent contamination, and are sampled as the ore is unloaded by taking a small shovelful from each wheelbarrow, giving a sample of approximately 150 lb. This is crushed if necessary, mixed, and quartered down to 35 lb., which is crushed to ¼ in. size and quartered down to 200 gm., which is used as a moisture sample, being dried overnight at 110 deg. C. The sample is ground to 120-mesh, and the chemical determinations are made upon portions of it in the usual way.

As the ore is sold, it may be in lumps or fine particles. If necessary to subject it to cleaning processes, it will usually be marketed as ore particles from ⅜ to ⅛ in. in size and smaller. As the ore is sold in guaranteed content and percentage limit of impurity, sampling and careful analysis are especially necessary.

Important amounts of this ore are produced in the Phillipsburg district, in Montana, from which point it is shipped to manufactories upon the Pacific Coast. Japanese and Chinese shippers offer favorable guarantees, but are unable to gain any share of the market.

HANDY KNOWLEDGE

Recent Developments in Mine Ventilation

BY GEORGE S. RICE

Written for Engineering and Mining Journal

The U. S. Bureau of Mines has been informed by S. de Smidt, deputy mine inspector in the Department of Mines and Industry in South Africa, regarding some recent methods used in the Rand mines for improving ventilation and laying rock dust, which has been so serious in the past in the production of miner's consumption. Mr. de Smidt points out, however, that one problem that is so serious in some of our deep mines, as at Butte, namely, high temperature, does not prevail in the Rand mines, where the temperature gradient is quite low, there being only one degree rise for every 230 to 240 ft. increase in depth. The air temperature in the deeper mines, 4,000 to 5,000 ft. deep, is under 80 deg. F., and it is expected that even in the City Deep mines, which will reach 7,000 ft. in depth, it will not be over 86 deg. F. The mines being practically dry, there is no difficulty as to humidity in the use of water for laying the dust.

Water drills are used universally, and operators are now beginning to attain such refinement in practice that they are discriminating as between different water drills in the matter of dust production. The kata-thermometer has been generally adopted as giving an index of the comfort of the men so far as temperature, air current, and relative humidity are concerned.

One of the most interesting points suggested by Mr. de Smidt is the introduction of a new type of pipe for ventilating headings which appears to have great advantages over the use of either galvanized iron or cloth pipes. This is a reinforced concrete pipe made in 6 and 8-ft. lengths and 1 in. thick for 12-in. pipe. It is made in plain cylindrical form, using wire mesh as reinforcement. The interesting feature is the employment of sleeves for the joints. These are about 4 in. long, and cover the joint between the lengths. Soft clay is pressed into the joint.

The method of construction adopted has the advantage that the sleeves permit a gradual bend in the line and special curved shapes can be made. The pipe that is used in South Africa is laid on the floor, which again presents advantages, as if there is any likelihood to falls from the hanging wall, the pipe can be covered with loose material so that small pieces will not break it. The greatest advantage, however, is that when blowing in cool air the air does not become heated in passing through a long length to a hot level, the concrete being a poor conductor; and if conditions favor the exhausting of the air through the pipe when gases are given off at the face, either from the strata or from blasting, the concrete pipe is better than long lengths of cloth pipe.

As such pipe cannot be brought as close to the face as cloth pipe (in South Africa it is brought within about 50 ft.), a movable length of cloth pipe can be fastened on the end and brought up to the face, as is now done in the Butte mines. Were it advisable to use this for exhaust purposes, the cloth could be reinforced by ribs.

Neighborly Chats With the Foreman—Timber Waste

BY DUNCAN MACGREGOR

Written for Engineering and Mining Journal

Your memorandum, Jim, about excessive timbering costs has given me some trouble, and I'm a little doubtful as to whether I can give you much real help. However, there's one thing that you ought to do first: Find out where the timber is going—that is, what parts of the mine and kinds of work—and then make systematic observations upon the condition of the standing timber in each part of the mine—shafts, drifts, crosscuts, stopes, and raises. Keep your notebook busy and record your observations from day to day. You can't put much time upon this during your shift, but you can get a little additional information each time you make your round. Have your timber bosses keep records of the timber going into each level. Note, also, the kind of ground in various parts of the mine. You know the length of time timbers have been in place in different parts of the mine.

Gathering this information will put your mind more sharply upon the conditions affecting the support of the workings. Talk the subject over at intervals with the mining engineer, and get his opinion upon the most suitable sizes of timbers and details of timbering required for your worst conditions. Get his assistance to prepare drawings of standard timbering for different workings. Insist upon the simplest framing, so that the labor for preparation and the wastage in cutting will be a minimum.

Discuss with your shift bosses the practicability of reducing the timber sizes or increasing the spacing between sets for the different kinds of ground, and where a change looks feasible, make it and then watch the results. Don't make too many changes in the prevailing practice all at once, but do it a little at a time, and by giving a reasonable time interval you will know whether your judgment has been good or bad. I have noticed among practical men a great tendency to use large timbers where much smaller ones would answer equally well. Undoubtedly there has been great waste in mining from this cause. Intelligent observation will enable closer discrimination to be made as to the suitability of timber sizes. There are no hard or fast rules that can be laid down, as the conditions in each mine are different. Your close study of the existing conditions in the mine is of far greater value than any book of rules.

Economy begins in the careful selection of timber sizes. Next is the preparation of some kinds of timbering. This will enable the timber shop to plan the quantity production of the pieces required and will enable you to do a minimum of cutting and framing underground. Doing this work underground, you are using the time of your timbermen to disadvantage, as the space is restricted, the light poor, and hand tools must be used, and there is a greater liability to accidents. The work of the timber gang should be restricted almost entirely to erection. To attain this end you should get the engineering departments to work up your standards thoroughly. Charles A. Mitke's little book, "Standardization of Mining Methods," is worth a considerable amount of study, as it will suggest specific things to you.

You ought to get interested, also, in the application of gunite underground. You know how much trouble you had in the long crosscut on No. 10 level. As I remember it, both you and your superintendent decided to timber it throughout. It occurs to me that there was practically no ground movement, and most of your trouble was caused by the action of the air and moisture of the rocks. Your men were always complaining about pieces flaking off, and then you had the whole crosscut timbered. This was all right at the time, but if you could have put an air-tight skin on that exposed rock you would have saved some money and would have made a permanent job. When you open up that crosscut on No. 12 level, you ought to interest the superintendent in trying out gunite. Gunite can't be used where you have heavy ground pressure due to moving ground. It's of no value except in your permanent openings, and in these only where there is no ground movement and the wall rocks show atmospheric action. If you had an outfit you could fireproof your worst stations.

The condition in your lowest stopes is exceedingly troublesome. You can avoid excessive timber breakage for a time by using more headboards, but you had better interest the superintendent in deciding upon an active campaign of waste filling. This is the only way you can minimize ground movement. As you say, the ground movement is becoming more pronounced, and you are using larger and larger timbers without much improvement. This increase of ground movement is a natural consequence of increasing the amount of open stope work. Your only remedy is systematic filling.

Relining a Hardinge Mill

By John Dixon

Written for *Engineering and Mining Journal*

On relining the 8 ft. x 30-in. Hardinge mill at the Kirkland Lake Gold Mines, Kirkland Lake, Ont., it was found that a large proportion of the liners were not worn sufficiently to be thrown away, but that the rest were worn through in places. If the whole lining were scrapped there would have been a serious waste of material, and if the partly worn liners were taken out and used again there would have been the double trouble of taking them out and replacing them, whether they were used as part of a new lining or saved until the mill could be relined entirely with partly worn liners. Also, it was necessary to open the mill periodically to observe the condition of the lining, to avoid the risk of wearing the shell. The following procedure was therefore adopted:

Every two weeks the mill is stopped with the rising manhole slightly above the center of the mill. This door is then removed and the work of replacing the badly worn liners is started without emptying the mill. The mill is lined with the standard Hardinge wedge and plate liners. The liners that are out of reach are left until the mill is turned further, but all the worn liners just above the ball level are replaced. If a wedge is badly worn, the bolts are loosened, the wedge is removed and a new one is put in place and bolted to the shell. If a plate is worn sufficiently, the wedge above it is removed, allowing the plate to be taken out. A new plate is put in, and the old wedge replaced.

After all the badly worn liners have been replaced that can be conveniently reached from the first position of the mill, the mill is turned by power to expose two or three more rows of liners. The liners in the rows newly exposed are then replaced, where necessary, together with those brought within reach from the top on the opposite side of the mill. The operation is repeated until the open door is as low as possible without spilling balls and slime. The door is then replaced and the opposite manhole is brought slightly above center with the mill turned 180 deg. This door is removed and all remaining liners are changed.

Three men work together on the job. One man works outside, loosening and tightening bolts. One man works inside, removing and replacing liners, and one man helps, inside or out as needed. From five to twenty liners are replaced every two weeks, with an average of ten. From five to nine hours are required to complete the job. Though this scheme is of particular advantage in the Hardinge mill where there is considerable variation of liner wear in different sections of the mill, it could also be used in other mills.

Examining Minerals in Ore Pulp

By Alfred T. Fry

Written for *Engineering and Mining Journal*

In *Engineering and Mining Journal* of Aug. 20, 1921, on page 283, R. E. Head describes a method of preparing microscope slides by dropping the mineral to be examined into molten wax, where it settles to the bottom. After cooling, the piece of wax is cut, polished, and etched if necessary.

This may suit a man who has the necessary apparatus, but by the more numerous unfortunates who are miles from such gear, and whose time would not permit its use if the means were at hand, the above description will scarcely be appreciated as it should. There is a possibility, also, that heavier particles may settle to the bottom of the wax first, leaving lighter ones to follow, so that it may be necessary to cut vertically.

Recently a friend demonstrated to me the use of the Kotze konimeter, the essential of which is the impingement of dust particles on to a film of vaseline, where they are caught and examined at leisure by the aid of the microscope. I have used a modification of the method for examining some powders such as feed, concentrate, and tailing, in the following way:

Smear an ordinary glass slide with vaseline by putting a small quantity toward one end. Then with a quick stroke of a glass rod held closely against the slide, the vaseline is spread in a thin even film. Have a small heap of the sample to be examined and press the greasy side of the slide lightly on the powder. Then shake off the non-adherent portion. It is preferable sometimes to have only a dusting of sample on the slide rather than a thick layer. It will be found on examining this slide, with the glass side up toward a low-power microscope, that the particles are in one plane practically and very easy to observe.

By gluing a strip of card at each end of a white card about the same size as the slide, a white background is provided which does not come in contact with the patch when the slide is rested on it for examination. As only small patches are necessary for observation, feed, concentrate, and tailing from a single machine can be accommodated side by side on the same slide.

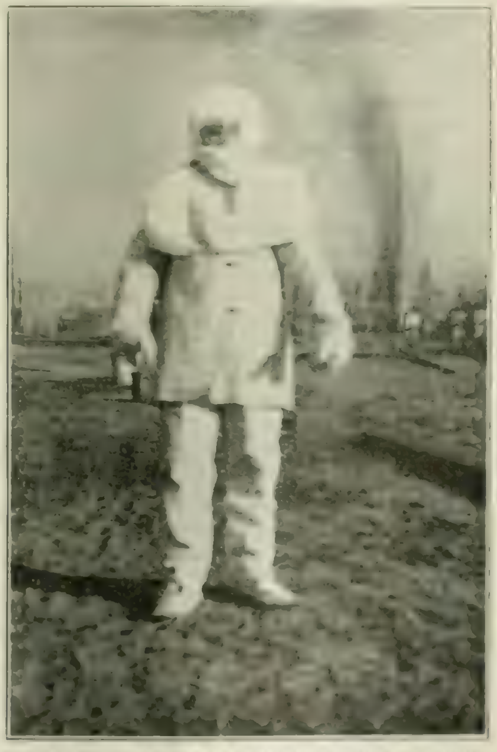
THE PETROLEUM INDUSTRY

Snuffing a Burning Oil Well

Recently an unusual method was adopted to extinguish a burning oil well at Long Beach, Cal. The Martin No. 1 well of the Shell Co., at Signal Hill, had been cemented at a depth of 2,640 ft. for about three days when an explosion took place, and the escaping gas became ignited. This is the first time in the history of California oil developments that a well had blown out after having been cemented. The plug had been setting for several days when the gas worked itself through the space between the 10-in. and 15-in. casing, and came out with such force that no ignition took place until the gas had come in contact with the oxygen at a point about 12 ft. above the point of discharge.

Attempts to smother the flame with steam and mud flow were unsuccessful, and it was then decided to make use of dynamite. Accordingly, a stand, about 7 ft. high, was incased in asbestos, and on this it was proposed to place 100 lb. of 80 per cent gelatin dynamite, wrapped in asbestos paper. To approach sufficiently near to the well to place the stand, it was necessary for two of the men, Ford Alexander and George E. Oliver, to wear asbestos suits, which had been brought by R. H. Clausen, an engineer of the H. W. Johns-Manville Co., from Los Angeles. While Alexander and Oliver were carrying the explosive, Clausen was looking after possible entanglements of the exploder wires, and as soon as the stand was in place and the powder placed thereon the charge was exploded by battery.

MEN LAYING TEMPORARY PIPE TO MARTIN NO. 1 WELL, LONG BEACH, CAL., WHICH WAS RECENTLY ON FIRE AND WAS EXTINGUISHED IN AN UNUSUAL MANNER



FORD ALEXANDER CLAD IN THE ASBESTOS SUIT WHICH HE WORE WHILE PLACING DYNAMITE, WHICH WHEN EXPLODED, EXTINGUISHED THE BURNING WELL

The explosion served to extinguish the flame, but did not shut off the gas flow. Additional boilers had been set up and a line of pipe was laid. Through this a stream of steam and mud was directed into the hole with the intention of forcing it in and thus choking off the gas. For several hours the mixture poured into the well was shot out about as fast as it was poured in, the pressure from below producing an effect not unlike that of a geyser. It was not until three days' work with the steam and mud that sufficient stoppage was produced completely to shut off the gas. The well has probably been lost and must be redrilled.

Petroleum Investigations by the U. S. Bureau of Mines

At the Petroleum Experiment Station of the Bureau of Mines at Bartlesville, Okla., an investigation of pipe-line losses from evaporation on the trunk pipe line of the Gulf Production Co. has been completed. In the course of the investigation a large number of samples of both oil and gas were collected and analyzed and the evaporation loss calculated. A similar investigation has been started on the main line of the Sinclair Pipe Line Co., and a series of tests similar to those conducted at the measuring stations of the Gulf pipe line will be carried out.

A series of tests has been conducted at the Bartlesville Station to determine pressures developed in tank cars containing natural-gas gasoline of 8 lb. vapor tension, which tests were supplementary to an investigation conducted at Drumright, Okla., on natural-gas gasoline of 10 lb. vapor tension. These tests are being conducted for the purpose of finding out the difference in hazard in handling gasoline of 8 lb. vapor tension as compared to that allowed by the regulations of the Bureau of Explosives. Arrangements have also been made for determining the temperatures and pressures that are commonly developed in insulated and non-insulated tank cars in transit and under general temperature and traffic conditions.

An investigation is being conducted to determine the effect of regulated back pressure on the production of oil. The tests are being made at two wells on the lease of the Osage Development Co. in Osage County, Okla. Results to date indicate that there is little difference between the production of the two wells against a back pressure of 30 lb. compared to a back pressure of 15 lb., but it is possible that there will be a noticeable difference at the lower pressures.

At the Pittsburgh Experiment Station a study has been made of viscosity temperature curves of fractions from Mid-Continent and Gulf Coast crude petroleums. Preliminary work has been started on cracking by means of high tension electric discharge. A study has also been made of analytical distillation of unblended casinghead gasoline, and of the oxygen bomb method of determining sulphur in petroleum.

At the Boulder, Col., field office, in the course of the oil-shale investigations, runs have been made with a large horizontal retort in which the highest yields and the best oils thus far produced were obtained. Changes in the retort have made its control much more effective than in the past. Recent work apparently indicates that oil yielded by a horizontal retort is not of as high quality as that which is recovered from retorts of the vertical type.

Experimental refining of shale oil at the Boulder office indicates the extreme difficulty of securing white refined products from shale oil without excessive losses, although oils of a somewhat darker color can be obtained with much smaller losses, and these apparently do not change color with age. The work has also indicated the value of using dilute reagents in the refining and the probability that commercial shale oil products will never be of as good color as present-day petroleum products. Lubricating oils of satisfactory color and viscosity have been obtained, but only at the expense of an excessively higher refining loss.

Work is being continued at the Boulder office on elementary analyses of oil shales. In making combustion analyses of the shales and their products, the bituminous matter of the shale, when freed from the inorganic matter, takes up water very rapidly, and much care has to be exercised that the sample does not gain moisture during the weighing period or while being transferred from the balance to the combustion tube. Very good check determinations have been made, however, and it can now be considered that the combustion problem has been solved. Samples of representative shales from different parts of the country have been received in connection with the investigation now progressing.

A study of the underground conditions in the Slick oil field near Bristow, Okla., has been undertaken by F. X. Schwarzenbek, assistant petroleum technologist, and J. H. Cable, assistant petroleum engineer. The object of the investigation is to prevent wastes of oil and gas by instructing operators in proper methods for drilling and handling wells. Funds for the investigation, which should be finished by May 1, 1922, are provided by the State of Oklahoma. At a later date, there will be prepared a report embodying the bureau's recommendations regarding the development of this field so as to provide for the effective conservation of oil and gas.

October Petroleum Shipments From Mexico

The shipments of petroleum from the Tampico oil fields for the month of October, 1921, according to *Commerce Reports*, reached a total of 16,052,589 bbl., of 42 gal. each, decreasing 1,154,537 bbl. from the September shipments. The decrease was due primarily to a restricted market for oil in the United States and also to a rather marked falling off of production, caused by salt-water inroads in the Southern Fields district of Amatlan. A considerable part of the October shipments was taken from storage, having accumulated during the months of July and August, when shipments were cut about two-thirds because of export taxes, which were alleged to be excessive. It is thought that such storage reserves have now been about exhausted and that exportations during the present month and in future months will more nearly parallel the actual production of the field.

Lack of Pipe Lines in Mexia, Texas, Field

SPECIAL CORRESPONDENCE

It has announced recently that the Standard Oil Co. of Indiana has contracted with the Humphreys-Pure Oil interests to take 33,000,000 bbl. of crude oil to be produced from the latter companies holding in the Mexia, Texas, field at $1.50 per bbl. The present posted price for Mexia crude oil is 75c., a price due entirely to the lack of pipe lines to this field. The oil probably will be handled through the projected Sinclair Pipe Line Co.'s line from Mexia to Eastland. It is stated that the Prairie Pipe Line Co. may also build into Mexia. The Texas Co. is now building an 8-in. line from its tank farm at Groesbeck, about 12 miles south of Mexia, to Freestone Junction, where it will be connected with the company's main line from North Texas to Port Arthur. The Humble Oil & Refining Co. is also building an 8-in. pipe line, to extend from Groesbeck to Hearne, where connection will then be made with the company's main North Texas line. The proposed improvements will materially benefit the Mexia district.

Recent Patents

Chloridizing Lead Ores—No. 1,396,740. S. Ganelin, Brooklyn, N. Y. The process covers the treatment of complex lead-zinc sulphide ores. A metal chloride is added to the ore, in amount corresponding to the sulphide of lead present (as well as any arsenic and antimony) and the mixture is charged to a mechanically rabbled furnace. The lead chloride which forms is then leached out and the lead recovered as metal. Precautions are taken to prevent a reaction between the metal sulphides present in the furnace product and the lead chloride.

Metallurgy of Vanadium—No. 1,396,922. A. H. Carpenter, Sawpit, Col., assignor to the Colorado Vanadium Corporation, Sawpit, Col. A process of recovering vanadium from its ores and compounds, comprising mixing the ore or compound with sodium chloride, a relatively stable alkali-metal salt, and a sulphur-containing material, and roasting to transpose the vanadium compound to one soluble in water.

Metallurgy of Molybdenum — No. 1,399,554. E. M. Hamilton, San Francisco, Cal., assignor to Hamilton, Beauchamp, Woodworth, Inc., San Francisco. The ore or concentrate is ground, mixed with water and with a non-volatile alkali metal to form an alkaline pulp, and the pulp is then heated to convert the molybdenum into a soluble compound. The pulp is then filtered and the molybdenum recovered.

Flotation Machine — No. 1,399,539. H. H. Bonnell, Denver, Col. A V-shaped cell in which the pulp is admitted through a submerged tube, carried up one side of the cell, and allowed to flow over an apron plate, after which the froth is removed and collected.

Cyanide Process—No. 1,399,458. J. C. Haun, Tonopah, Nev., and A. Silver, San Francisco, Cal. The ore is subjected to the action of a solution containing a cyanide, a bicarbonate, and a lead compound capable of combining with the sulphur of sulphides.

Metallurgy of Vanadium—No. 1,399,246. W. F. Bleecker, Boulder, Col., assignor to the Tungsten Products Co., Boulder, Col. The process consists in mixing the ore with an alkali-metal carbonate and water, heating under pressure to a high temperature, separating the alkaline liquor from the product, treating the residue with an acid, separating the acid liquor by filtration, and removing vanadium carrying slime from the residue.

Hydrometallurgy of Zinc—No. 1,399,020. F. E. Lee, A. L. McCallum, and S. G. Blaylock, Trail, B. C., assignors to the Consolidated Mining & Smelting Co., Montreal, Que. A process for treating zinc ores, concentrates and residues, which consist in oxidizing the zinc compounds, extracting the soluble zinc, and heating the residue in a sulphating atmosphere to convert the remainder of the zinc into soluble compounds. A flow sheet is shown.

Flotation—No. 1,397,703. H. R. Robbins, Washington, D. C., assignor to Metals Recovery Co., New York. In the flotation treatment of copper sulphide ores the patent covers the use of a non-alkaline salt without organic frothing agent.

Cyanide Process—No. 1,397,684. A. W. Hahn, New York. Before the addition of zinc to the pregnant solution, a chemical is added that will be acted upon by the zinc to liberate hydrogen and precipitate the precious metal. The advantage is claimed of not consuming free cyanide present in the solution.

Dry Ore Concentrator—No. 1,397,749. A. W. Tyler, Los Angeles, Cal., assignor to Walter Young, Los Angeles, Cal. The patent covers a table having a perforated ore-supporting surface, means to blow air upwardly through the perforations, and means to move a portion of the table in an elliptical path.

Flotation—No. 1,398,989. E. W. Wilkinson, San Francisco, Cal., assignor to Minerals Separation North American Corporation, New York. An organic substance is subjected to partial decomposition in the presence of free oxygen, and the mixed volatile products of such operation are mixed with the ore pulp along with another gas, to produce a mineral-bearing froth. A second patent, No. 1,398,990, covers much the same process.

Roasting Furnace — No. 1,399,046. F. J. Bowman, Cleveland, Ohio, assignor to the Graselli Chemical Co., Cleveland, Ohio. A roasting chamber having a plurality of triangular heated elements, with means for introducing finely divided ore and oxygen.

Patent Index — The U. S. Patent Office, Washington, D. C., has issued a 1,315-page book containing a list of all the patents issued in 1920, arranged alphabetically by patentees and by inventions.

Book Reviews

Handbook for Field Geologists. By C. W. Hayes, Ph.D. Third edition. Revised and enlarged by Sidney Paige, U. S. Geological Survey. Flexible binding; 4½ x 6¾; pp. 166; Figs. 22. John Wiley & Sons, Inc., New York, 1921. Price, $2.50.

This useful and handy little volume has been standard since first published, in 1908, by the late Dr. Hayes. It is essentially a manual for young professional geologists, notably those in the Federal geological survey and state surveys, also for geological work in connection with universities and other institutions, and for students. It is not a prospector's guide, nor even a treatise on economic geology. It describes the technique and field and office methods of the professional geologist. It is compact, valuable, and accurate, and the publication of a new edition demonstrates the fact that there is a permanent field for it.

Technical Papers

Copper Leaching—The [illegible] copper-leaching process employs sulphurous acid for reducing ferric sulphate to the ferrous form. It has been used at the Mount Hope copper mine, in New South Wales, and was recently described in a government report issued by T. Blatchford, assistant state mining engineer. Mr. Blatchford's description is abstracted in the November issue of *The Mining Magazine.* (Salisbury House, London Wall, London, E. C. 2, England; price, 1s. 6d.) The ore, averaging 6 per cent copper in the form of carbonates and oxides, is leached with sulphuric acid, and the resulting solution passed through so-called pyritic filters. These are vats with false bottoms on which is placed pyritic ore. The solutions from the pyritic filter are passed over scrap iron, forming a precipitate containing about 70 per cent metallic copper.

Western Australia—The 1920 report of the Department of Mines of Western Australia is now obtainable from the Under Secretary for Mines, Perth. The report contains over 200 pages and gives a complete account of mining activities during the year. A map of the territory drawn to a scale of four miles to the inch is included.

Powdered Coal — "The Preparation, Transportation, and Combustion of Powdered Coal" is the title of a 131-page bulletin recently issued by the Mines Branch, Department of Mines, Ottawa, Canada. It may be obtained on request. The book is well written, and all who are interested in the subject will find it worth while to procure a copy. The information given has not been obtained from research work at the government laboratories, but, in the opinion of the author, John Blizard, such research work would have valuable results in increasing present efficiencies. Manufacturers and power-plant operators in the United States and Canada were the source of most of the data.

Mining Methods—The Nov. [illegible] issue of the *Salt Lake Mining Review* (Salt Lake City, Utah; price, [illegible]) contains a three-page article entitled "Methods of Mining at the Highland Boy Mine of the Utah Consolidated, Bingham, Utah." The method of mining employed consists of modified square-set stoping and subsequent filling.

Mining in Chile—"A History of Mining in Chile" occupies seven pages in *The Mining Magazine* for November (Salisbury House, London Wall, London, E. C. 2, England; price, 1s. 6d.)

Mineral Resources—Recent additions to the "Mineral Resources" series published by the U. S. Geological Survey include "Gold, Silver, Copper, Lead, and Zinc in California and Oregon in [illegible]," [illegible] pages, and "Natural-Gas Gasoline," [illegible] pages. Either may be obtained on request to the Survey at Washington, D. C.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Exchange of Goods and Services, Not Gold, Necessary to International Trade

The accumulation of the world's gold in the United States called forth the following comment from W. P. G. Harding, the governor of the Federal Reserve Board, in a recent public address:

"During the past year we have received large additions to our stock of gold by reason of importation from foreign countries. These importations do not represent sums for account of central banks, which have as a rule increased their gold holdings since the outbreak of the war, but they represent widely scattered holdings from practically all countries which have been sent here in payment of pressing obligations or for the purchase of supplies urgently needed.

"It is evident, however, that a normal volume of foreign trade cannot be supported by shipments of gold from abroad. In ordinary circumstances international trade is based upon the exchange of goods and services, actual transfers of gold representing only a very small proportion of the total volume of business and being made merely for the purpose of stabilizing the exchanges.

"The question is often asked, Why in view of our enormous stock of gold, American bankers do not avail themselves of the opportunity of making the United States the world's banker. There is no question that our present gold supply is far beyond our domestic requirements, nor is there any doubt that a great stimulus would be given to our foreign trade were it practicable for American bankers to engage in world finance in a large way.

"Judging from our own history after the Civil War, many years will doubtless elapse before some European countries can restore the normal value of their currencies, but if the violent fluctuations in exchange which have marked the past two years can be prevented in the future, and a stabilization on some basis accomplished, it will be possible to engage in commercial and financial transactions with Europe on a much larger scale than at present.

If we wish to sell our surplus products abroad, it is evident that we must continue to exchange commodities with foreign countries, for where we sell we must buy. A curtailment of production to meet merely American requirements would involve widespread unemployment and would invite disaster. On the other hand, because of the great depreciation in the currencies of many foreign countries, their labor costs are much less than ours, and partly because of this fact and partly because of the high premium on dollar exchange, they are able to undersell us in our own markets. One of the great problems of our national legislators today is to frame a tariff which wiil prevent the dumping upon our markets of foreign goods, without at the same time erecting a tariff wall so high that our exports will be greatly reduced because of the inability of foreign nations to trade with us."

Mining Policy Discussed by New York Section, M. and M. Society

C. M. Weld, chairman of the New York Section of the Mining and Metallurgical Society of America, opened the December meeting of the section at the Harvard Club, on the evening of Dec. 14. C. K. Leith was introduced and discussed the report of the Committee on Foreign and Domestic Mining Policy. Criticisms of the report were answered. Mr. Leith stated that the listing of minerals used in the committee's report might be extended and improved upon. Referring to the criticisms that the report is a "free trade document," Mr. Leith stated that in Group A, minerals of which the United States has large quantities available for export, protection was unnecessary and a tariff would bring in no revenue; in Group B, minerals in adequate amounts but without excess or deficiency, a tariff for revenue purposes was not an important matter, but under certain conditions a tariff might be put on; in Group C, minerals of which there is an inadequate supply, there existed the greatest difference of opinion.

Robert Linton, the next speaker, stated that the plans for the annual meeting of the society to be held early in 1922 included an extended discussion of the question of mineral policy which would include the statistical position of the minerals, a board consideration of the tariff and the development of mineral deposits in other countries by American capital.

W. R. Ingalls offered a resolution approving the report of the Committee on Foreign and Domestic Mining Policy by the New York Section and referring it to the society as a whole. After some discussion the resolution was passed. The discussion of the relation of the tariff to mineral policy became general, D. M. Liddell, W. Y. Westervelt, S. H. Dolbear, Van. H. Manning and others taking part.

Guy C. Riddell praised the report of the committee and advised the members of the society to get the committee's report before the Tariff Commission or the Senate Committee without delay.

J. E. Spurr pointed out that what is most wanted is efficiency in the management of our mineral resources. After discussing the depletion of mineral deposits, he stated that the data for the appraisal of our mineral resources is available and that the U. S. Geological Survey is the instrument that should make the appraisal.

J. F. Callbreath, on being invited to speak on the subject, asked that H. W. Smith be heard instead of himself. Mr. Smith presented many complex angles of the tariff question. He sketched the work of the American Mining Congress in gathering data on the tariff question and showed various charts and groups of curves. According to Mr. Smith, the price curve upon a mineral commodity, unprotected by a tariff, showed great fluctuation over a time period of considerable duration, the depressions indicating an approach to bankruptcy in the particular industry and the peaks, profiteering. The consumer received no benefit from the very low prices. Price fluctuations of a mineral product protected by a tariff were less accentuated and there was a considerable degree of stabilization in the industry. Mr. Smith was of the opinion that we can develop mineral deposits by legislation and made a plea that tariff experimentation should be tried, to the end that various mineral industries be permitted a normal life.

Mr. Leith and Mr. Manning closed the discussion. Charles W. Potts was then invited by the chairman to present some phases of the manganese situation.

Boston Section, A. I. M. E., Considers Engineering Consolidation Plan

The seventy-first meeting of the Boston Section, A. I. M. E., was held at the Engineers Club, on Dec. 5, 1921. It was preceded by the usual dinner and was well attended.

A report was read on a plan for consolidating the administrative work and headquarters of the engineering and technical societies of Boston. The plan in question had been prepared by a joint committee consisting of representatives from the several societies and provides for:

1—A consolidation of the administrative work of the societies in the hands of a council consisting of two councillors from each society.

2—The employment of a paid secretary and office force.

3—The use of the present quarters of the Boston Society of Civil Engineers in Tremont Temple building.

4—That the name of the organization be The Associate Technical Societies of Boston.

The advantages and disadvantages of such an arrangement and the obstacles in the way of its accomplishment were discussed by Allan H. Rogers, Professor Bugbee, Professor Lane, G. H. Clevenger and others, the general sentiment being that such a consolidation is desirable. Considerable doubt was expressed, however, regarding the possibility of making financial arrangements which would not be a serious burden to the section.

Professor Lane made a motion as follows, which was seconded by Professor Bugbee and carried unanimously: "That a committee of three be appointed by the chairman to recommend to the section the action which it should take in accepting or declining the invitation to join the proposed Boston Association of Technical Societies and in case of a favorable recommendation to recommend a method for financing the assessment of the section in this association and report to the section at its next meeting."

F. W. Denton gave an interesting talk on "Mining Methods at the Copper Range Mines," supplemented by lantern slides, most of which were taken underground, illustrating mining methods.

Mineral Output of Alaska for 1920 Shows 12½ per Cent Increase

In his report to Congress, the Governor of Alaska refers to mining in that territory, as follows:

"Mining at a profit has been rendered most difficult, and large enterprises have been compelled to close down or greatly curtail their operations. Both quartz and placer mining have been checked by adverse economic conditions.

"In view of the present extreme stagnation in all the mining regions of the States, and the demoralized condition of the entire metal market, the Alaska mining industry appears to be in a healthy condition. The fact that the mineral output of Alaska for the year 1920 shows a substantial increase over that of 1919—12½ per cent—and represents a normal growth when compared with the average annual production for the past decade, is very encouraging."

MEN YOU SHOULD KNOW ABOUT

W. H. Blackburn, of Tonopah was recently in San Francisco.

C. E. Chaflin has returned to New York after a six months' trip to South America.

F. J. S. Sur, petroleum geologist of San Antonio, is inspecting lands in Rockwall County, Tex.

V. S. Garbarini, superintendent of the Argonaut mine, at Jackson, Cal., was recently in San Francisco.

George H. Garrey, who recently returned from geological work in British Columbia, was a visitor in New York last week.

N. S. Sheridan, mining engineer with the Midnight mine, in Idaho, is in New York in consultation with the directors of the company.

Hugh M. Henton has resigned his position with Case School of Applied Science and has opened an office as consulting engineer at 615 National City Building, Cleveland, Ohio.

R. W. Stone, of the staff of the U. S. Geological Survey, has resigned to accept a position as assistant state geologist of Pennsylvania. He will enter upon his new duties Jan. 1.

David White, chief geologist of the U. S. Geological Survey, delivered a lecture on "The Origin of Coal and Petroleum" on Dec. 17 before the Royal Canadian Institute at Toronto.

Mining and metallurgical engineers visiting New York City last week included: **John C. Anderson**, Tucson, Ariz.; **E. B. Emrick**, Grand Junction, Col.; **Stanly Easton**, Kellogg, Idaho; **Arthur C. Green**, Chicago; **E. Eggleston Smith**, Paris; **Charles Janin**, San Francisco; **J. S. Cheyney**, Canon City, Col.; **Frank M. Smith**, Spokane; **Gaichi Yamada**, Japan; **Thomas S. Roberts**, Shamokin, Pa.; and **David Douglas**, Fort Worth, Tex.

SOCIETY MEETINGS ANNOUNCED

At the annual meeting of the **Colorado Scientific Society**, the following officers were elected for the ensuing year: President, W. F. R. Mills; first vice-president, J. Claire Evans; second vice-president, W. A. Johnston; treasurer, Charles W. Henderson; secretary, W. A. Johnston; members of executive committee, terms to expire Jan. 1, 1925, L. G. Carpenter and Robert W. Gordon.

The Columbia Section, A.I.M.E., will hold its eleventh annual meeting at the Davenport Hotel, Spokane, on Dec. 28. The nominating committee has submitted the following names of members for officers for the coming year: Rush J. White, Wallace, Idaho, for chairman; Frank M. Smith, Spokane, for vice-chairman; and L. K. Armstrong, Spokane, for secretary-treasurer.

The following papers will be presented at the annual meeting of the Society of Economic Geologists, Amherst, Mass., Dec. 28-30: Presidential address, R. A. F. Penrose, Jr., "The Society of Economic Geologists: Its Sphere and Its Future"; "Plain Geology," by George Otis Smith; "The Need of Expediting Topographic Mapping of the United States," by F. W. De Wolf; "Ore Deposits of Leadville, Col.," by G. F. Loughlin; "The Geology of the Braden Mine, Chile," by Waldemar Lindgren and E. S. Bastin; "Stressing Economics in the Teaching of Economic Geology," by E. S. Bastin; "The Oil and Gas Section of the Course in Economic Gealogy," by Roswell H. Johnson; "Experimental Study of Invasion of Oil Into a Water-Wet Sand," by Orren W. Skirvin; "Results Obtained by Improved Methods of Extracting Petroleum," by Robert B. Bossler; "Probable Origin of Certain Vein Structures," by L. C. Graton; "A Recent Hot Spring Deposit in Bolivia" and "A Suggestion for the Terminology of Certain Ore Deposits," by Waldemar Lindgren; "The Gold-Bearing Cummingtonite Schists of the Black Hills, S. D.," by J. J. Runner; "Petrographic Notes on the Franklin, N. J., Zinc Ores," by W. C. Bowen; "Primary Native Silver Ores Near Wickenburg, Ariz., and Their Bearing on the Genesis of the Silver Ores of Cobalt, Ont.," by E. S. Bastin; "A Study of the Supergene Process at Neihart, Mont.," by M. E. Hurst; "Some Etching Tests on Pyrrhotite," by H. C. Boydell; "Geologic and Geographic Occurrence of Precious Stones," by Sydney H. Ball; "Geology of the Virginia Emery Deposits," by T. L. Watson, and "The Domestic Magnesite Industry in 1920," by R. W. Stone.

OBITUARY

Edward C. Arnold, general mine foreman for the Federal Lead Co., Flat River, Mo., died suddenly at Farmington, Mo., on Dec. 7. Mr. Arnold was a native of Texas, and was associated with the Inde Gold Mining Co., Inde, Durango, Mexico, for several years previous to 1913, when he went to Flat River. He was thirty-six years old.

Stephen Donaldson, mine captain at the Kirkland Lake mine, was killed on Dec. 13 by a blasting accident. Mr. Donaldson was thirty-four years old.

Robert H. McKean, manager of the credit department of the McGraw-Hill Company, Inc., died at his home on Dec. 17. Mr. McKean's services began with *Engineering and Mining Journal* in April, [illegible], as assistant in the accounting department. Within two years he had been promoted to the position of head bookkeeper, and at the time the *Journal* was purchased by Mr. Hill he was in charge of the accounting department. About a year after the purchase of the *Engineering and Mining Journal* by the Hill Publishing Co. Mr. McKean was appointed manager of the *Journal*, which position he held until he was elected a director and secretary of the Hill Publishing Co. At this time he assumed the management of the credit department of the company. He was a director and secretary of the Hill Publishing Co. until its consolidation with the McGraw Publishing Co. After the consolidation he became manager of the combined credit departments, and held this position until his death.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

Following repeated rumors of a proposed merger of the Anaconda Copper Mining Co. and the American Brass Co., it has been officially announced that the former has made a definite offer for the latter's stock contingent upon its securing 51 per cent of that outstanding.

Arrangements for financing the construction of a new railroad from Gallup, N. M., to Durango, Col., have been completed in Los Angeles. This road will give easy access to the San Juan district and will connect with the Santa Fe main line at Gallup.

Arizona's first industrial conference was held in Phoenix on Dec. 15 and 16. Louis D. Ricketts was the principal speaker at the mining session.

The new regulations governing the handling of claims under the recently enacted War Minerals Relief measure have been promulgated. It is also announced from Washington that the House Ways and Means Committee sees little chance for the McFadden gold bonus bill to be enacted.

The Federal Trade Commission has amended its complaint in the "Pittsburgh Plus" case, requiring the Steel Corporation and subsidiaries to file an answer within thirty days.

The state law of Arizona prohibiting the issuance of injunctions by courts in picketing during labor disputes has been held invalid by the U. S. Supreme Court.

Plan To Merge American Brass Announced

Anaconda's Offer for Stock Contingent Upon Acquisition of 51 Per Cent of Outstanding Shares

It has been officially announced that a plan has been made for the taking over of the American Brass Co. by the Anaconda Copper Mining Co. Stockholders of the former will soon be offered an opportunity to dispose of their shares to Anaconda on a basis of $150 in cash and three shares of Anaconda stock in exchange for each share of American Brass Co. stock. The period of time to be allowed for the deposit of American Brass stock will probably be the month of January. It is said that the offer will be conditional upon the deposit within that time of not less than 51 per cent of the $15,000,000 par value of American Brass stock outstanding.

This announcement was made after a meeting of the representatives of the larger stockholders of the American Brass Co. with John D. Ryan, chairman of the Anaconda, and J. A. Coe, president of the American Brass Co. Mr. Ryan said that no new financing would be necessary to carry out the merger of the two companies.

Spanish Producers Object to Tax on Pyrites Exports

By Reuters Agency

Madrid, Nov. 27—The mine owners at Huelva, Spain, are beginning to protest against the proposed duty of eight pesetas per ton on pyrites. They say that this duty will mean the ruin of the industry. The defenders of the proposed tax reply that the restrictions on exports will lead to the establishment in Spain of the manufacture of superphosphates, refined copper, and sulphuric acid.

Rich Radium Ore in Cornish Mine

By Cable From Reuters to "Engineering and Mining Journal"

London, Dec. 20—The manager of the South Terras mine, Cornwall, which is controlled by the Societe Industrielle du Radium, reports that a rich patch of ore has been struck, of which two tons were extracted. The assay averaged 80 to 100 mg. radium per ton.

Relief Work in Butte District Well Organized

At the time of the shutdown in Butte, Mont., last spring there were left on the mining companies' payrolls about 4,000 men, who since that time have been employed on rotation in ten-day shifts, with preference given to married men. Likewise at Anaconda there have been about 800 on rotating shifts.

Among the others in the Butte district who are not thus taken care of, it is possible that some may occasionally need temporary relief. To furnish such relief an organization known as the Silver Bow Relief Association was formed with some of the prominent members of different benevolent societies as directors. As to the necessary funds, there was in existence at this time the "War Chest," a relic of the war period. This was renamed the "Community Chest" and now receives and distributes funds and acts as treasurer for the Silver Bow association. All applications for relief are strictly investigated. As this scheme would be apt to divert business from local merchants, in order to be fair to the latter the association solicits bids for furnishing the supplies it distributes, the lowest merchant bidding getting the business. Contributions to the Community Chest are solicited from individuals, generally on a monthly basis. Each of the mining companies also contributes.

New Railroad to Durango, Colo., from Gallup, N. M., Assured

Construction To Begin Early in 1922—Will Connect with Santa Fe—Project Financed

Announcement is made that the requirements stipulated by a group of Los Angeles capitalists for furnishing the necessary capital to construct a broad-gage railroad from Gallup, N. M., to Durango, Col., have practically been complied with, and that construction work will start early next year. At present the San Juan district is served by a narrow-gage branch of the Denver & Rio Grande. The route is through cañons and over mountain passes, expensive to maintain, and the service, especially in the winter, is irregular and often entirely suspended for weeks at a time. Freight rates are almost prohibitive, and in consequence, a well-mineralized country, that is also rich in agricultural and stock-growing possibilities, lies almost dormant for lack of a market for its products. The proposed road connects with the Santa Fe at Gallup, and would offer direct connection with the East as well as the Pacific Coast.

I. C. C. Refuses To Continue Reduced Iron Ore Rates

Action Affects Certain Carriers Only—Holds Reduction Unfair and to Advantage of Competing Interior Furnaces

The Interstate Commerce Commission has refused to grant special permission to certain carriers to reduce rates on iron ore. In taking this action, the Commission explains that this decision is in no sense to be interpreted as a disinclination to approve justifiably lower rate levels. In this particular case the action is based upon the continuance of premature reductions confined to certain rates. The Commission points out that the reduction of these rates would be prejudicial to iron and steel manufacturers on the Lakes to the advantage of competing interior furnaces. In announcing its refusal, the Commission says:

"The Commission's action is based upon protests of shippers located at Buffalo, Cleveland, Erie, Chicago and other lake ports alleging that the proposed rates result in undue discrimination against them and preference for competing furnace interests at Pittsburgh and other interior points.

"Coal and iron ore are two of the important elements entering into steel manufacture. Most of the iron ore used in the East comes from Minnesota by lake. Lake front furnaces, therefore, pay no rail freight charges on ore but transport their coal by rail from Pittsburgh and other interior points. Interior furnaces on the other hand, while paying rail freight from Lake Erie ports on ore, are in most cases located in close proximity to the coal fields and pay only short haul rates on coal.

"In 1917, iron ore was transported from Lake Erie ports to Pittsburgh for 82c. per ton of 2,000 lb., whereas coal was charged $1.40 per ton from Pittsburgh to Buffalo, a difference of 58c. per ton. Iron ore rates in the East were not increased during Federal control, but coal rates were increased approximately 25 per cent. Rates on both commodities were increased in August, 1920, resulting in rates on ore and coal of $1.14 and $2.51, respectively.

"Under the adjustment now proposed by Eastern railroads the ore rate would be 82c. or the same as in 1917, whereas the coal rate would continue $2.51, including the increases of 1918 and 1920 and being higher by $1.69 per ton or 206 per cent than the ore rate. The rates on iron ore which will apply after Jan. 1, 1922, will include materially less increase over the pre-war basis than rates on commodities generally—even less than the reduced rates on farm products soon to be made effective."

New Idria Wins $1,803,364 Verdict in Damage Suit

Following ten days of testimony at Providence, R. I., in the $2,500,000 suit brought by the New Idria Quicksilver Mining Co., of California, against the British-American Manufacturing Co., of New York, a verdict for $1,803,364.05 was given on Dec. 16 in favor of the plaintiff. The New Idria claimed that the defendant had failed to keep its contract to buy 11,000 flasks of quicksilver.

Great Northern To Build New Dock at Duluth

Duluth—The Great Northern Railroad is preparing to begin work on a new ore dock which is estimated will cost $3,000,000. The new dock will take the place of the present No. 2 which is of wooden construction.

Arizona Industrial Conference Convenes

Phoenix Scene of First Gathering of Its Kind in State—Robert E. Tally Presides Over Mining Session—L. D. Ricketts Principal Speaker

By JAMES H. McCLINTOCK

THE civic and economic needs of Arizona inspired the gathering at Phoenix, Ariz., on Dec. 15 and 16, of about 200 representative business men of the state, with the mining interest prominent, though hardly in a majority. It was generally agreed that concerted action must be secured and to this end a state industrial body was organized through which reforms might be suggested.

The mining session of the conference was presided over by Robert E. Tally, assistant general manager of the United Verde Copper Co. of Jerome. In his brief address Mr. Tally told of the value to Arizona of the mines' payroll and of how the companies are striving to co-operate with all other state industries.

Dr. Louis D. Ricketts was the main speaker of the session. His address was a logical array of facts and figures showing what mining means to the Southwest and its advancement in the years since he came to Arizona, in 1890. In that time the population had increased 420 per cent, agriculture 600 per cent, railroads 145 per cent and mining production 1,500 per cent. When he came there were only tiny blast furnaces and 10-per cent copper ore was the leanest that could be handled. Jerome alone produced matte. In 1894 Dr. James Douglas introduced, at Bisbee, the first converter and about the same time small and imperfect concentrators were started in the Clifton district. In 1903 there was a great advance, the Copper Queen introducing at Douglas the large blast furnace, electric haulage, mechanical feeding and large slag cars. Three years later, at Cananea, came the first reverberatory furnace. In 1912 experiments at Inspiration proved flotation applicable to Arizona ores and then came development of new chemical processes by acid leaching and electrolytic recovery of copper in the mine at Ajo. The first great advance in mining methods was when Gates brought the shrinkage system from Utah for the Ray mines. Then, with Felix McDonald supervising, the so-called Ohio system was introduced at Inspiration.

In 1890 about 140,000 tons of copper ores were treated in Arizona, with a yield of about 250 lb. to the ton and a production of 35,000,000 lb. In 1920 probably 100 times this ore tonnage was handled, with a yield of not over [illegible] lb. of copper.

Upon this matter of methods, Dr. Ricketts laid especial stress, saying: "In the early days we were able to work only rich ore, because our methods were crude and our appliances inadequate and small. Through improvements in processes and the wonderful revolution in methods of handling material we have been able to pay labor at higher rates, to meet the increased demand for labor from other industries and to do away with it to a very large extent. The efficiency of a man today is tremendously increased. Probably the man output today is ten times as great as in 1890."

The peak of the Arizona copper output was in 1917, a matter of 720,000,000 lb. The expenditures of the Arizona mines for the year were: For labor, $34,299,000; freight, $17,786,000; refining, $5,035,000; supplies at their source, including fuel oil and coke, and taxes, etc., $26,055,000. Thus, the gross cost reached $83,173,000. Without inclusion of New York or central office costs, the cost of copper production, per pound, was 11.5c. About 50 per cent of the freight was paid for Arizona transportation. Over $40,000,000 went to wages and taxes. In 1920 the output was 20 per cent less, and refining, taxes and labor, especially the last, were much higher and the amount of money spent was about the same as during the peak year, so the copper cost rose to about 15c. a lb. These charges do not include eastern office expenses, interest charges, depreciation or mine exhaustion.

Since April of this year scarcely an Arizona mine has operated, yet there have been costs possibly amounting to $2,000,000, a quarter of the sum in the Warren district alone. Much copper has been sold during the year, but at a loss, at between 11 and 13c. a lb. The companies will have a cash surplus and will be able to resume operations when the time comes.

The great Arizona questions of the future concern freight rates and the fuel supply. The rates assuredly will be reduced, but only a few years will elapse, according to Dr. Ricketts, "when this commodity will become so costly we cannot afford to use it. We probably can get an inferior coal at high cost sufficient for smelting purposes, but I hope we will not be obliged to use this coal for power. The [illegible] of the Southwest [illegible] about [illegible] hp., in addition to that recovered from heat waste, and [illegible] hp. will be needed within a few years. Cheap power is essential, such power as can be obtained through hydro-electric development of the Colorado River." With this available at low cost, the speaker stated his belief that there will come great development and extension of leaching and the production of electrolytic copper in Arizona will become a much more important industry than at present. He said that he has able chemists at work "trying to devise methods of leaching certain classes of oxide and sulphide ores in order to provide for future contingencies."

Truax Picketing Case Decision Reversed

U. S. Supreme Court Declares Ruling of Arizona Court Unconstitutional—Guarantee of Equal Protection Violated

The Arizona state statute prohibiting the issuance of injunctions by courts in picketing cases during labor disputes has been held invalid by the U. S. Supreme Court in a decision handed down on Dec. 19 by Chief Justice William Howard Taft. The court split five to four on the decision, Associate Justices Holmes, Brandeis, Pitney and Clarke dissenting. The statute violates the guarantees in the Federal Constitution of equal protection under the law and prohibition against the taking of property without due process of law, in the opinion of the majority of the court.

This decision reverses that of the Arizona Supreme Court refusing an injunction applied for by William Truax, proprietor of a Bisbee eating house, who was picketed because he refused to put in operation an eight-hour day for his cooks and waiters, as demanded by organized labor. The methods used by the picketers were illegal, according to the decision just handed down. The effect of the ruling now held unconstitutional, the opinion states, is that "under the statute, loss may be inflicted on the plaintiff's property and business by 'picketing' in any form if violence be not used, and that because no violence was shown or claimed the campaign carried on, as described in the complaint and exhibits, did not unlawfully invade the right of the complainant.

American Labor Cheapest

When the relative efficiency of American labor is compared with foreign labor, according to a study made by H. E. Miles, chairman of the Fair Tariff League, it will be found that American labor is the cheapest on earth. In a statement to the Senate Finance Committee, who is conducting hearings on the tariff bill, Mr. Miles stated that Japanese labor receives only one-sixth the wage paid American labor, but on the basis of the units produced the Japanese workman receives two-thirds the wages paid here and he quotes the Tariff Commission to show that this third is offset by other considerations.

Exports To Be Reclassified

A new schedule governing the classification of exports of domestic commodities will be put into effect Jan. 1 by the Bureau of Foreign and Domestic Commerce. In order that the new regulations in regard to statistical returns of exports may be carried into effect, J. Hohn, the chief of the Bureau's Division of Statistics, points out that the co-operation of exporters is essential.

Beginning in 1922, the amendment to the Ontario Mining Act passed in 1919, regarding the testing of hoisting ropes, will come into effect. The new regulation provides that at least once in every six months the hoisting rope shall have at least six feet in length cut off the lower end and shall be sent to a reliable laboratory for a breaking test. A certificate of such test must be kept on file at the mine.

Pittsburgh Plus Case Complaint Amended

Steel Corporation Must Answer Charges of Federal Trade Commission—Hearing Starts Jan. 9

An amended complaint in the "Pittsburgh Plus" case, charging discrimination in prices between different purchasers and consumers, has been filed against the U. S. Steel Corporation and eleven subsidiary companies by the Federal Trade Commission. This complaint does not generalize the offences as the former one did, but makes specific charges of discrimination in prices between purchasers and consumers of rolled steel products which are manufactured and sold by the defendants.

The charges on the amended complaint will be heard by the Federal Trade Commission in Washington, D. C., on Jan. 9, when the United States Steel Corporation will present its case and show cause why an order should not be entered by the commission requiring the companies to cease the listed violation of the law. An answer is required to be filed with the commission within thirty days.

The Federal Trade Commission further announces that in the controversy which arose between the commission and various steel companies relative to the questionnaire that the commission desired to be filed by the steel companies, an amended answer also has been filed. The answer is registered against the petition of the steel companies for a permanent injunction to prevent them from having to answer questionnaires as to the affairs of the steel industry.

NEWS FROM WASHINGTON

By **PAUL WOOTON**
Special Correspondent

New War Minerals Regulations Announced

Govern Reopening of Claims Under Liberalized Relief Act—Some Uncertainty as to Unspent Balance

Regulations governing the reopening of claims under the liberalized War Minerals Relief Act were promulgated Dec. 17 by E. C. Finney, acting Secretary of the Interior. In a statement to "War Minerals Relief claimants and attorneys therefor," Mr. Finney says in part:

"Should you conceive that your claim, or any claim properly represented by you, heretofore filed within the time mentioned in the Act, is within the contemplation of the Act as now amended, a motion for re-hearing of the claim will be duly considered, pursuant to the following regulations:

"I. As To Claims Heretofore Passed On:

"1. Such motion for re-hearing must be in writing and must be filed not later than Feb. 15, 1922, in the office of the War Minerals Relief Commissioner, Room 2117, Interior Department Building, Washington, D. C. It must plainly designate the claim and state specifically the grounds upon which re-hearing is asked.

"2. If the claim for which a re-hearing is asked, or any part thereof, has heretofore been rejected on the ground that there was no government request or demand, the written motion must be duly under oath, setting forth:

"(a) The exact character of the personal, written, or published request, demand, solicitation or appeal which stimulated the claimant to produce or prepare to produce the mineral.

"(b) The government agency mentioned in the Act from which the request, demand, solicitation or appeal came.

"(c) How or by whom the request, demand, solicitation or appeal was communicated to the claimant.

"(d) The time and place of such communication.

"3. If the claim has been rejected, or partially rejected, on other grounds than the question of stimulation, the errors complained of should be stated in detail in the written motion for re-hearing.

"II. As To Claims Heretofore Excluded:

"If the claim is one which was mailed in time but not received in time, so that no action has ever been taken on it, written request for a hearing thereof, filed in the office aforesaid not later than the date aforesaid, will be granted as of course, and the claimant should proceed with due diligence to establish the claim by proof before the War Minerals Relief Commissioner."

Some further uncertainty as to the unexpended balance of the War Mineral appropriation has been occasioned by an item in the first deficiency bill. The language in this item, some believe, is such as to allow the War Department to draw upon the War Minerals fund in payment of claims against that department. The discussion of this point in the House of Representatives indicates that it is highly improbable that any efforts will be made by the War Department to take advantage of this technicality to draw upon the War

Minerals Relief appropriation, but it is recognized that there is some uncertainty as to the action that may be taken by the Comptroller of the Treasury. The War Minerals Relief Act is a section of an act providing for relief of War Department claimants.

Now that the Secretary of the Interior and the War Minerals Relief Commissioner have worked out the policy which will be followed under the liberalized act, it is expected that hearings will begin in the near future, although no actual dates have been set.

No Chance for Gold Bonus Bill, House Committee Believes

Western Senators To Continue Fight—Campaign Caused Adoption of More Liberal Revenue Clause

The McFadden gold bonus bill is dead. This is the opinion of members of the Ways and Means Committee of the House of Representatives and of many of the proponents of the bill. With the economic tendency now operating to the advantage of the gold producer, it is believed that it will be impossible to overcome the very vigorous adverse report made by the Secretary of the Treasury. Though it is the intention of Senator Oddie and the twenty-one Western Senators who joined him in a recent letter to Secretary Mellon, to continue the fight for special assistance for the gold mining industry, the opinion is generally held that there is no chance for legislation along lines of McFadden's proposal.

It is believed, however, that the agitation for the McFadden bill made possible the adoption of the retroactive provision in the recently enacted revenue law, which broadens the exemptions on profits made in gold production to include those of 1917.

Gold Situation Reviewed by Secretary of Treasury

The Secretary of the Treasury, in his annual report to Congress, reviews gold production and makes reference to the McFadden bill as follows:

"Due to the unfavorable influence of high prices and consequent high costs of production on the mining and reduction of gold, there have been further discussions of proposals for subsidizing the gold-mining industry. A bill has been introduced in the House of Representatives (H. R. 5025) 'To provide for the protection of the monetary gold reserve by the maintenance of the normal gold production of the United States, by imposing an excise, for revenue and other purposes, upon all gold used for other than monetary purposes, and by the payment of a premium to the producers of newly-mined gold, and providing penalties for the violation thereof.' The Treasury does not approve this bill or other measures for subsidizing the gold-mining industry, believing that the problem will ultimately adjust itself and gold mining become more remunerative as the purchasing power of the dollar increases. The position of the Treasury with reference to this question was stated in some detail in a letter dated September 30, 1921, in reply to a resolution signed by twenty-two Senators from the western states and submitted to the Secretary of the Treasury, requesting an opinion as to H. R. 5025.

"The production of gold in the United States, as well as in other countries of the world, is still below pre-war figures. This is true even of the South African gold fields, notwithstanding the arrangements for sale to the highest bidder of the product, after shipment to London, by which arrangements producers of that region reap the benefits incident to exchange conditions. These benefits have averaged since January, 1920, according to the June, 1921, report of the Rhodesian Chamber of Mines, more than £1 5s. per ounce above normal, about 30 per cent. The United States production in 1920 is estimated at $51,186,900, a reduction from the prior year's output of over $9,000,000. The industries of the United States are estimated to have consumed in 1920 new gold to the value of about $54,000,000, approximately $3,000,000 more than the domestic production.

"The Treasury, acting in accordance with the advice of the Department of State, does not accept at United States mints and assay offices gold known or suspected to be of Soviet origin, but does regard as free from any suspicion or possibility of Soviet origin gold which bears the official coinage or mint stamp of recognized governments, including for this purpose Germany and Mexico. Privately stamped gold bars are accepted only if accompanied by a satisfactory certificate of ownership and non-Soviet origin executed by a responsible bank or banker, or by other satisfactory proof of new mine production or other facts negativing Soviet origin."

Hearings on Mine Law Revision Bill To Start in January

Definite announcement has been made by Representative Rhodes, chairman of the Committee on Mines and Mining of the House of Representatives, that hearings on the bill providing for the revision and codification of mining laws will be begun during January. The exact date has not been set, but in all probability the first hearing will be held during the week beginning Jan. 23.

Metric Bill Hearings Resumed

Hearings on Senator Ladd's bill providing for the compulsory adoption of the metric system after ten years, were reopened recently. The hearing is being conducted by a sub-committee of the manufacturers' committee of the Senate, of which Senator McNary, of Oregon, is chairman.

NEWS BY MINING DISTRICTS

London Letter

Prestea Block A Makes Poor Showing—Van Ryn Gold's Report Satisfactory

By W. A. Doman

London, Dec. 5—While attempts are being made to revive interest in West African gold mining, the results achieved by some of the existing companies are not such as to encourage investors to venture more capital. At one time the Prestea Block A looked to be a sound property, but last year it fell upon bad times. Labor shortage was a great factor, for it not only affected the output and working costs, but seriously delayed the development, which is all important in the present state of the mine. As an indication of the shortage it may be mentioned that the daily average attendance dropped from 3,242 in 1917 to 1,496 in 1920, the year under review. During the period [illegible] tons of ore were milled, for a yield of £256,678 (including [illegible] premium) or [illegible] per ton. As working expenses were [illegible] per ton, there was a loss of [illegible].

Depreciation called for a sum of £22,896, and no less than £183,076 was written off as development redemption in consequence of reduction in the ore reserves, owing to permanent unavailability and other causes. The debit balance on profit and loss account is [illegible].

A good deal of unproductive driving was done on the 13th level north of Prestea shaft; also at 14th level south of north shaft, and, owing to the intersection of a body of loose graphite, most of Prestea shaft below the 13th [illegible]. At present the tonnage milled [illegible] tons were added of an average value of [illegible]. At the end of 1920 the reserves were [illegible] tons at [illegible], as compared with [illegible] tons at [illegible] at the beginning of the year. Unless additional pay [illegible] is developed, the outlook is critical.

A satisfactory report is presented by the directors of the Van Ryn Gold Mines Estate for the twelve months ended June 30 last. Tonnage crushed was [illegible] against [illegible] in the preceding year, the recovery being [illegible] per ton, against 22/3. Expenses rose from 19/6 to 25/9, due to a higher per cent of sorting, to heavy outlays on sand filling, and to extra cost of feeding natives.

On the standard price of gold, the pay ore reserves amount to 864,583 tons, averaging 6.1 dwt. over 48 in. These reserves have been paid for out of profits. The year's profit was £90,393 in contrast with £87,307, the improvement being due partly to the higher grade of ore crushed, and partly to the increased price of gold. Owing to the sand filling scheme, no less than 165,781 tons of ore, representing 33.31 per cent of the total ore mined, was drawn from reclamation in the old workings. In 1918 only 1,136 tons was so obtained. According to the view of Sir George Albu, the quantity of ore remaining to be reclaimed is sufficient to last the mine for many years. On the year the reserves on standard price of gold are down 283,000 tons, owing to a fall in the price of gold and higher working costs.

In the year to June 30, the El Oro Mining & Railway Co. treated 383,043 tons of ore, producing bullion to the value of $2,546,446, in contrast with 366,730 tons yielding $2,789,457. Ore reserves were drawn upon to a small extent, as is here shown:

	June 30, 1920	June 30, 1921
Total tons.........	293,779	282,124
Gold value per ton..	$11.27	$7.96
Silver, oz..........	2.71	2.11

The falling off in values was $1.13 per ton in the northern and southern sections, and $5.17 in Somera and Ofir, and in the San Patricio region the average value rose from $4.56 to $5.65.

It has been decided definitely to abandon operations on the 2,200 level of the San Rafael vein. Profits were largely the result of a reduction of approximately $1 per ton in expenses.

Johannesburg Letter

Discoveries of Minerals in Namaqualand Not New

By John Watson

Johannesburg — With reference to the reported discovery of gold-copper and minerals in Namaqualand, a correspondent of "The Star" interviewed Dr. W. Verseld, of the Government Analytical Laboratory in Cape Town, who has had much experience in prospecting in Southwest Africa. The doctor believes that Namaqualand has a great future in minerals; but some of the finds reported are not new. Gold was found long ago, associated with copper ore. As quartz had been found and not alluvial gold the outlook was quite promising. There must be plenty of copper left in workable quantities. Kaolin had been reported and corundum had been worked there. Tin occurs further inland in the Southwest Protectorate and was worked in 1900 by a party of Britishers, who were considerably hampered by the German authorities, and had to give up the attempt. Dr. Versfeld had identified columbite and tantalite from Namaqualand.

CANADA

British Columbia

Florence Silver To Sell Part of Output To Paint Company

Ainsworth—Negotiations are about concluded which will open up a market for disposal of a large portion of the Florence Silver Mining Co.'s output to a British Columbia coast firm, for use in paint and color manufacturing.

Ontario

Provincial Geological Survey of Cobalt Camp Completed

Cobalt—During November Nipissing produced 359,000 oz., with an estimated net value of $251,253, and shipped bullion from Nipissing and customs ore of an estimated net value of $71,807. The value was estimated at 66¾c. per oz. The low-grade mill treated 6,343 tons, and the high-grade plant 197 tons. The refinery shipped 100,602 oz. of fine silver. Some small veins were cut during the month, but they were of no particular importance. November output constitutes the high record in production for any month of this year, and the estimated value was $60,000 greater than for the corresponding month of 1920. The directors have declared the regular quarterly dividend of 3 per cent, with a 3 per cent bonus, payable Jan. 20. The financial statement shows cash in the bank, investments and ore and bullion to the amount of $4,124,961.

The Bailey Silver Mines has taken a lease on the Silver Cliff property and expected to start shipping Dec. 19.

The Coniagas was the only company which shipped ore from Cobalt for the week ended Dec. 10, sending one 60,000-lb. car to Perth Amboy.

A 4-in. vein, carrying high-grade ore, and which has been uncovered for 60 ft., has been found on the Sanderson claims in Gowganda.

During November the Coniagas, Hudson Bay, the Mining Corporation and the O'Brien shipped a total of 213.5 tons of ore and concentrates from Cobalt. Of this 64 tons went to Canadian smelters, and the balance to the United States.

Kirkland Lake—Repairs to the hoist at the Ontario Kirkland have been completed and the mill has again been started.

The directors have decided to get the plant of the Bourkes Mines in shape for operations, and have also started to replace the buildings destroyed by fire last summer.

Porcupine—It is understood that the McIntyre shaft will reach the 2,000-ft. level in the course of a few days. During the sinking other work was curtailed to a certain extent, and mill heads have been running from $8.50 to $9, which is somewhat less than formerly.

On the lower levels of the Dome a section of the orebody has been found to contain selenium. Recently there has been a great deal of trouble in the mill owing to the reprecipitation of gold, and the chemists are endeavoring to determine whether or not the selenium would have any effect, as they cannot find any other cause.

During the last three months the Hollinger has had the highest recovery in the Porcupine district, with an average of $8.83 a ton. Production for the period, including exchange, is valued at approximately $2,800,000. The Hollinger's recovery of $8.83 a ton compares with $8.50 for the McIntyre, and $7.10 for the Dome. The directors have declared a 1 per cent dividend, payable Dec. 31. There was some talk of an additional bonus being paid, but the shareholders who expected it will be disappointed.

An announcement has been made by the T. & N. O. Commission that the question of electrification of the road will be thoroughly investigated. The proposed extension of the railroad north of Cochrane to the vicinity of Tin Can Portage would facilitate this work, as it is understood that approximately 300,000 hp. could be developed on the river.

C. W. Knight, of the Ontario Geological Survey, has just completed his survey of the Cobalt camp, on which he spent a year. The only possible criticism that could be offered regarding this work is that it should have been started several years ago. If the work had been done earlier a great many underground openings would have been available for the survey which cannot now be reached. Mr. Knight deserves a great deal of credit for the work that he has done. While his report will not be available for some months to come, the results have already shown ample justification for the survey. Those who have been in touch with this work are of the opinion that it will result in the discovery of new orebodies in practically undeveloped territory. He has made a complete and exhaustive study of all the geological data in all underground workings that were available, and his final report will cover the entire camp. It is hoped that this work will result in the government taking similar action in Porcupine and Kirkland Lake. The time to start this work is now, when the mines are in the early stages of their development and all geological data are available. It appears to be of sufficient importance to keep a man permanently occupied on these three camps.

MEXICO

Chihuahua

Construction of Chihuahua & Oriente Road To Start About Jan. 1

Work will start about Jan. 1 on the construction of the Ferrocaril de Chihuahua y Oriente, which is being built to connect the property of the Erupcion Mining Co., and the Ahumada Lead Co., with the main line of the Mexican Central railroad at Lucero station, 136 kilometers south of Juarez, Chihuahua. Col. John C. Greenway, of Warren, Ariz., who is interested in the mining companies, closed the contract for the road bed and bridges with Dudley & Orr of El Paso. The proposed line will be 47 kilometers long, of standard gage, and will carry both freight and passengers. The contract given must be completed within 150 days. It is expected that the railroad company will lay the steel, as this item was not included in the contract. It is generally understood that there are several hundred thousand tons of lead-silver ores blocked out in this camp awaiting transportation to the El Paso and Chihuahua smelters. Colonel Greenway is president of the new railroad company and Louis D. Ricketts vice-president.

Word has been received of the capture of R. A. Atkins, manager of La Dorada mine in the Allende district, in the southern part of the state of Chihuahua, by armed bandits, who are holding him for ransom of 5,000 pesos.

Coahuila

Furnaces at Torreon Smelter To Be Blown In Soon

Torreon—Repairs of the Torreon smelter are nearly completed and it is expected that several furnaces will be blown in early in January. A number of mines in this district are resuming operation and shipping their ores to this plant.

Durango

Rosario Company To Build Mill

George Stinson, who for a number of years was mining in the Mapimi district west of Torreon, is now representing the Cia. Minera El Rosario, which is taking over some properties in the Victoria camp west of Santiago Papasquiaro. One of the properties taken over by this company is the Montoros, located on the east side of the Perico Mountains. Some gold-silver ore is being mined but it must be carried some distance on the backs of burros to the wagon road and from there by wagon to the Santiago Papasquiaro station. The Rosario company, which is composed of American capitalists and miners, proposes to begin the erection of a mill soon for treating its ores on the ground.

A general meeting of the stockholders of the [illegible] Mining Co., with mining properties in Durango, is to be held in Mexico City on Dec. [illegible] where a majority of the shareholders reside. Aside from the general routine of business to be transacted a proposition for the [illegible] of the San [illegible] de Mata [illegible] will be discussed.

An issue of [illegible] shares, par $1, is to be made by the Queen Creek Copper Co., of Arizona, to be used in payment for the purchase of three unpatented lode claims in Pioneer district. The controlling interest in the company, which is operating a copper property at Superior, is [illegible] of the Dundee-Arizona at Jerome.

ARIZONA

Stene Consolidated To Be Heard on Hydro-electric Project — Navajo Copper Co. To Be Reorganized

By James H. McClintock

Phoenix — For a year or more the Stene Consolidated Copper Co has been planning a hydro-electric development on Bill Williams fork, in western Arizona. A notice of a hearing on its application for stream rights has been issued, this to be held at Phoenix Jan. 12 by E. C. LaRue, engineer of the Geological Survey. The plans include a 150-ft. dam, a 35-mile canal, a power house near Planet and then irrigation of 95,000 acres of land near Parker. The company has a large acreage of low-grade surface carbonates, said to be suitable for leaching.

The "smoke farm" idea appears to have had material around Douglas, Ariz., where organization has been effected of ranchers who own property within seven miles of the city and its smelters. In expectation of purchase by the smelting interests, prices ranging from $20 to $200 an acre have been put on the land alleged to be affected. Several meetings of an amicable sort have been held with the mining representatives, though it is alleged that the people of Douglas are more friendly to the smelting interests than to the farmers. In Douglas there would be a joyous welcome to sulphur fumes, however thick.

Dos Cabezas—According to a recent report by John W. Prout, Jr., manager of the Central Copper Co. the company is employing about 250 men on development and operation, mainly on the Central and Mascot properties, the latter being held under a twenty-year lease together with the 15-mile railroad to a Southern Pacific connection at Willcox. Eleven new orebodies are reported to have been opened within the year in the Mascot section, and development in the Elma mine is declared gratifying. Altogether about 70,000 ft. of underground development has been accomplished. The company has thirty claims of its own and fifty-six held under twenty year lease from the Mascot. The camp has about ninety buildings, including power plant, offices and store. A clubhouse has been added for benefit of the employees, for whom housing has also been provided at lowest possible cost.

Grand Canyon — Lloyd C. Ashley states that the Navajo Copper Co. is to be reorganized, with expectation of [illegible] more [illegible] and more [illegible]. A commissary is to be opened at the Gap on the Navajo Reservation, 90 miles from Flagstaff, where the company already has a camp from which transportation of ore by tractor was directed. The corporation has been inactive for three years. Its ores are rich, but hardly rich enough, it is understood, to defray the costs of [illegible] miles of motor truck transportation to the railroad at Flagstaff over poor roads.

NEW MEXICO

Coal Cheaper—Freight Rates on Zinc Ores Reduced—E. P. & S. W. Gets Permit To Take Over A. & N. M.

By James P. Porteus

Lordsburg—Reductions in rates and wages favorable to mining operations continue in evidence. In the Raton section the reduction in coal miners' wages to conform to the southern Colorado scale has been reflected in a reduction in coal prices at the mine, effective at once. The Santa Fe railroad has announced a reduction in freight rates, effective about Jan. 1, on zinc ores moving from southern New Mexico points to the smelters in the Kansas-Oklahoma gas field. The scale will be as follows. On ores of $25 value per ton or less a rate of $5 per ton will be made; over $25 but not exceeding $50 per ton $6; and on ores over $50 but not exceeding $100 per ton, $7 per ton freight will be charged. This will be of very material help to the mines of the Kelly and Fierro districts. The reductions in freight rates on fuel, timber and iron and steel products to mining points in the Southwest have not been promulgated as yet but are expected soon.

Part of the assets of the Arizona Copper Co. taken over by the Phelps Dodge Corporation consisted of the Arizona & New Mexico railroad, extending from the El Paso & South Western railroad at Hachita, N. M., to Clifton, Ariz., a distance of 110 miles. On Dec. 12 the state corporation commission approved the request of the E. P. & S. W. road to take over that property, which will in the future be operated by the E. P. & S. W. under lease as a branch line. Considerable reconstruction work will be started at once and a much improved service given at an early date.

The total shipments from the district for November amounted to 7 carloads, or 310 tons. Five of these were lump fluorspar from the [illegible] mine and 100 tons of high-grade silver-lead ore from the [illegible] property.

In the District Court at Lordsburg recently the [illegible] Copper Co. took judgment by default in an action against the [illegible] Mining Co. for an indebtedness of approximately [illegible].

Mogollon—[illegible] About twenty [illegible] About eighty men are now working.

Silver City—[illegible] by the Phelps Dodge Corporation. It is understood that this company is not particularly interested in these properties [illegible] Chloride Flat holdings.

COLORADO

Conditions in Alma District Satisfactory—Activity at Leadville Reflected in Power Company's Report

(From Our Special Correspondent)

Leadville—Evidence of the revival of mining activity in the Leadville district is shown in the report of the local manager of the Colorado Power Co., who announces the following as to new power connections or resumptions since Sept. 1 last:

"The reopening of the Western Zinc Oxide plant on Sept. 23 was the turning point in the mining activities. The Blain shaft, operated by Cortellini & Co., the Graham Gulch shaft, operated by the C. & H. Mining Co., and the Henriette shaft, operated by W. E. Bowden & Co., were all started up on Oct. 1. On Nov. 11, the Shamus O'Brien, operated by Oscar Laurila, resumed operations. Power was turned on at the Tucson on Nov. 12, which is being operated under the management of John Harvey. The Chrysolite lease, operated by Cortellini & Co., began work on Nov. 23. Otto Thurn resumed operations on the Hibschle on Dec. 5, and Frank Mohar started up the Robert E. Lee on Dec. 7.

"The Utley zinc plant at Florence reopened Dec. 1 and this will open up a market for a large quantity of Leadville ore."

Silverton — While production this year from the Silverton district will show a marked decrease as compared with 1920, on account of the closing down of the Sunnyside mines, there has been more actual development of new mines than for many years past. Development work on various properties in different sections of the district has resulted in opening up promising orebodies, the output from which will greatly increase the district's production next year. This production can be greatly increased if reductions in the now prohibitive freight and treatment charges can be secured.

Alma—Mining conditions in the Alma district are satisfactory for this time of the year. Thus far the weather has been mild and little snow has fallen. This has aided the properties which resumed operations in the late fall and in most instances the outside work is well under way or completed.

The Mt. Lincoln Consolidation Mining Co. has its new electric compressor installed and is pushing work on the Hoosier tunnel. This will open up considerable new territory and make the low-grade ore and stope fillings in the old Russia workings available.

The Colorado Power Co. has about twenty men employed extending its power line from the station north of Alma to Buckskin and Mosquito gulches, a distance of about four miles. This will make electric power available for most of the operators in the district.

The Platte River Dredging Co., which is building a 9-cu.ft. dredge to be operated on the gravel bar near Fairplay, Col., has its boat ready to float and nearly under cover. It will start installing the machinery as soon as it is delivered.

UTAH

Utah Apex-Utah Consolidated Decree Expected Soon—Grand Central at Mammoth Being Prepared for Increased Production

(From Our Special Correspondent)

Park City—Shipments for the week ended Dec. 10 amounted to 2,161 tons as compared with 2,068 tons the week preceding. Shipments were: Tintic Standard, 61; Judge allied companies, 1,172 tons; Silver King Coalition, 527; Ontario, 463 tons.

Bingham—Differences in the estimates of the Utah Apex and the Utah Consolidated as to the value of ore extracted by the Utah Consolidated from an orebody by court decree adjudged to belong to the Apex are under consideration by Judge Tillman D. Johnson of the United States district court at Salt Lake City. The statement of the Utah Consolidated puts the value of the ore at $1,070,000 while that of Utah Apex fixes the amount at $1,171,000. A conference between the attorneys on both sides was held on the afternoon of Dec. 10 in the chambers of the court, Judge Johnson being present also. A decree in the case is expected shortly.

Eureka—The lime quarry of the Chief Consolidated, which has been closed down for almost a month, has resumed work. The smelters in the Salt Lake Valley use a large tonnage of limestone, and these, as well as the sugar factories throughout the state, offer a market for the product of the quarry.

Ore shipments from the Tintic district for the week ended Dec. 16 amounted to 176 cars, this being an increase of ten cars over the output of the week preceding. Shippers were: Tintic Standard, 61; Chief Consolidated, 43; Victoria, 16; Dragon, 15; Iron Blossom, 12; Eagle & Blue Bell, 8; Mammoth, 4; Colorado, 4; Swansea, 4; Centennial-Eureka, 3; Plutus dump, 1; Showers, 1; Gemini, 1; Bullion Beck, 1; Empire Mines, 1; Tintic Drain Tunnel, 1.

Mammoth—The Grand Central mine in the Tintic district is being put into shape for increased production. The property is under lease to Paul Hilsdale. About sixty subleases have been let, and there are still a number of applications. The new management is making a thorough survey of the property, having three crews of surveyors at work. The mine is to be electrified, and the use of steam power done away with. Power will be available for pumping below water level.

Alta—Ore is reported to have been opened in the Emma mine on the west side of the Montezuma fault and north of the Bay City tunnel above water level, in hitherto unprospected ground. Orebodies in this mine have thus far been on the eastern side of the fault.

MONTANA

East Butte Completes New Shaft—Butte & Superior's Copper Ore on 2,200 Level Widens—Tuolumne's New Ore on 1,600 Level

By A. B. Keith

Butte—The annual report of the Davis-Daly Copper Co. for the fiscal year ended June 30 last, while belated, tells a story of progress from the standpoint of increasing its reserves, which was continued until recently when production was suspended until the company could receive the return for its copper that it feels itself entitled to. The situation now is that the company is in good shape to avail itself to the utmost of a good copper market when it arrives.

The tonnage of ore developed at the Colorado property during the company's fiscal year was 62,000 tons in excess of the amount mined, and this condition has been further improved since the year covered by the report ended.

Butte & Superior's body of copper ore on the 2,200 level is reported to be from 8 to 12 ft. wide, carrying 8 per cent of copper and more than an ounce of silver for each per cent of copper.

Tuolumne Copper has opened a commercial body of ore on the 1,600 level. An official of the company is credited with the statement that the ore already in sight is worth several times the amount of the Tuolumne's bond issue, which is for $500,000, in his estimation. It appears apparent the company has located the zone of greatest mineralization on the 1,600, and with the strike of the vein veering to the north giving it over 800 ft. more of drifting it is believed that the tonnage possibilities are considerable.

The Tuolumne company has started deepening its Main Range shaft from the 18th to the 24th level. This suggests that the company has succeeded in financing its program of deep development. The 16th level continues in commercial ore.

The East Butte Copper has completed the raising of its new working shaft from the 1,800 level to the surface. The engineers made a bull's-eye in the center of a ring of slag designed as a collar for the shaft, and when the opening finally was poked through to the daylight, assistant general manager P. E. Beaudoin and other officials crawled through and the ceremony was completed after a handshake. This shaft was completed at about 50 per cent less cost than would have been entailed had the shaft been sunk. Because of beds of quicksand, gravel and clay within 400 ft. of the surface, it was necessary first to churn-drill a hole down to one of the mine levels to permit the ground to drain, with a consequent settling of the loose structure. When it was ascertained that the ground was safe to raise in, which was during July last, raising was started at a distance of about 800 ft. from the surface, with the finishing touches given it Dec. 10.

MICHIGAN

The Copper Country

No Date Set Yet For Calumet & Hecla's Resumption—Wolverine's Output Greater Than Last Year's

By M. W. Youngs

Houghton—Though there are rumors of resumption by Calumet & Hecla and its subsidiaries on Feb. 1, no definite date has been set. When the mines are reopened, production will probably begin on a 50-per cent basis, increasing as the demand for metal grows. It is variously estimated it will require from thirty to ninety days to put all units of a mine in operation. Reassembling of machinery at hoisting and compressor plants and repairs to mill equipment will be quite a task. On the whole, the ground in all of the mines has held up well. Some of the stopes and drifts, no doubt, will have to be cleaned out, but little time will be wasted in this way.

Mohawk will finish the year with a production of close to 14,000,000 lb., equaling the 1916 output and greater than the production of any year since. It is understood to have no more than normal stocks of metal on hand, having managed to sell the greater part of its output from month to month. A full program of drifting and stoping is under way in all four operationg shafts, while sinking is proceeding in Nos. 1 and 6 shafts. The yield holds well to the average of 24 lb. to the ton. This yield includes mass, a considerable amount of which is being mined.

Wolverine will have produced in excess of 4,000,000 lb. of copper this year, comparing favorably with the 1919 and 1918 outputs and exceeding that of 1920 by about 800,000 lb. Regular mining is being carried on in many of the levels of Nos. 3 and 4 shafts, and pillar mining is in progress on the 36th and 37th levels of No. 4. The recovery of rock from the pillars has exceeded expectations, the average yield being 15 lb. to the ton. In addition to regular mining, much rock is being obtained from cutting out the vein along the footwall in the older stopes on the upper levels. Wolverine still has much valuable ground to work out. A great deal of rock remains to be taken out along the footwall in many of the levels between Nos. 3 and 4 shafts from the 20th level to surface tributary to both shafts.

Construction of the new collar for Gratiot No. 2 shaft and bases for the new hoist, preliminary to the resumption of sinking, is well under way. Shaft repairs will be undertaken as soon as the collar is completed. It is possible that Seneca may send more rock to the mill in the spring, if warranted by a good metal market. Surveys have been made for track extensions from the mine to the Mineral Range, over which shipments will be made to the Point Mills plant. Before production will be attempted on a large scale, however, it will be necessary to install a new hoist at the Seneca shaft.

MINNESOTA

Mesabi Range

M. A. Hanna & Co. To Resume Work at Four Underground Mines

Chisholm—M. A. Hanna & Co. have issued orders to reopen four underground properties on the Mesabi iron range. At Chisholm, the Leonard No. 3 mine will resume with about 120 men. The No. 3 shaft is a new one on the north bank of the Leonard pit and has opened up the ore that could not be mined and trammed to the pit. The Fay mine at Virginia will employ about seventy-five men. The Thorne mine at Kuhl will employ approximately seventy-five men. Near Hibbing, the Harold mine is to be placed in operation again with over 100 men. For the present these mines will run on single shift.

JOPLIN-MIAMI DISTRICT

Kanok Metal Co. Treats Record Tonnage in November—Vinegar Hill Zinc Co. Developing Mine Near Hockerville

By P. R. Coldren

Joplin—Convincing evidence that the zinc mines of the Tri-State district are not all reporting unusually light operations is offered in the record just reported for the Premier mine of the Kanok Metal Co. The Premier is located at Picher, Okla., and has been in operation for approximately three years. It divides its year into eight four-week months and four five-week months, and November was a five-week month, including thirty working days. In this five weeks the Premier lifted and sent through its mill a total of 30,142 tons of dirt. From this it produced 1,232 tons of zinc concentrates and 1,072 tons of lead concentrates, or a total tonnage of 2,304. The average recovery was 7.64 per cent (in local parlance), which is considered good dirt in this district, but not extraordinarily good for the Picher camp.

The heavy tonnage of dirt handled accounts for the good production of concentrates, and it can be considered large when it came from one shaft, equipped with the ordinary 1,200 lb. tubs or cans. There is another shaft used for handling men and steel, but all the dirt was brought up the one shaft. The hoisting was done in two eight-hour shifts per day, so it means an average of a can of dirt hoisted every thirty-four seconds for the entire thirty days. It is believed this is almost a record for hoisting from a single shaft in this district.

It is understood that the Vinegar Hill Zinc Co. is developing a good mine at the property formerly known as the Texas, located a short distance southwest of Hockerville, Okla., east of Picher. Production at present is not being pushed, but a good orebody is being developed.

The old Mutt & Jeff lead mine on the Maher land, south of Joplin, is being reopened by Joplin miners.

ALABAMA

Rumored Henry Ford Holds Almost Half of Great Southern Steel Co.'s Acreage

By George Huntington Clark

Birmingham—Announcement in November of the acquirement by the Great Southern Steel Co. (incorporated by Chicago interests under a Delaware charter) of 101,000 acres of coal and ore lands, in close proximity to Birmingham, and 65 miles distant from Muscle Shoals, has been followed by a further but as yet unconfirmed statement to the effect that 45,000 acres of these holdings have passed into the ownership of Henry Ford.

The Chicago interests, organizing the Great Southern Steel Co., are now further credited with having extended their holdings through the acquirement or control of the Alabama Land Syndicate; White Iron & Coal Co.; Palatine Mining & Development Co.; and the Etowah Coal & Iron Co., so that they now own or control about 400,000 acres of mineral lands located in Etowah, Marshall, St. Clair, DeKalb, and Cherokee counties.

Included in these holdings are all the lands originally belonging to the Fort Payne Coal & Iron Co., also an option on the right of way and road bed of the Fort Payne & Eastern R.R., which extends 10 miles from Fort Payne into the Lookout Mountain coal field.

The authorized capital of the new steel company is stated to be $105,000,000 for the merger contemplated.

There is no reliable confirmation and there is small probability of any definite Ford interest in the matter, which would be obviously premature.

As regards the 101,000 acres originally acquired, Charles E. Pain, counsel for the Great Southern Steel Co., is authority for the statement that estimates made by Robert W. Hunt, engineer, state that about 3,000,000 tons of ore and 1,700,000,000 tons of coking coal as raw material reserves are carried in the tracts. These estimates are based upon drill tests and exploitation work that has been in progress for some time and there are sufficient raw materials near by for fluxing purposes.

If these estimates are even conservatively approximated and prove at all possible of realization, developments of some magnitude may result when industrial conditions improve.

In iron making, the new blast furnace is scheduled to go into blast on Jan. 1. This is one of the Sheffield stacks of the Sloss-Sheffield Steel & Iron Co. The Sloss-Sheffield company is the largest producer of foundry iron in the South, with four stacks at Birmingham, two at Sheffield, and one at Florence; all of which have been idle during the year.

It is believed that the Republic Iron & Steel Co. will shortly become active in making iron now that the installation of improved equipment at its Raimund ore mines on Red Mountain has been completed.

THE MARKET REPORT

Daily Prices of Metals

Dec.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
15	13.50@13.625	33.25	33.75	4.70	4.35	4.85
16	13.625	33.125	33.75	4.70	4.35	4.85
17	13.625	33.125	33.50	4.70	4.35	4.85
19	13.625	32.625	33.00	4.70	4.375	4.85@4.90
20	13.625	32.50	33.00	4.70	4.375	4.85@4.90
21	13.625	32.50	32.875	4.70	4.375	4.85@4.90

*These prices correspond to the following quotations for copper delivered: Dec. 15, 13.75@13.875c.; Dec. 16 to 21 inc., 13.875c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Dec.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
15	66½	67½	74	174½	176	25¾	24⅞	27¼	27⅝
16	66¾	67¾	74½	174½	176¼	25⅝	24¾	27⅜	27⅝
17	...	...	...	....	....	...	...	...	...
19	66¾	67¾	74½	172½	174½	25½	24⅝	27⅝	27¾
20	66⅝	67⅝	74½	171½	173¼	25½	24⅝	27½	27⅝
21	66⅝	67⅝	74½	171⅜	173¼	25⅜	24½	27⅜	27½

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Dec.	Sterling Exchange "Checks"	Silver			Dec.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
15	419	99⅝	65⅜	35⅛	19	420½	99⅝	66¾	35⅞
16	416	99⅝	65⅝	35⅝	20	420⅝	99⅝	66¾	35⅞
17	417⅞	99⅝	67	36⅜	21	420¼	99⅝	66	35½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Metal Markets

New York, Dec. 21, 1921

The approach of the Christmas holidays seems to have had a quieting effect on the metal markets during the last week, as inquiries were not so numerous as usual. Prices remained firm, however, and business is expected to improve again early in January.

Copper

Conditions are much the same as they were last week as far as domestic business is concerned. The larger producers are generally asking 14c., delivered, for first-quarter business, but are selling only an occasional carload. A few orders of 500 tons or thereabouts have been placed by those willing to meet the market, at 13.75@13.875c. The deliveries at the lower price were for consumers near refineries where the freight rate is not over 15 or 20 points. No one in the last few days, so far as we are advised, has been willing to sell copper for any delivery to net 13.50c. f.o.b. refinery.

Export business has improved, Germany and France being the best customers. This business is being placed generally at 14.125@14.25c., c.i.f., so that members of the Copper Export Association can obtain a higher return by selling for export than on the domestic market. With export business satisfactory, they are not worrying about a temporary lull in domestic demand, and prices are unlikely to fall.

Lead

The official contract price of the American Smelting & Refinery Co. continues at 4.70c. This figure also represents the figure at which near-by lead can be obtained from other producers. February lead generally brings about 5 points' premium, but not much is being sold for such forward delivery. Desilverized continues somewhat scarcer than chemical lead. A prominent storage-battery company placed a large order for December to February delivery yesterday, the business being distributed. The St. Louis market is somewhat firmer, with quotations ranging from 4.35 to 4.40c. A little lead has been sold at 4.35c., and it is possible that lead can still be obtained from one interest at that price. Several sales have been made at 4.375c. Lead continues firm in London, and the possibility of American lead going abroad is still being considered. This may have had something to do with the slightly stronger feeling in the Middle West.

Zinc

The market has become firmer. Several producers are holding at 4.90c., St. Louis, and a few sales were made at that level, but the greater part of the week's business was transacted on a 4.85c. basis. There has been a stronger disposition to sell future zinc at a 5-point premium for each month forward. It would not be surprising to see prompt zinc sell for 5c. per lb. before the year is over. Possibility always exists of the advance loosening some lots of metal that have been weakly held, but the market has not been influenced in the recent advance by any such disturbance. High-grade zinc has been sold in fair volume at unchanged prices, 6c. with freight allowed.

Tin

Tin has been very quiet at the higher prices now being asked, which have been caused by the advance in sterling exchange as well as increased firmness in the London market. Consumers seem to have provided generally for their immediate needs before the price reached 30c. Tin for forward delivery has sold for approximately the same prices as spot metal, though in some transactions business was done at slightly lower levels.

Arrivals of tin, in long tons: Dec. 14, Australia, 35; Straits, 70; London, 275; 15th, Liverpool, 100; 16th, Straits, 100; 17th, Straits, 380.

Gold

Gold in London: Dec. 15th, 98s. 1d.; 16th, 98s. 10d.; 19th, 98s. 1d.; 20th, 97s. 8d.; 21st, 97s. 7d. The marked decrease in the price of gold with the increased firmness in sterling exchange will undoubtedly make conditions extremely difficult for some of the South African producers who have been doing little more than break even.

General stock of money in the United States, Dec. 1, 1921: Gold coin, $3,545,125,101; standard silver dollars, $354,662,378; subsidiary silver, $272,828,861; United States notes, $346,681,016; Federal Reserve notes, $2,698,675,810; Federal Reserve Bank notes, $118,533,400; National Bank notes, $749,307,097; total, $8,085,813,663. Stocks of gold have increased $41,000,000 in the last month; of silver dollars, $13,000,000; and outstanding notes have decreased $14,000,000.

Foreign Exchange

Sterling has recovered close to the high figure reached several days ago, and the other European exchanges have also been firm. On Tuesday, Dec. 20, francs were 8.095c.; lire, 4.59c.; and marks, 0.59c. New York funds in Montreal declined to the lowest figure in two years, being quoted at 7 1/16 per cent premium.

Silver

Silver prices have continued to fluctuate, with China and India operating on both sides of the market. Business, however, has been on a reduced scale, and the premium over the London equivalent has disappeared, New York and London prices being on an approximate parity. The market closes quiet.

Mexican Dollars—Dec. 15th, 49⅝; 16th, 49⅞; 17th, 51; 19th, 50⅝; 20th, 50⅞; 21st, 50¼.

Other Metals

Quotations cover wholesale lots unless otherwise specified.

Aluminum—20c. per lb. for 99 per cent grade; 19c. for 98@99 per cent; 18c. for 94@98 per cent. Outside market nominal at 17@18c. for 98@99 per cent virgin grades.

Antimony—Chinese and Japanese brands, 4.50c.; W. C. C. brand, 5.25@5.75c. per lb. Cookson's "C" grade, spot, 9c. per lb. Chinese needle antimony, lump, nominal at 4c. per lb.

Iridium—Nominal, $150@$170 per oz.

Palladium—Nominal, $55@$60 per oz.

Platinum—$75@$78 per oz. Market quiet.

Quicksilver—$49@$50 per 75-lb. flask. San Francisco wires $49.75. Market better.

The prices of the following metals remain unchanged from the figures published in these columns on Dec. 3: Bismuth, Cadmium, Cobalt, Molybdenum, Monel Metal, Nickel, Osmium, Rhodium, Selenium, Thallium and Tungsten

Metallic Ores

Manganese Ore—22@24c., per unit, seaport; chemical ore, $55@$60 per gross ton, lump; $75 per net ton, powdered. Nominal.

The market is generally exceedingly quiet, and prices on the following ores remain unchanged from the figures published in the Market Report in the Dec. 3 issue: Chrome, Iron, Magnetite, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, Zircon, and Zirkite ores

Zinc and Lead Ore Markets

Joplin, Mo., Dec. 17—Zinc blende, per ton, high, $28.70; basis, 60 per cent zinc, premium, $28; Prime Western, $27@$26; fines and slimes, $25@$23; average settling price, all grades of zinc, $25.28.

Lead, high, $58.40; basis 80 per cent lead, $57; average settling price, all grades of lead, $56.57 per ton.

Shipments for the week: Blende, 11,321; lead, 2,150 tons. Value, all ores, the week, $407,900.

Zinc ore prices continue a steady advancement, with sellers holding firm and buyers trying to increase purchases without stimulating the market. Premium blende sold today on $28, an advance of $1 each of three weeks.

Lead prices were boosted today, with offerings of $57 basis in an effort, presumably, to stop further purchases by an outside party that has been very active lately.

Platteville, Wis., Dec. 17—Blende, basis 60 per cent zinc, $30. Lead ore, basis 80 per cent lead, $55 per ton. Shipments for the week: Blende, 93; lead ore 30 tons. Shipments for the year: Blende, 10,812; lead ore, 1,793 tons. Shipped during the week to separating plants, 818 tons, blende.

Non-Metallic Minerals

Feldspar—No. 1 pottery grade, $6.50 per long ton; soap grade, $7.50, f.o.b. North Carolina points. No. 1 Canadian, ground, $23, f.o.b. Ohio points.

Fluorspar—Gravel, guaranteed 85 per cent CaF_2 and not over 6 per cent silica, $20 to $22.50 per ton, f.o.b. Kentucky enamel grades, $32.50 to $50. F.o.b. New Mexico points, 85 per cent grade, $12.50 per ton; 95 per cent, $25; 97 per cent, $30.

Fuller's Earth—16 to 30 mesh, $20 per ton; 30 to 60 mesh, $20; 60 to 100 mesh, $17; 100 mesh and over, $15, f.o.b. Pennsylvania points. Market quiet.

Graphite—Ceylon lump, first quality, 5½@6½c. per lb.; chip, 4@5c.; dust, 2½@3½c.; No. 1 flake, 5@7c.; amorphous crude, $15@$42.50 per ton. All f.o.b. New York.

Talc—20 to 200 mesh, $7@$12 per ton, f.o.b. Vermont; $8.25@$13, f.o.b. points in Georgia.

Generally dull markets exist for the non-metallic minerals, and there is no quotable change in the following from the prices published in our Dec. 3 issue: Asbestos, Barytes, Bauxite, Borax, Chalk, China Clay, Emery, Gypsum, Kaolin, Limestone, Magnesite, Mica, Monazite, Phosphate Rock, Pumice Stone, Pyrites, Silica and Sulphur.

Mineral Products

Arsenic—[illegible]7¼c. per lb., f.o.b. New York; [illegible] for imports.

Potassium Sulphate—Powder, domestic, [illegible]90@$1 per unit, basis 90 per cent, f.o.b. New York.

Sodium Nitrate—$[illegible] per cwt. ex vessel, Atlantic ports

Copper Sulphate — Large crystals, 5.65c. per lb.; small crystals, 5.55c., f.o.b. New York.

The price of Sodium Sulphate is unchanged from the quotations published Dec. 3.

Ferro-Alloys

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 12c. per lb. of chromium contained; 4 to 6 per cent carbon, 13c., f.o.b. works.

Ferromanganese—English and German, $58.35@$54, c.i.f. Atlantic seaports. Other quotations unchanged.

No quotable changes have taken place in the following ferro-alloys from the prices quoted in the Dec. 3 issue: Ferrotitanium, Ferrocerium, Ferromolybdenum, Ferrosilicon, Ferrotungsten, Ferro-Uranium, and Ferrovanadium.

Metal Products

Copper Sheets — Current New York list price, 21.25c. per lb.; wire, 15@15.25c.

Yellow Metal — Dimension sheets, 17.75c.; sheathing, 16.25c.; rods ⅜ to 3 in., 14.75c.

Lead Sheets, Nickel Silver, and Zinc Sheets unchanged from Dec. 3 quotations.

Refractories

Prices on the following are unchanged from the figures published in the Dec. 3 issue: Bauxite Brick, Chrome Cement, Chrome Brick, Fire Brick, Magnesite Brick, and Silica Brick.

The Iron Trade

Pittsburgh, Dec. 20, 1921

Under date of Dec. 15 the National Tube Co. has issued new price lists on standard steel pipe, O. D. pipe, oil-country goods, and line pipe, reducing prices about $5 a ton except line pipe, which is reduced 3 points, or about $6. The reduction was caused by continued shading by independents, shallow in standard pipe but deep in line pipe and some classes of oil-country goods. The independents had sixty-day guarantees outstanding on standard pipe. The basing discount is now 71 per cent.

Though demand for steel products in general is light, it is [illegible] geographically and by industries. All buyers are proceeding conservatively, and consumption is probably decreased a trifle. An increase in demand is to be expected by Feb. 1. Steel ingot production in the first half of the new year is likely to range between [illegible] and [illegible] tons a year, against rates of [illegible] tons last July, [illegible] tons in October and November, and about [illegible] tons at present, capacity being about [illegible] tons.

Pig Iron—The [illegible] Sanitary Manufacturing Co. came into the market last week and bought foundry [illegible] Valley, the market having been [illegible] at [illegible] Valley. [illegible] at [illegible] and [illegible] Valley, with practically no demand.

Coke

Connellsville—[illegible]@$3.50; foundry, [illegible] per ton.

Lead Market Shows Small Fluctuations

European Demand Is Strong and Stocks Are Low —Mexican Lead Going Abroad—Spanish Output Is Expected To Decrease—Germany a Good Buyer

EDITORIAL MARKET STUDY

EVER SINCE SEPT. 23, when the market reached 4.70c. per lb., New York, lead price changes have been small and relatively unimportant. Although sales have been made periodically with more than customary briskness, the market has refused to move far, either up or down. Lead in its present position can hardly be thought of as a plaything for the speculative metal dealer. Its price changes on short swings of the market have afforded the speculator, who fortunately is a minor factor in the lead market, but little opportunity to exercise his proclivities.

At 4.70c. per lb. lead consumers seem to be able to purchase all the metal they require and producers willing to sell in any quantity. For a time in November it appeared that lead would reach higher levels by the end of the year, but the market has been unable to break away from the fascination of 4.70c. The reduction in freight rates from Missouri points to New York has made it possible for lead from the Middle West to compete in the New York market and has helped to keep the eastern price where it is.

GOOD POSSIBILITY OF EXPORTING DOMESTIC LEAD

Although export trade is unimportant in the American lead market, prices in the United States are greatly affected by those abroad, particularly the prices in the London metal market. American lead producers have up to now been concerned more over the possibilities of importing foreign lead into the United States and disturbing the domestic market than upon the prospect of exporting part of domestic production.

Early in 1921 large quantities of Spanish lead came into the United States, owing to the higher market level here, but at present, owing to a stronger and higher market in Europe, there is a possibility of shipping American lead abroad. International movements narrow down to a question of which market will yield the greatest profit to the producer. When the demand for lead is poor in Europe, lead, especially cheaply produced Mexican lead, is imported into the United States and sold in competition with American metal after payment of a duty. Conversely, if a better market exists abroad, Mexican metal seeks the European market, where the duty charge is not so important.

The heavy shipments of Spanish lead to the United States last spring resulted in greatly disturbing the domestic market, imported lead making itself immediately felt in the New York market, reducing prices in the East to a level with those of the Middle West, and stimulating lead producers in their fight for a tariff. As importations of foreign lead are at this time unimportant, the full freight differential is being expressed between the St. Louis and New York markets, which is as it should be.

FOUR COUNTRIES YIELD BULK OF WORLD'S LEAD

The four countries that are most important from a producing standpoint in the world's lead market are the United States, Spain, Australia, and Mexico. From a consuming standpoint, the United States, Germany, France, and Great Britain are the principal factors. The United States is producing enough lead for its own requirements and is independent of outside supplies. The consumption of lead has been so good that stocks have not had opportunity to pile up and become oppressive. Lead has been going steadily into the manifold channels of consumption open to it. Paint, cable, pipe and storage-battery manufacturers continue to take good-sized tonnages of the metal. Business has in general been brisker at the beginning of each month than at any other period.

Supply and demand seem to be nicely adjusted, judging from the steadiness of the market at its present level.

Demand for lead in Europe has been strong during the last few weeks. Ordinarily this demand is partly satisfied by the local production of various European countries, such as Germany, Poland, Spain, and France, plus importations from Australia. However, conditions in all of these countries are unsettled—if not politically, then industrially—affecting the production of each.

Germany is duplicating her activity in the copper market by her eagerness to absorb lead for manufacturing purposes. This is not strange when one considers the great necessity for the intense development of German export trade, and consequently of German manufactures, to pay a large reparations bill. Germany so long as she has a heavy indemnity to pay, should be a splendid market for raw materials, mineral, agricultural, and vegetable. Spanish lead and Mexican have been moving freely into Germany. There is a disposition to consider the fluctuations of mark exchange a deterrent to trade. However, Germany's activities in the copper markets and the unfulfilled predictions that exchange would adversely affect them, would indicate that exchange variations will have little to do with her ability to buy lead whenever necessary.

SPANISH GOVERNMENT REGULATIONS DISCOURAGE DEVELOPMENT

Not only have Spanish producers been the victim of labor troubles, but some of the recent legislation of the Spanish government has apparently not been passed with the purpose of stimulating the development of Spanish resources. This new law prevents the formation of new foreign mining companies in Spain—in other words it stops the introduction of outside capital into the development of Spain's mineral resources. This legislation may act as a boomerang to Spanish lead trade. Production in that country is expected to show a large decrease as a result.

France and Spain have engaged in a tariff war. Since Dec. 10 Spanish lead entering France has had to pay a higher tariff, so that Spanish lead may be diverted elsewhere. France is not a large lead producer, and is mainly dependent upon imports for an adequate supply of the metal. Of late French demands for lead have been strong.

Australia, which is normally the world's third largest producer, has been so hampered by labor troubles that production from there has been pitifully small considering the large mineral resources of the country. The rise and recent decline of Australian production is vividly shown by the following figures, which also show the production of Spain, Mexico, and the United States.

LEAD PRODUCTION OF AUSTRALIA, SPAIN, MEXICO, AND THE UNITED STATES, 1913-1920

In Short Tons

Year	Australia	Spain	Mexico	United States
1913	110,440	198,830	62,000	385,643
1914	101,790	143,525	23,600	472,125
1915	102,720	171,475	31,385	468,658
1916	134,070	147,405	19,965	506,490
1917	144,950	176,310	46,610	511,940
1918	163,370	160,710	98,500	503,702
1919	83,410	125,720	78,645	391,980
1920	7,800	175,195	84,200	440,220

Recent cable reports indicate a revival in mining by the Broken Hill companies, which feel that present metal prices are a sufficiently strong inducement to enlarge production of lead in the near future.

The United States has been fortunate in being able to take advantage of the disorder existing in other countries. Should the scarcity of lead continue in Europe, it will be natural to see London prices rise and be reflected in this market.

COMPANY REPORTS

Tomboy Gold Mines Co., Ltd.

A report of operations of the Tomboy Gold Mines Co., Ltd., for the year ended June 30, 1921, shows a realized **profit of £18,006 0s. 2d. There has to be provided for depreciation:**

	£	s	d	£	s	d
Plant and machinery	£17,687	0	10			
Reserved for taxes	3,000	0	0			
				£20,687	0	10
Debit balance				£2,681	0	8
Previous balance of loss				1,581	8	2
Net debit balance of profit and loss account				£4,262	8	10

From the appended statement of returns it can be seen that for the first six months ore of an average milling grade of $5.24 per ton was treated, resulting in an operating profit of approximately $100,000; during this period the best stopes had to be drawn upon, in view of the fact that local loans had to be repaid, but when Mr. Kelsey took up the management in January the higher grade ore was for the time being exhausted and he at once advised that, looking at the mine as a whole, future profits would depend upon treating large tonnages at low cost.

REVENUE AND EXPENDITURES

Dry tons ore milled, 197,557, yielding bullion worth			$56,637 72
Concentrates worth			789,729 32
60-Mill clean-up bullion			24,367 69
60-Mill clean-up concentrates			3,481 85
Miscellaneous (copper bullion)....			2,139 66
			$876,356 24
Less loss on boarding house, rents			5,267 58
			$871,088 66
Mining and development expenses	$1 73 per ton	$340,214 37	
Milling	65 per ton	127,209 06	
Concentrating (including transportation to railway)	82 per ton	162,470 85	
Water supply	19 per ton	[illegible] 14	
Assay....................	04 per ton	7,371.25	
60-Mill clean-up	02 per ton	4,735 72	
General expenses	31 per ton	61,684 46	
Taxes and insurance	22 per ton	43,219.16	
			$785,396 04
Total expenses	$3 98 per ton		
Profit			$85,692 62

Davis Daly's Quarterly Report

A report of the Davis Daly Copper Co. for the three months ended Sept. 30, 1921, states that conditions at the property have changed little during the period covered. The mines are being operated at the minimum of activity, and the directors are considering the advisability of suspending Colorado operations, so as to conserve good ores for better **copper markets and lower costs of operation.**

Development of ore reserves continues at a satisfactory rate. Despite 22,961 tons exhausted by mining, the ore reserves were increased from 337,316 tons to 394,813 tons **at the end of the period, a net increase of 17.05 per cent and in copper content of 10.44 per cent. Of the total tonnage** of ore reserves 45 per cent is above the 2,500 level and the **rest below.**

Shipments from the Hibernia have decreased during the quarter. By Jan. 1 the ore-bearing veins should have all **been cut on the 750 level, and fairly definite information of what to expect in the way of production from this level should be available.**

Total development for the quarter, including Hibernia, was 2,742 ft., comprising 869 ft. of crosscuts, 803 ft. of drifts, 946 ft. of raises, and 124 ft. of shaft sinking.

Tonnage for the quarter, including Hibernia, amounted to 35,423, producing 2,076,064 lb. of copper and 385,825 oz. of silver. The average assay of ore shipped from the Colorado was 5.12 per cent copper and 5.22 oz. of silver to the ton and from the Hibernia 24.05 oz. of silver to the ton.

Operating receipts and disbursements were: Ore returns $219,072.17; miscellaneous revenues, $5,341.56; total receipts were $224,413.73. The disbursements were: Development, $24,416.04; mining cost, $91,623.61; equipment, $5,070.91; Butte general expense, $19,721.23; Boston expense, $12,612.12. Total disbursements were $153,443.91.

Davis Daly Shows a Loss for 1920-21

A report of operations of Davis Daly Copper Co. for the fiscal year ended June 30, 1921, states that production amounted to 8,456,062 lb. of copper, 1,463,182.5 oz. of silver, 2,608.2 oz. of gold, 2,127,290 lb. of lead, and 5,060,368 lb. of zinc. Net operating loss was $411,230.87, as the following account shows:

RECEIPTS

Ore returns	$[illegible]	
Precipitates	[illegible]	
Miscellaneous revenues	[illegible]	
Total receipts		$[illegible] 28

DISBURSEMENTS

Mining cost	$1,246,507.00	
Butte expenses	81,672 43	
Boston disbursements	34,534 43	
Taxes........	49,596 53	
Total disbursements........		1,412,310 39
		$[illegible] 11
Depletion	$[illegible] 74	
Depreciation	[illegible] 02	
		332,113 76
Net operating loss		$411,230 87

Barnes-King Development Co.

A report of operations of the Barnes-King Development Co. shows the following operating results for the quarter ending Sept. 30, 1921:

Balance June 30, 1921....................			$[illegible]

RECEIPTS

Received during the quarter as follows:			
[illegible] bullion		$[illegible]	
North Moccasin royalties		[illegible]	
Interest		[illegible]	
Overpayment on accounts received		[illegible]	
Total receipts for quarter			$[illegible]
Total balance			$[illegible]

DISBURSEMENTS

[illegible] property: Operations [illegible] (exclusive of depreciation)		$[illegible]	
[illegible]: General expense [illegible]		[illegible]	
North Moccasin: General expense [illegible]		[illegible]	
Kendall: General expense		[illegible]	
[illegible]: Operations [illegible]		[illegible]	
Betsy Baker: [illegible]	$[illegible]		
Operations [illegible] development	[illegible]		
Total Betsy Baker expense		[illegible]	
Miscellaneous Expense:			
[illegible] new properties	[illegible]		
Tax Matters [illegible]	[illegible]		
Capital stock tax	[illegible]		
Total miscellaneous expense		[illegible]	
Increase in inventories		[illegible]	
		$[illegible]	
Deduct:			
Decrease in accounts [illegible]	$[illegible]		
Increase in accounts payable	[illegible]	[illegible]	
			$[illegible] 40
Balance:			
Cash on hand and in bank	$[illegible]		
Bullion in transit	[illegible]		$[illegible] 24
Deduct:			
September 1921 payroll	$[illegible]		
September 1921 accounts payable	[illegible]		
			[illegible] 17
Leaving funds available from [illegible]			$[illegible] 07

In addition the company also owns Liberty **Bonds amounting** to $[illegible]0,000

MINING STOCKS

Week Ended December 17, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Ahmeek	Boston	63	59	62½	Sept. '20, Q	$0.50
Alaska-Br. Col. new	N. Y. Curb	2¾	2½	2¾		
Allouez	Boston	24	23	24	Mar. '19	1.00
Anaconda	New York	50	48½	48¾	Nov. '20, Q	1.00
Arcadian Consol.	Boston	3½	3	3¼		
Ariz. Com'l.	Boston	10	9½	9½	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*30	*26	*28		
Bingham Mines	Boston	†13½	†12¾	13	Sept. '19, Q	.25
Calumet & Arizona	Boston	.	.	58	Sept. '21 Q	.50
Calumet & Hecla	Boston	280	258	273	June '20, Q	5.00
Canada Copper	N. Y. Curb	*42	*29	*38		
Centennial	Boston	10	9½	10	Dec. '18, SA	1.00
Cerro de Pasco	New York	36½	35	35¼	Mar. '21, Q	.50
Chile Copper	New York	16⅞	14⅞	15½		
Chino	New York	29½	27⅞	27¾	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	....		*10½		
Con. Arizona	N. Y. Curb	*4	*3	*3	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1¾	1 9/16	1¾		
Copper Range	Boston	40¾	39½	40	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*56	*48	*55		
Davis-Daly	Boston	6¾	6⅛	6½	Mar. '20, Q	.25
East Butte	Boston	11¾	10¾	11¼	Dec. '19, A	.50
First National	Boston Curb	*90	*75	*85	Feb. '19, SA	.15
Franklin	Boston	2	2	2		
Gadsden Copper	Boston Curb	*49	*46	*49		
Granby Consol	New York	30	28½	29	May '19, Q	1.25
Greene-Cananea	New York	29½	27¾	28	Nov. '20, Q	.50
Hancock	Boston	3½	2½	3		
Howe Sound	N. Y. Curb	2⅞	2¾	2⅝	Jan. '21, Q	.05
Inspiration Consol.	New York	42¼	39½	41¾	Oct. '20, Q	1.00
Iron Cap	Boston Curb	8	7½	8	Sept. '20, K	.25
Isle Royale	Boston	24½	23½	23½	Sept. '19, SA	.50
Kennecott	New York	27¼	26½	26¼	Dec. '20, Q	.50
Keweenaw	Boston	2	1⅞	2		
Lake Copper	Boston	3½	2½	3		
La Salle	Boston	2	1	2		
Magma Chief	N. Y. Curb	.	.	*8		
Magma Copper	N. Y. Curb	26⅞	22½	24¾	Jan. '19, Q	.50
Majestic	Boston Curb	*5	*3	*5		
Mason Valley	Boston	1¾	1¾	1¾		
Mass Consolidated	Boston	3	2½	3	Nov. '17, Q	1.00
Miami Copper	New York	28	27	27½	Nov. '21, Q	.50
Michigan	Boston	2	2	2		
Mohawk	Boston	59	57½	58½	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	5¾	5¾	5½		
Nevada Consol.	New York	15¾	14¾	15	Sept. '20, Q	.25
New Cornelia	Boston	18¾	16¾	18½	Aug. '20, K	.25
North Butte	Boston	14½	12½	13½	Oct. '18, Q	.25
North Lake	Boston	†*50	†*20	*24		
Ohio Copper	N. Y. Curb	*12	*10	*10		
Old Dominion	Boston	25½	25	25	Dec. '18, Q	1.00
Osceola	Boston	35½	32	34	June '20, Q	.50
Phelps Dodge	Open Mar.	†185	†175	....	Oct. '21, Q	1.00
Quincy	Boston	46½	45	46	Mar. '20, Q	1.00
Ray Consolidated	New York	16	15½	15¾	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*19	*16	*19		
St. Mary's Min. Ld.	Boston	44¾	43	44	Dec. 21, K	1.00
Seneca Copper	Boston	..	.	24½		
Shannon	Boston	1½	1	1	Nov. '17, Q	.25
Shattuck Arizona	New York	9¾	8	9	Jan. '20, Q	.25
South Lake	Boston	†1	†*50	*60		
Superior & Boston	Boston	1½	1⅛	1¼		
Tenn. C. & C. cfs.	New York	11	10¼	10¼	May '18, I	1.00
Tuolumne	Boston	*70		*67	May '13	.10
United Verde Ex.	Boston Curb	30	28¾	30	Nov. 21, Q	.25
Utah Consol	Boston	2	2	2	Sept. '18,	.25
Utah Copper	New York	66⅛	63	64	June '21 Q	.50
Utah Metal & T.	Boston	1⅛	1¼	1¼	Dec. '17,	.30
Victoria	Boston	2	1¼	1¾		
Winona	Boston	*40	*40	*40		
Wolverine	Boston	12½	10¾	11½		
		NICKEL-COPPER				
Internat. Nickel	New York	13¾	12¼	12¾	Mar. '19,	.50
Internat. Nickel, pf.	New York	70	69¾	69¾	Nov. '21, Q	1.50
		LEAD				
National Lead	New York	87	85	85½	Sept. '21, Q	1.50
National Lead, pfd.	New York	107½	107½	107½	Dec. '21, Q	1.75
St. Joseph Lead	New York	14	13¾	14	Sept. '21, Q	.25
		QUICKSILVER				
New Idria	Boston	†*75	†*50	*50		
		ZINC				
Am. Z. L. & S.	New York	14¼	12½	13¾	May '20,	1.00
Am. Z. L. & S. pfd.	New York	40¼	38	39	Nov. '20, Q	1.50
Butte C. & Z.	New York	6¼	5½	[illegible]	June '18,	.50
Butte & Superior	New York	22	18	20½	Sept. '20,	1.25
Callahan Zn-Ld	New York	7¼	6¾	[illegible]	Dec. '20, Q	.50
New Jersey Zn.	N. Y. Curb	124½	121	123	Nov. '21, Q	2.00
Yellow Pine	Los Angeles	*45	*45	*45	Sept. '20, Q	.03

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Los Angeles, Chamber of Commerce and Oil, Colorado Springs; The Financial Press, N. Y.

Stock	Exch.	High	Low	Last	Last Div.	
		GOLD				
Alaska Gold	New York	½	⅜	⅜		
Alaska Juneau	New York	¾	⅝	⅝		
Carson Hill	New York	13⅛	11½	12		
Cresson Consol. G.	N. Y. Curb	2⅞	2½	2 9/16	June '20, Q	$0.10
Dome Extension	Toronto	*71	*69	*70		
Dome Mines	New York	19	18	18	Oct. '21, Q	.25
Florence Goldfield	N.Y. Curb	*30	*26	*28		
Golden Cycle	Colo. Springs	*72	*72	*72	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*3	*3	*3	Dec. '19,	.05
Hollinger Consol.	Toronto	7.80	7.74	7.79	Dec. '21, 4 wks.	.05
Homestake Mining	New York	56	54½	54½	Nov. '21, M	.25
Kirkland Lake	Toronto	*33	*28½	*30		
Lake Shore	Toronto	1.22	1.19	1.20	Nov. '21, K	.02
McIntyre-Porcupine	Toronto	1.99	1.94	1.98	Sept. '21, K	.05
Porcupine Crown	Toronto	*13	*11	*11¾	July '17,	.03
Porcupine V. N. T.	Toronto	*18	*17	*17½		
Portland	Colo. Springs	*42	*42	*42	Oct. '20, Q	.01
Schumacher	Toronto	*35	*28½	*31		
Silver Pick	N. Y. Curb	*50	*50	*50		
Teck Hughes	Toronto	*15½	*14½	*15		
Tom Reed	Los Angeles	*40	*37	*40	Dec. '19,	.02
United Eastern	N. Y. Curb	2 7/16	2 5/16	2 7/16	Oct. '21, Q	.15
Vindicator Consol.	Colo. Springs	*20½	*20	*20½	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	*4	*4	*4		
Yukon Gold	N. Y. Curb	1¼	1⅛	1¼	June '18,	.02½
		SILVER				
Batopilas Mining	New York	⅜	½	⅜	Dec. '07, I	.12½
Beaver Consol.	Toronto	*24½	*20	*21	May '20, K	.03
Coniagas	Toronto	1.60	1.35	1.50	May '21, Q	.12½
Crown Reserve	Toronto	*9¼	*8	*9½	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3½	3¾	3½	Oct. '21, Q	.12½
La Rose	Toronto	*34	*32½	*32	Apr. '18,	.02
McKinley-Dar-Sav.	Toronto	*17	*14	*15	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.15	1.00	1.15	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	7	6⅞	7⅛	Oct. '21, Q	.03
Ontario Silver	New York	4⅞	4	4¼	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	....	....	*12	Jan. '12,	.10
Temiskaming	Toronto	*27	*25	*27	Jan. '20, K	.04
Trethewey	Toronto	*9¾	*9	*9¾	Jan. '19,	.05
		GOLD AND SILVER				
Boston & Montana	N. Y. Curb	*89	*85	*88		
Cash Boy	N. Y. Curb	*6	*5	*5		
Dolores Esperanza	N. Y. Curb	1⅛	1⅛	1⅜		
El Salvador	N. Y. Curb	*10	*5	*6		
Jim Butler	N. Y. Curb	*7	*7	*7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*3	*2	*3	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	⅛		
MacNamara M. & M.	N. Y. Curb	*11	*11	*11	May '10,	.02½
Tonopah-Belmont	N. Y. Curb	1½	1⅜	1⅜	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*66	*56	*61		
Tonopah-Extension	N. Y. Curb	1⅜	1 7/16	1⅜	Oct. '21, Q	.05
Tonopah Mining	N. Y. Curb	1⅜	1 7/16	1 9/16	Oct. '21, SA	.05
West End Consol.	N. Y. Curb	*83	*80	*83	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N. Y. Curb	*6	*5	*5	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	†1.00	†*85	*92	Dec. '20,	.15
Chief Consol.	Boston Curb	3	2⅞	3	Aug. '21, Q	.05
Consol. M. & S.	Montreal	18¾	18½	18½	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†3.00		....	July '20, Q	.10
Daly-West	Boston	†3½	†1½	1½	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†3	†2	2½	Apr. '21, K	.05
Electric Point	Spokane	*4	*3	*3	May '20, SA	.03
Eureka-Croesus	N. Y. Curb	*29	*26	*28		
Federal M. & S.	New York	13¾	10	12½	Jan. '09,	1.50
Federal M. & S., pfd	New York	43½	34	42½	Dec. '21, Q	1.00
Florence Silver	Spokane	*18½	*17	*18½	Apr. '19,	.01½
Grand Central	Salt Lake	†*49	†*36	*36	Jan. '21, K	.01
Hecla Mining	N. Y. Curb	4¾	4⅞	4 5/16	Sept. '21, Q	.10
Iron Blossom Con.	N. Y. Curb	*24	*18	*24	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	.	†2.00	2.50	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*4	*3	*3	June '21, I	.02
Prince Consol.	Salt Lake	*6½	*6	*6	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*4½	*4	*4½	Feb. '19,	.01
Rex Consol	N. Y. Curb	*8	*7	*8		
South Hecla	Salt Lake	†*50	†*20		Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*10	*10	*10	Oct. '17,	.05
Stewart Mining	N. Y. Curb	*3	*2	*2	Dec. '15	.05
Tamarack-Custer	Spokane	2.20	2.15	2.15	Jan. '21, K	.04
Tintic Standard	Salt Lake	1.95	1.77½	1.85	July '21, Q	.05
Utah Apex	Boston	3	2¾	2¾	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	....	....	*1	Nov. '17,	.01
		VANADIUM				
Vanadium Corp.	New York	33½	31½	32¼	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	53	53	53	Oct. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	76	76	76	Oct. '21, Q	1.75
		SULPHUR				
Freeport Texas	New York	15¾	14½	15	Nov. '19, Q	1.00
Texas Gulf	New York	35¼	32¾	34¼	Dec. '21, Q	1.00
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	47¼	45¼	46½	Mar. '21, Q	1.00
Amer. Sm. & Ref. pf.	New York	90	88	88¾	Dec. '21, Q	1.75
Am. Sm. pf. A	New York	87¾	86½	87¾	Oct. '21, Q	1.50
U. S. Sm. R. & M.	New York	39½	36½	37¾	Jan. '21, Q	.50
U.S.Sm R.& M. pf.	New York	44¾	44	44	Oct. '21, Q	.87½

Volume 112 December 31, 1921 Number 27

ENGINEERING AND MINING JOURNAL

JOSIAH EDWARD SPURR, *Editor*
TENTH AVENUE AT 36TH STREET, NEW YORK CITY

Contents

*Illustrated Article

Editorials 1041
The Anaconda-American Brass Merger—What Can Be Done to Revive the Mining Industry—Competition Among the Metals—Oh, Those Germans!—A German Divining Rod—The Hartford Instrument—The "Journal" To Publish Annual Progress Number

What Others Think 1044
*Gold Mines at Sardis

***Recent Developments in Mining in Jalisco and Nayarit, Mexico** 1045
By Henry M. Payne
Mining Activities in Nayarit Mountains are briefly described. Important developments are under way in this region. The author gives the impressions received during a recent extended visit.
Engineering and Mining Journal, December 31, 1921

Production of Tin in Burma 1048

Tin Exports From Federated Malay States 1048

Lead Mining Active in Swatow District 1048

The Hollinger Mine 1049
By Alexander Gray
This Ontario Producer is compared with the New Modder in South Africa as to past and present production. Future prospects of Hollinger are briefly outlined.
Engineering and Mining Journal, December 31, 1921

***The Santa Barbara 500-Ton Mill for Concentrating Lead Carbonate Ores** 1050
By Fred M. Heidelberg
An Unusually Complete Description of the mill recently erected by the American Smelters Securities Co. under the direction of David Cole. Details are given of method of estimating tonnages, water elevator, and grade requirements, also of much of the construction. Process includes crushing, grinding, classifying and tabling.
Engineering and Mining Journal, December 31, 1921

Mountain of Sulphur in Pacific 1057

Maine Molybdenum Tested 1057

The Permian Revolution in North America 1058
By J. B. Finlay
An Important Geological Event which produced great climatic, geographic and geologic changes in North America. Its study gives a good perspective on ore deposition in the southwest.
Engineering and Mining Journal, December 31, 1921

Bureau Studying Lean Iron Ores 1059

***Mining Engineers of Note** 1060
Hugh F. Marriott.

Consultation 1061
Preparation and Uses of [illegible]—[illegible] Permissible Explosives

Handy Knowledge 1062
[illegible] With the Foreman [illegible]—*A Coarse Ore Transfer—Grain vs. Flesh Side for Leather Belts—Safety Device for Station Gate—Estimating Minerals in Ore Pulp

The Petroleum Industry 1064

Echoes From the Fraternity 1065

Men You Should Know About—Society Meetings—Obituaries 1066

The Mining News 1067
Leading Events—Anaconda To Resume Soon? Hoover Heads Colorado River Commission. Anaconda [illegible] Proposal Made to American Brass Co. Trail Smelter To Settle on [illegible] Basis. Consolidated Arizona Receiver Seeks To Sell Property. Jerome Verde Transfer Time Extended. Iron Cap—Arizona Commercial Suit in Progress.
News from Washington—I. C. C. To Hear Ore Shippers on Freight Rates. Dolbear War Mineral Case Settled. Next Mining Convention at Cleveland.
News by Mining Districts—Overwinding Accident at [illegible] Mine. Cleveland-Cliffs Iron Co. To Unwater North Lake. Ford's Imperial Mine Hoisting Ore. [illegible] Moffat Road Postponed. Anaconda Reported To Have Made Contract With Silica Gel Corporation. [illegible] Amber Found at Coalmont, B. C. [illegible] Coast Beginning To Move. Tom Reed Mill To Handle Custom Ores. Proposed Mine Law Revision Not Popular in Cœur d'Alenes.

Markets 1075

Anaconda Copper Shares as an Investment 1077

Company Reports 1079

Stocks 1080

Searchlight Section 18
Directory of Engineers 32
What and Where To Buy 36
Advertising Index 42

McGRAW-HILL COMPANY, INC., Tenth Ave. at 36th St., NEW YORK

JAMES H. McGRAW, President
ARTHUR J. BALDWIN, Vice-President
J. MALCOLM MUIR, Vice-President
EDWARD D. CONKLIN, Vice-President
JAMES H. McGRAW, JR., Sec'y and Treasurer

WASHINGTON, D. C., Colorado Building
CHICAGO, Old Colony Building
PHILADELPHIA, Real Estate Trust Building
CLEVELAND, Leader-News Building
ST. LOUIS, [illegible] Star Building
SAN FRANCISCO, Rialto Building
LONDON, E. C., 6 Bouverie St.

Cable Address "Machinist, N. Y."

Copyright 1921 by McGraw-Hill Company, Inc.

Publishers also of
Chemical and Metallurgical Engineering
Coal Age
Engineering News-Record
American Machinist
Power
Electrical World
Electrical Merchandising
Electric Railway Journal
Journal of Electricity and Western Industry
Ingeniería Internacional

The annual subscription rate [illegible] United States, Mexico, [illegible] Philippines, Canal [illegible] Shanghai, China and Canada. [illegible]

Change of Address—When change of address is ordered the new and the old address must be given. Notice must be received at New York at least ten days before the change takes place.

[illegible] second-class matter [illegible] Post Office at New York, under the Act of March 3, 1879.

Member Audit Bureau of Circulations.
Member Associated Business Papers, Inc.

CIRCULATION OF THIS ISSUE 9,215 COPIES

JEFFREY
ARMORPLATE TYPE
LOCOMOTIVE

Solved the Problem of Heavy Motor Capacity With Light But Indestructible Frames

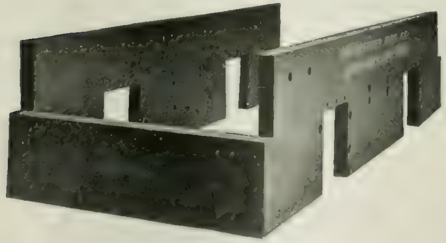
A Jeffrey 10-ton Armorplate Locomotive with cab in operation at the plant of the Kansas City Smelting and Refining Co., El Paso, Tex. Used to haul cars containing hot calcine from Wedge Roaster to Reverberatory Furnace.

IN THE evolution in Mine Haulage Methods, to meet the rapid growth of coal mines and to obtain desired outputs, it became necessary to increase the capacity of haulage units, which necessitated greater motor capacity as compared with the weight of locomotives.

In the early machines, eight horsepower per ton of weight was about the maximum capacity obtainable. This was because of the cast iron frames then used. The problem to be met was that of building a locomotive with the largest percentage of its weight concentrated in the motors and gearing and the least percentage in the frame, without sacrificing durability or making the locomotive subject to severe injury either in normal operation or in possible collisions.

The Jeffrey Armorplate Type Locomotive designed in the year 1908 virtually solved the problem. The armorplate frame, consisting of solid steel forgings, was relatively light as compared to side plates of cast iron and took up far less space. As a result, the weight of the locomotive could be concentrated in the motors and gearing and these parts made far more powerful for a given weight of locomotives and it was also possible to improve such elements as the brake rig, sanding device and the like.

The Heavy Capacity Ball Bearing Motors and other electrical equipment of Jeffrey Armorplate Locomotives are of such ample capacity that load and mine conditions are secondary considerations; the wheels slip before the locomotives can be overloaded. In other words, they are so designed that it is practically impossible to overload them.



Write for Catalog No. 263-B on Jeffrey Standard Locomotives

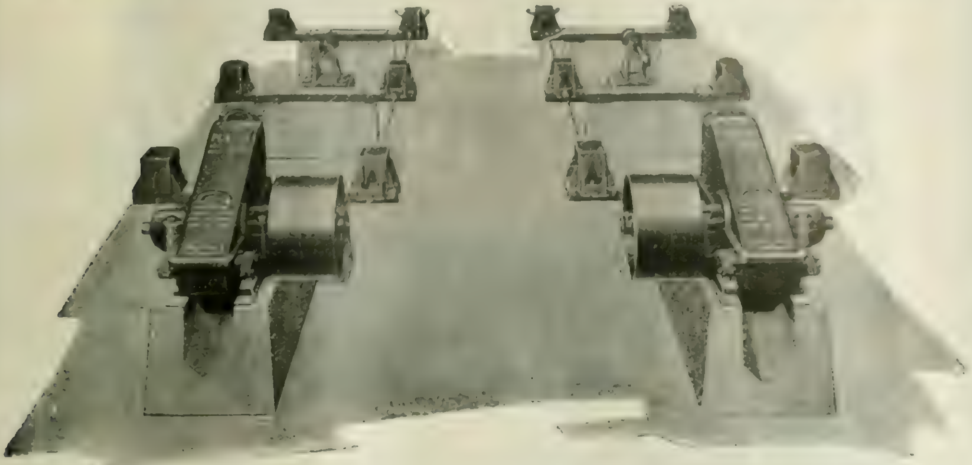
The Jeffrey Mfg. Co., Columbus, Ohio

New York
Boston
Scranton
Philadelphia
Cleveland
Buffalo
Pittsburgh
Charleston, W. Va.
Chicago
St. Louis
Birmingham
Middlesboro, Ky.
Dallas
Milwaukee
Detroit
Montreal

Denver Office: 421 U. S. National Bank Bldg.
Los Angeles Office: Herman W. Hellman Bldg.

JEFFREY
MATERIAL HANDLING MACHINERY

PLAT-O Underconstruction
—Substantial, Accessible and Simple



Right Hand Underconstruction

Left Hand Underconstruction

Compare it in actual operation
Compare it in first cost

The tilting mechanism and bearings of the Plat-O table are fastened to *concrete piers.*

We abandoned the use of steel channels for this more substantial, less expensive, simple and accessible arrangement. It is only another one of the improvements that have made possible: *Better concentrate and more concentrate—at a lower cost.*

And, by reason of high-score tonnage and low-score cost, you will find Plat-O tables in the mills of concerns like the Arizona Copper Co., Anaconda Copper Mining Co., Bunker Hill and Sullivan M. & C. Co., Federal Lead Co., and scores of others of similar character.

Use Plat-O Tables for Ore Concentration and Coal Washing

DEISTER MACHINE COMPANY

East Wayne Street **Fort Wayne, Ind., U. S. A.**

E. Deister, Pres. and Gen. Mgr. W. F. Deister, Vice Pres. E. G. Hoffman, Secy. and Treas.

The PLAT-O TABLE

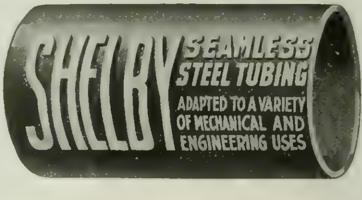
GENUINE SHELBY

SEAMLESS COLD-DRAWN

STEEL TUBING

Manufactured by the

NATIONAL TUBE CO.



SHELBY TUBING is so accurate in diameter, gauge and wall thickness that it is often used with little or no machining.

Its uniformity and general high quality render it of unique value in a wide variety of uses, at a saving in time, tools and labor over solid or forged stock.

We are distributors in the

ROCKY MOUNTAIN REGION

and carry a stock of

317 Sizes in Denver

to insure immediate shipment of all orders

Let us send you Stock List, which also gives information on Outside Diameters, Thickness of Materials, Decimal Equivalents, Weight per Foot and List Price per Foot.

THE HENDRIE & BOLTHOFF
MANUFACTURING AND SUPPLY CO.
Since 1861 **DENVER, COLORADO**

How About the Hum?

"ALL'S well; everything's humming"; so says the man on the Geophone listening to the Waugh Turbro drills hammering away 300 feet below.

THE right rock drills always make things hum and the Turbro is a hummer of the first order. There's a strong, steady, dependable rythm in its song that will distinguish it among a thousand other types.

MINES standardizing on Turbros for heavy drifting are always sure that "all's well" underground. Why not make things hum in your mine? Turbros will do it. Drop us a line and ask for a Turbro bulletin.

The Denver Rock Drill Manufacturing Co.

Denver, Colorado

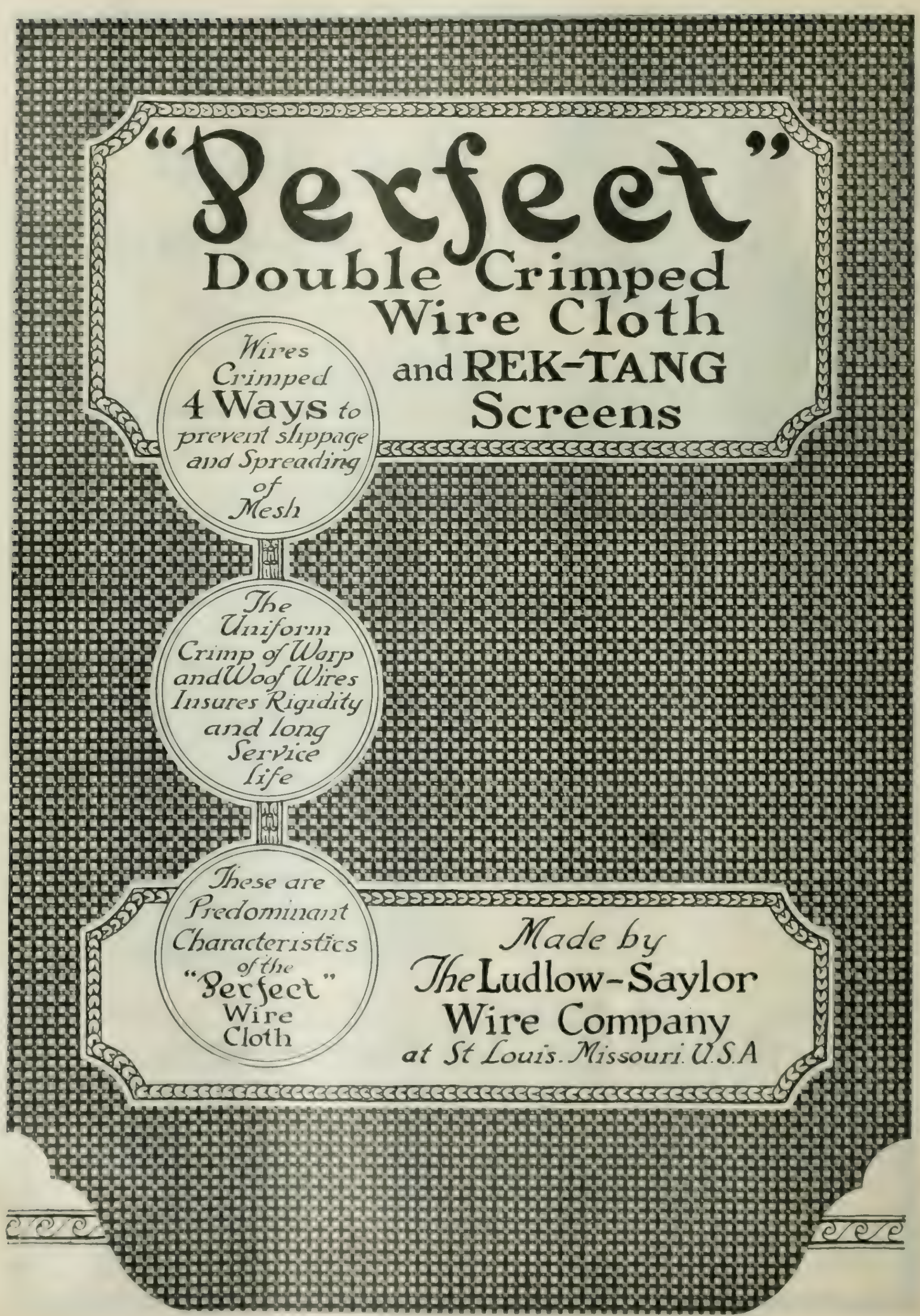
San Francisco
Scranton
El Paso
Los Angeles
Seattle
Duluth
Joplin
Wallace
Salt Lake City
Lima
Santiago
Butte
New York
Houghton
Birmingham
Melbourne
Johannesburg
Mexico City

Canadian Rock Drill Company, Limited

Sole Agents in Canada

Toronto, Ont   Cobalt, Ont   Nelson, B. C.   Vancouver, B. C.

B 138



"Perfect"
Double Crimped
Wire Cloth
and REK-TANG
Screens

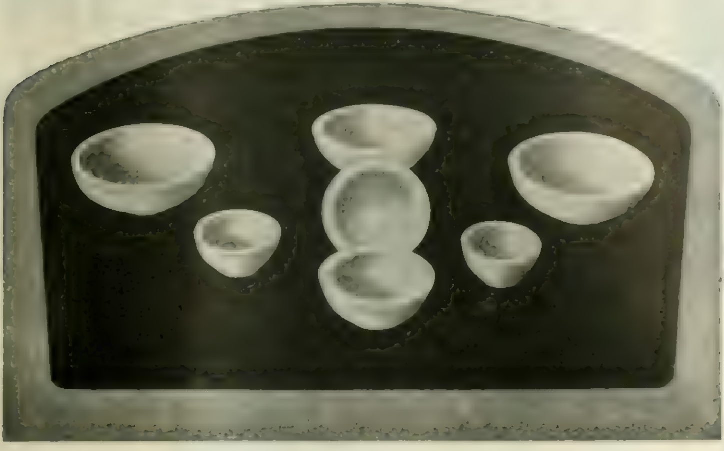
Wires
Crimped
4 Ways to
prevent slippage
and Spreading
of
Mesh

The
Uniform
Crimp of Warp
and Woof Wires
Insures Rigidity
and long
Service
life

These are
Predominant
Characteristics
of the
"Perfect"
Wire
Cloth

Made by
The Ludlow-Saylor
Wire Company
at St Louis. Missouri. U.S.A

Actual Tests—
Have Proven Their Survival Value



The
New D. F. C. SCORIFIERS

Under actual working conditions — in practice as well as in theory — our new D. F. C. SCORIFIERS are making good. They are giving survival value.

This is what the Bunker Hill Smelting Company of Kellogg, Idaho, wired us, "We just started using shipment of Scorifiers, but from sample sent us and those used today we believe they will be very satisfactory."

Read what the Coeur de Alene Hardware and Foundry Company, of Wallace, Idaho, have to say, "Samples fine and dandy. Hope the barrels which we ordered are as good as the samples."

Specify the NEW SCORIFIER on your next order

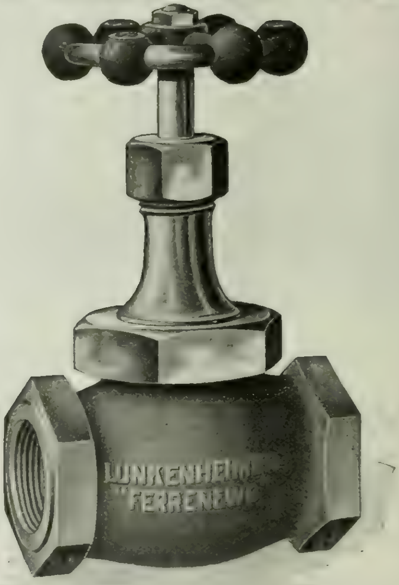
REMEMBER D. F. C. PRODUCTS HAVE SURVIVAL VALUE

THE DENVER FIRE CLAY COMPANY

Salt Lake City DFC New York City

DENVER, COLORADO, U. S. A.

LUNKENHEIMER
"Ferrenewo" Valves



"FERRENEWO" Valves are *economy* valves, proved so by their record of years in service. Low initial cost, wear resisting materials and the ease of renewal of all the parts should necessity require, makes them highly desirable for piping equipment where the pressure does not exceed 150 pounds.

LUNKENHEIMER "Valve-iron" from which "FERRENEWO" Valve bodies are made is an especially alloyed and processed Ferrous Composition. The renewable *seatring* and *disc* are made of LUNKENHEIMER "Valve-nickel," while the bonnet, stem and bonnet ring are made of bronze compositions formulated especially for the duty each part performs.

The "FERRENEWO" material combination and unique design, coupled with the LUNKENHEIMER method of manufacture insures successful results under the wide range of operating conditions for which "FERRENEWO" Valves are adapted.

LUNKENHEIMER Distributors situated in every commercial center carry "FERRENEWO" Valves in stock for immediate delivery.

To standardize on "FERRENEWO" Valves is
to *economize* in valve cost and maintenance.

THE LUNKENHEIMER CO.
"QUALITY"

LARGEST MANUFACTURERS OF
HIGH GRADE ENGINEERING SPECIALTIES
IN THE WORLD

NEW YORK CHICAGO **CINCINNATI, U.S.A.** BOSTON LONDON
EXPORT DEPT. 129-135 LAFAYETTE ST., NEW YORK

CURRENT EDITION
OF CATALOG BEARS
Nº 58
COPIES PROCURABLE FROM
LUNKENHEIMER
DISTRIBUTORS

2-15-20

The Wedge Mechanical Furnace

Patented

A Study of Roasting Brings Results

All roasts are not alike; therefore different detail in furnace construction is required. This means you secure the calcine desired and generally reduced operating cost.

Write us stating analysis of ore, concentrates, mixture or material you desire to roast, characteristics and physical condition of same, number of tons to be treated per twenty-four hours, and results desired in the calcine.

Wedge Mechanical Furnace Company

Widener Building, Philadelphia

Just a Handful for the Night Express

This view was taken as the Phillie Gear Belt Line Truck was backing up to the shipping room door. It shows a portion of a day's output that is going by express.

There is not a gear in this lot that is overdue and the majority of them are from 48 to 72 hours ahead of schedule.

This gives a pretty fair idea of our plant range, but you ought to see some of the big fellows on the floors below.

Our special service, however, applies to all gears. On many we can ship within 24 hours—on all we can meet your most urgent needs.

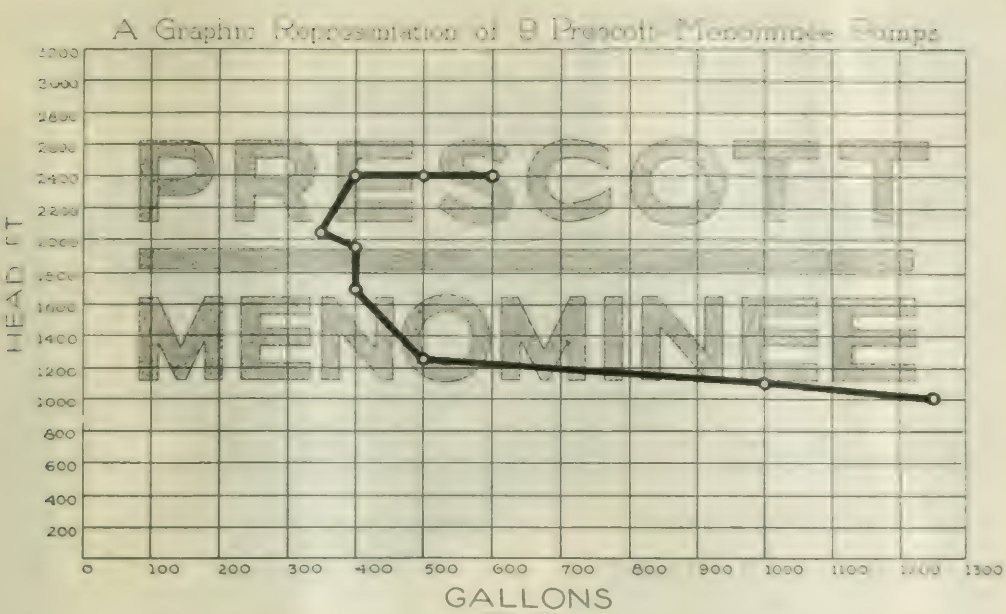
We save you the hours that mean dollars on every break-down job.

The *Phillie Gear Book* is a valuable gear treatise.
Your copy is ready.

Spur — Bevel — Mitre — Spiral — Worm — Helical

Philadelphia GEAR Works, Phila. Pa.

Sprockets — Racks — Rawhide — Micarta — Gears



The Pump that Made the Single Lift Practical

With a Prescott installation all the pumping equipment is in *one place.*

And, all water entering the suction pipes goes direct to the surface; there's no shambling or relaying with its inconvenience and unnecessary expense.

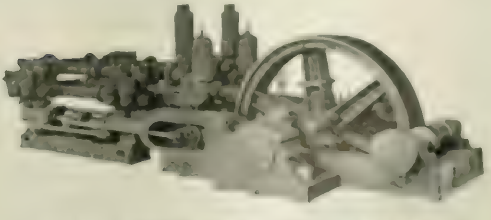
There are Prescott-Menominee Pumps that are throwing 3000 gallon per minute, others operating against 2400 foot heads.

All Prescott installations are operating efficiently and economically—and doing the work *in one lift.*

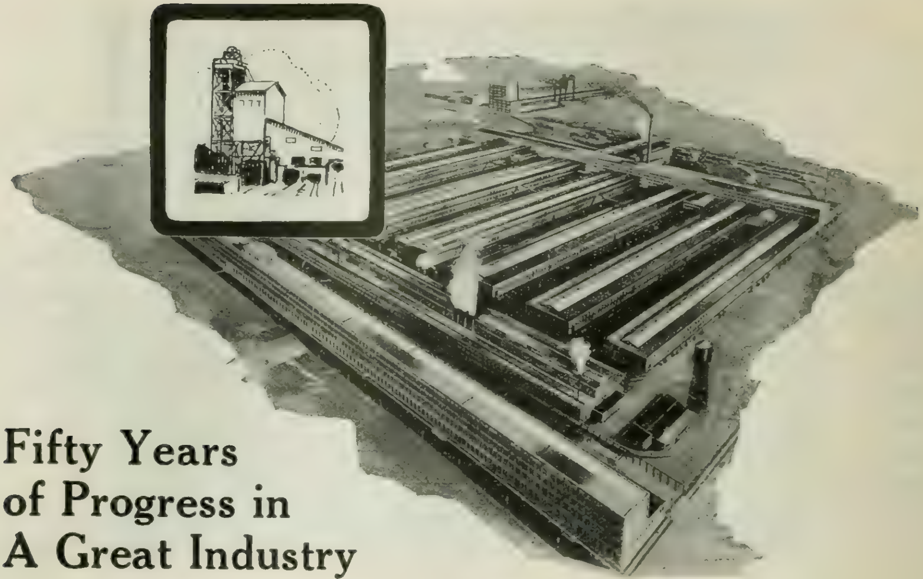
We specialize in Electric Pumps for deep mines and would welcome an opportunity to discuss your pumping problems with you.

PRESCOTT
MENOMINEE

Company	Gal per Min	Ft of Head
McKinney Steel Co.	1250	1000
Cleveland-Cliffs Iron Co	1000	1100
Montreal Mining Co (two) .	500	1250
Oliver Iron Mining Co (three)	400	1700
Newport Mining Co . . .	400	1950
McKinney Steel Co	350	2050
Cleveland-Cliffs Iron Co (two) . . .	500	2400
U. S. Steel Corporation (three).	400	2400
Steel & Tube Company of America	600	2400



THE PRESCOTT COMPANY
FRED M. PRESCOTT, President
Menominee, Michigan



Fifty Years of Progress in A Great Industry

ALLIS-CHALMERS MANUFACTURING COMPANY and its predecessors have been identified with the development of mechanical equipment used in connection with mining and metallurgical operations during the past fifty years.

This period covers the development of the precious metal mining industry in the United States, as well as the metallurgical processes connected therewith from its infancy. Prior to the discovery of gold in California, in 1849, very little gold, silver, copper, zinc or lead was produced in the United States.

There was some gold mining—both placer and quartz—in Georgia and the Carolinas, and lead was mined in Illinois, but the methods employed in the mining and reduction of ore were based on European practice and compared with present day methods were crude and costly.

The discovery of gold in California stimulated prospecting for this metal throughout the mountain regions of the west and incidentally led to the discovery of large and valuable deposits of other precious metal-bearing ores, such as the Comstock gold-silver mines at Virginia City, Nevada, the lead-silver mines at Leadville, Colo., and many others. The discovery of these large bodies of complex ores created a necessity for new metallurgical processes and improved methods of treatment.

The inventive genius of American metallurgists and chemists asserted itself and an era of improvement in old methods and discovery and development of new processes followed rapidly until today American mining and metallurgical practice is recognized as pre-eminent the world over.

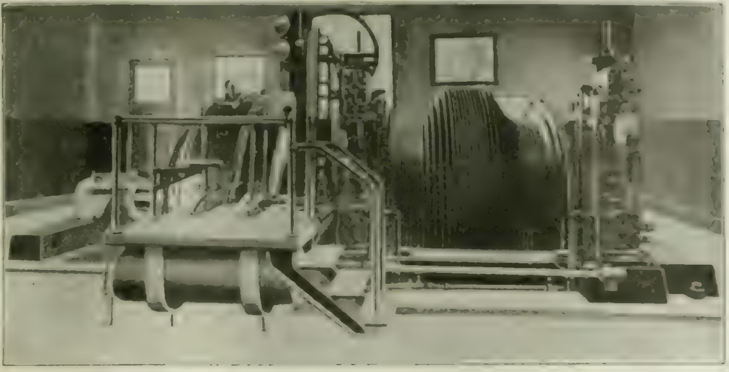
Concurrent with the discovery and development of new metallurgical processes and methods for the treatment of ores, American Mechanical Engineers and Manufacturers invented and improved the mechanical apparatus and equipment necessary to make such new processes and methods mechanically and commercially operative.

Present day mechanical equipment used in connection with mining and metallurgical operations has reached a high state of perfection in this country. ALLIS-CHALMERS MANUFACTURING COMPANY and its predecessors, Fraser & Chalmers, E. P. Allis Company and Gates Iron Works, have unquestionably been the largest contributors to the development and improvement of this class of machinery. "ALLIS-CHALMERS" machinery is recognized as Standard everywhere and is to be found in every prominent mining district in the world.

No other mnufacturer is in position to offer on such a complete line of mining and metallurgical machinery, including Power and Electrical equipment, designed and built under the direction of one organization, as Allis-Chalmers Manufacturing Company. Its products include a complete line of hoists, pumps and compressors for mines, ore crushers and fine grinding equipment, including ball and rod mills, concentration, cyanidation and chlorination machinery, roasting, smelting and converting equipment.

ALLIS-CHALMERS MANUFACTURING CO.
MILWAUKEE, WIS. U.S.A.

VULCAN



Vulcan Cylindro-Conical Hoists

For great depths and large loads, hoists equipped with double cylindro-conical drums have proved to be the most economical type. The obvious advantage of this drum is that it reduces the starting load; the acceleration of the ascending cage occurs while the rope is winding on the small diameter. A very appreciable saving in power is thus effected, and a smaller motor may be used.

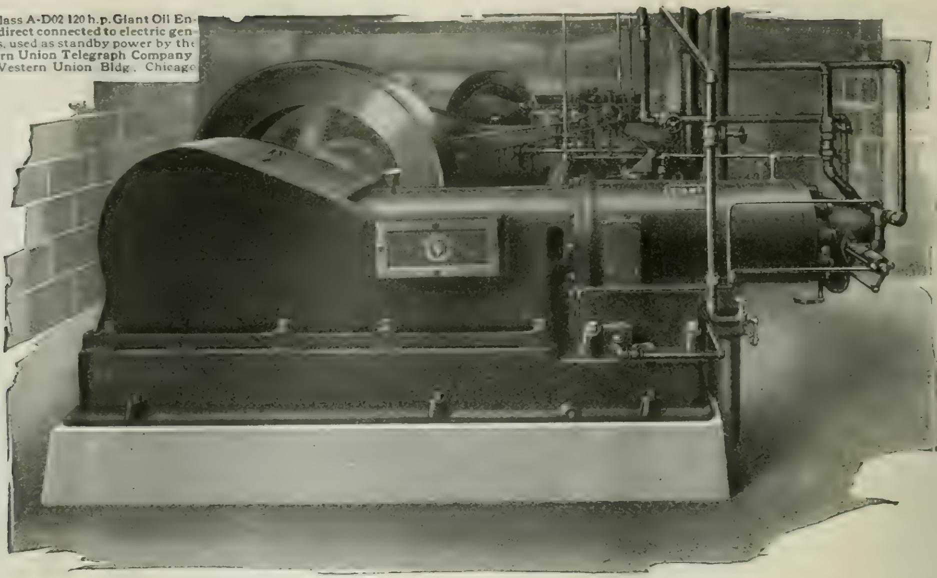
Then, too, with this type of drum less braking is needed to bring the cage to a stop; wear on the mechanical parts of the hoist is thus reduced to a minimum—lower up-keep cost and longer life results.

The illustration shows a Vulcan of Wilkes-Barre Hoist equipped with double cylindro-conical drums, typical of many installations throughout the bituminous and anthracite fields.

Tell us of the conditions which you wish to meet. For over seventy years we have been building hoists to meet widely varied requirements.

VULCAN IRON WORKS
Established 1849
1733 Main St., Wilkes-Barre, Pa., U. S. A.

VULCAN



Two Class A-D02 120 h.p. Giant Oil Engines, direct connected to electric generators, used as standby power by the Western Union Telegraph Company new Western Union Bldg., Chicago

Why Giant Oil Engines have a cross-head

THE Giant cross-head and the efficient lubrication system which it makes possible, *double engine life.*

Giant cross-head construction conforms to high-grade steam engine design. It prevents side pressure against the cylinder walls. It obviates uneven cylinder wear, worn pistons, loss of compression and consequent hard-starting. It reduces friction to a minimum. It provides easy accessibility to all moving parts by permitting the use of readily removable frame covers. It permits compressing the charging pressure in the cylinder proper, and not in the crank case where leakage is almost unavoidable. It allows the crank end of the cylinder to be closed, thus providing for full *automatic splash lubricating system.*

The Giant system of lubrication is *positive-oiling, continuous in circulation, entirely automatic.* It saves time and saves oil.

Longer life and lower power costs invariably result from these and other Giant features that prove the worth of Giant Engines on a cost-per-year basis.

How much can Giant Oil Engines reduce *your* power bills? Engineering counsel, extended without obligation, is available to assist you in answering this important question. Giant Engines are built in single and duplex types, capacities 12 to 200 h. p. Ask for Bulletin 389.

Chicago Pneumatic Tool Company
Chicago Pneumatic Building · · 6 East 44th Street · New York

*Sales and *Service Branches all over the World*

*Birmingham *Boston *Buffalo *Chicago *Cincinnati *Cleveland *Detroit El Paso Erie Franklin Houston Joplin *Los Angeles *Minneapolis *New Orleans *New York *Philadelphia *Pittsburgh Richmond Salt Lake City *San Francisco *Seattle *St. Louis Baku *Berlin Bombay Brussels Buenos Aires Christiania Copenhagen *Fraserburgh Havana Helsingfors Honolulu Johannesburg *London Manila Milan Montevideo *Montreal Osaka Paris Rio de Janeiro *Rotterdam Santiago Sao Paulo Seoul Shanghai Tientsin Tokyo Toronto Vancouver Winnipeg

F N 41

BOYER PNEUMATIC HAMMERS · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS · VACUUM PUMPS · · PNEUMATIC HOISTS
GIANT OIL AND GAS ENGINES ROCK DRILLS · · COAL DRILLS

GIANT ENGINES
Dependable Power at Less Cost Per Hour

J. E. SPURR
Editor
G. J. YOUNG
Western Editor
D. E. A. CHARLTON
Managing Editor
A. H. HUBBELL
News Editor
E. H. ROBIE
Metallurgical Editor

Engineering and Mining Journal

F. E. WORMSER
W. N. P. REED
Assistant Editors
BENJAMIN L. MILLER
ROBERT M. HAIG
J. VOLNEY LEWIS
Special
Consulting Editors

Volume 112 New York, December 31, 1921 Number 27

The Anaconda-American Brass Merger

AFTER MANY RUMORS, denials, further rumors, and more denials, it appears to be a foregone conclusion that the Anaconda Copper Mining Co. will acquire the American Brass Co. This will mark an exceptionally important development in the copper industry. For many years Anaconda has been active in the manufacture of rods and wire at its Great Falls plant, the success of which has evidently induced the company to expand its manufacturing interests in a slightly different channel.

It is to be noted that this gigantic corporation includes multitudinous ramifications. Copper, lead, zinc, gold, silver, rare metals, coal, phosphate, brick, sulphuric acid, and lumber are some of the most important commodities it produces, not to mention the smelting, refining, transportation, and, in part, the manufacture into finished form of some of its products. In its growth Anaconda has branched more and more into the conversion of its metals to articles fit for the ultimate consuming markets. Only last year an electrolytic white-lead plant established in East Chicago was placed in operation, but the acquisition of the American Brass Co. will eclipse anything heretofore done by Anaconda in the expansion of its manufacturing enterprises.

Although Anaconda is capitalized at $116,562,500, and American Brass at $15,000,000, the actual comparative value of the two is at present more nearly expressed by the ratio 2.5 :1. Anaconda is absorbing a company almost half as large, from a financial standpoint, as itself.

The copper industry has been slow to follow the lead of other industries in supervising the utilization of its raw materials and their transformation into finished marketable form. The development is an old one in others, and is well illustrated by the organization of the Standard Oil Co., the United States Steel Corporation, and the Aluminum Company of America. All of these corporations may be considered to fall into the so-called "vertical trust" type of combination, which is the term used to designate an organization that controls the handling of a commodity from its original production as a raw material to its final disposal as a completed product to consumers. This is to distinguish it from the "horizontal trust," which controls some particular part of the path from producer to consumer. The American Brass Co. may be grouped in the latter class, as it is a consolidation of many subsidiary companies engaged in the same manufacturing activity. The development of trusts has reached its highest point in Europe.

Both Anaconda and American Brass have had long and eminently successful careers. By their merger the largest producer of copper joins hands with the largest consumer. The copper consumption of American Brass is so large—estimated to be between twenty and thirty million pounds monthly—that Anaconda will be unable to fill both the brass company's and its own wire mill's requirements from the twenty million pounds or so that Anaconda normally produces each month. American Brass will have to make outside purchases of copper.

The consolidation will partly replace the copper business that other producers have had with this good customer, but will, at the same time, give a better market to other copper producers in the remaining consuming fields. It should have no effect on the business of copper marketing other than to eliminate Anaconda from active participation therein. Anaconda will henceforth be interested more in the outlet for brass and wire than in the market for copper, which, in view of the criticism leveled at manufacturers and retailers of copper and brass products, will be a splendid development, as it should insure the injection of the producer's viewpoint into the manufacture and sale of the finished products. Anaconda will obtain an excellent opportunity to popularize copper and brass.

What Can Be Done To Revive The Mining Industry?

THE NEW YORK SECTION of the American Institute of Mining and Metallurgical Engineers recently held a meeting at which competent "diagnosticians and physicians" were summoned to determine "what can be done to revive the mining industry." This lean and debilitated old stager was trundled in under the sympathetic eyes of his well-wishers. The learned "doctors" determined that "world conditions" had infected the patient directly in the coppery part of his anatomy and indirectly in all his other metallic and nonmetallic parts. C. F. Kelley, the copper specialist summoned to the consultation, after indicating the foregoing diagnosis, called attention to the importance of improving the merchandising of copper and copper products. In our opinion, in this he has struck a hot trail and one that will lead to substantial and permanent good not only in the copper but also in other mining lines.

Hitherto, the mining industry, and particularly the copper-mining industry, has conducted its business like old John Taylor did his. John Taylor was an old-time merchant. He wore a frock coat and bore with dignity, when going to and from his place of business, a high hat of unimpeachable polish. His gray whiskers and active eyes impressed a [illegible] personality upon his customers. He often sold his own goods. His reputation for honest dealing was long, broad and deep. But John Taylor never went after business in the modern way. What came to him naturally sufficed, and a more energetic merchant bought him out and established an important and far-reaching business upon the honest seed planted by John Taylor. Modern merchandising was responsible.

It seems to us that the mining industry has passed the John Taylor stage of its existence and must study the principles of present-day merchandising. It must actively protect the demand factor and seek by every legitimate means to increase demand. It has placed its goods upon the commercial counter and has complacently awaited customers, and has then given but little concern as to what happens to its goods en route to the final consumers. This attitude belongs to the antediluvian stage of merchandising.

Successful merchants go after business and protect that business at every turn. The mining industry will have to play the game in a similar way. The zinc people have got under way. The copper people are beginning to develop the industrial uses of copper. Other mining lines must find or create similar opportunities.

Competition Among the Metals

IN THE December issue of *The Nation's Business* is a prominent advertisement of a steel manufacturer in which two illustrations are displayed of metal housings such as one finds covering gears. One of these illustrations shows a pressed-steel housing, and the other is ostensibly made of aluminum. Above these photographs is the caption "Press It From Steel Instead," and below "Pressed Steel Saves 33⅓ Per Cent," followed by the claim that a saving of 33⅓ per cent in cost was made by the substitution of pressed steel for the use of aluminum in this particular application of the metal.

This is an interesting sidelight on the keen competition that is going on among the metals, for which violently fluctuating markets and the destruction of normal price relations between them is responsible. Were the two photographs respectively of a copper and iron tack, or of some other article in whose manufacture both metals find independent employment, the lesson from the "ad" would be driven home more forcibly. As it is, the domestic aluminum industry is so closely controlled and so little is known of its operations that no great anxiety will be manifested over the particular example we have cited.

Copper producers are seriously concerned when someone mentions substitution, and they are devoting much time and thought as to how they can regain lost markets for their product. We have not seen any advertisements of the fact that in such and such an electrical transmission line copper displaced aluminum or vice versa, or—to step into another field—that zinc paint in a particular application is better than lead, or that steel can be used more profitably in a certain installation in preference to brass or bronze. Competition hasn't reached that stage where the metals are out to cut each others' throats.

Undoubtedly, it is within the right of every producer to indicate possible savings in the use of the metal which he produces, be it iron, copper, tin or some other one. We may look for such developments in the readjustment which is now taking place and in which each metal is seeking to recover an older superiority. Merit will be the ultimate basis upon which the use of each will depend. Careful weighing of price and physical characteristics will be required to determine the fitness of copper, aluminum, iron, or other metal for each especial use.

All the metals have fields which they occupy to the exclusion of others. Thus, copper is par excellence the metal for armature windings, iron for stoves, and aluminum when lightness is essential, as in airplane construction. Then there is a twilight zone in which competition will naturally be keen. A good illustration is the electrical transmission field, in which both copper and aluminum are used. With copper selling for 13.75c. and aluminum for 17c. the lighter metal has a decided advantage, as whenever the price of aluminum is less than twice as much as that of copper it is more economical from a conductivity standpoint to use aluminum.

An advertisement similar to the one noted above is an excellent reminder of the race between the metals for enlarged markets. May the best one win!

Oh, Those Germans!

CONSIDERING THE INSISTENT REPORTS concerning the fabrication or transmutation of gold from base metals, it is really remarkable that this secondary or manufactured form of the element does not come upon the market. Some time ago we told editorially of the announcement by Engineering Foundation of the advent of an alchemist who looked to them as if he might be able to do the job. The latest herald or harbinger of free gold is none other than Prof. Irving Fisher, of Yale, distinguished economist and advocate of a market-basket purchasing-power dollar rather than a dollar on a gold security. In a speech at the London School of Economics on Dec. 16 and in an article published in the *New York Tribune* on Dec. 18, he said:

> "We can imagine that the same German chemists who worked out the hideous chemical warfare will work out a chemical way of paying their debt. This seems now as chimerical as, before, the prognostications of Zeppelins bombing London. I have just been credibly informed that a German chemist has already succeeded in a laboratory in making synthetic gold out of baser metals by means of an electric vacuum furnace. It only remains to cheapen the process sufficiently, to flood the world with chemically manufactured gold and to make it worthless. In that case the reparation payment would become a farce and Germany instead of paying the penalty would get enormously rich by exploiting this new philosopher's stone."

We all have our little fears. Professor Fisher fears that Germany will make cheap gold and dump it on our shores. What we fear is that Professor Fisher's pet hobby of discarding gold for his own (to our notion) impracticable basis of currency, has influenced and inflamed his imagination as to the manufacture of gold. We not only fear it: we know it. What a lot of foolish, credulous, misleading, cheap talk is spread abroad by those who ought to know better!

A German Divining Rod

SPEAKING OF DIVINING RODS and ore-finding machines, of which the air, so to speak, is full (so that we expect some fine morning to wake up, and learn that all the ore has jumped out of the ground and lies still writhing in the bleak winter sunshine), we listened to a tale the other night, told by a successful and prominent business man, who held a very responsible position in Washington during the war, adjusting metal supply problems. His tale apparently related to the ore-finding instrument whose wonderful possibilities have been so strongly hinted at by Mr. Herman Holz, of New York, as commented on (unfavorably) in an editorial in our issue of Dec. 25, 1920.

The instrument to which our friend referred had recently been tried out by a former associate of his, a man experienced in the metal business. The instrument, on trial, had been found to be so delicate that, set up over an orebody in the iron country, it would register the amount of manganese in the ore; it would record the passage of a car loaded with ore in a tunnel beneath, or the startings and stoppings of an ore-laden cage in a shaft. So active was the instrument that on one occasion when it was being carried in an automobile past a field to which it discovered attraction, on account of the land being (presumably) oil-bearing, it jumped from the seat through the windshield of the car, and landed thirty feet inside the field. Not only could it detect the oil in the ground, but the kind of oil—whether it had a paraffine base or what not. The instrument, it appeared, consisted in part of a device that revolved rapidly. The curious thing about it was that it revolved in one direction when in the hands of men, and in another direction when in the hands of women; and the very young or very old could not use it at all. By means of this instrument, it was related, thousands of acres of oil land had been located, and would be drilled.

Query: Why drill? Make a powerful, big, sixteen-cylinder, dreadnought size of this instrument, and the oil can be drawn out of the ground and into the tanks. A moderate sized make should be sufficient to draw metallic coin from the pockets of passers-by; it could be worn unostentatiously on the person, and could be scraped off after each promenade down Fifth Avenue.

This is also a German invention. Oh, those Germans! First, they make an instrument to locate all the gold in the earth and its assay value, and in the same breath they make a gold out of old iron and we shall have to put a tariff on it.

Wonderful! Colossal! And a never-ending line of suckers slip down the stream.

The Hartford Instrument

IF THERE IS ANY ONE who can beat the Dutch, however, it is the Connecticut Yankee, the legendary inventor of wooden nutmegs and oak hams. There is a man in Hartford—a responsible man—who sends us a story of what he has found, seen, tested with his own eyes. We publish extracts:

"DIVINING ROD" THAT MIGHT MAKE A POOR MAN RICH

"Why steal, hold up people and sell fake stocks and borrow money of friends with no intention of ever returning it?

"A Hartford, Connecticut, man has a 'divining rod' that is a perfect magnet for gold, silver, and platinum."

No, the above is not intended to be humorous; it is the Hartford man's idea of writing an ad. He continues:

"It will not work on base metals at all, and it is the most peculiar thing the author ever ran across."

The promoter is a man of practical ideas:

"If this rod will find gold in places nearer civilization than many of the present gold fields it would be a godsend, as the precious metal could be handled much better and more money made in mining it."

True, O Connecticut Yankee: if you can locate gold mines at Hartford or in the Bronx, it would be convenient; or in the basement of the Treasury in Washington; but you have never heard of that other Connecticut Yankee's (Fisher, of Yale) prognostications that the Germans would dump cheap gold in New York and Washington. The ocean freights would be overcome by the cheap German labor and the depreciation of the mark, and we estimate that German gold could be laid down in New York at the wharf two dollars a ton cheaper than it could be produced, even if you were to locate your plant at Bethlehem, Pa. So your hopeful suggestion that the rod "might make a poor man rich" should be amplified thus: "and then, again, it might not."

The Mining and Metallurgical Society of America gives a gold medal each year for some great mining, metallurgical, or geological advance. What better use than to offer it for a competitive showing of all these methods of getting cheap gold?

We are let in on the mystery of the instrument more than we usually are—more than in the case of the instrument the marvelous workings of which Mr. Holz has hinted at. Concerning the Connecticut instrument:

"The rod is a small copper tube about three inches long and a half inch in diameter. It is sealed at both ends and the owner laughingly says when asked what is in it: 'If I told you, you would know as much about it as I do.' Attached to the rod are small bamboo or whip sticks. The sticks are soaked in water for a long time before being used, and they bend very easily when gold, silver, or platinum is waved in front of the tube. The operator, it has been proven, must be of a nervous high-strung temperament, and the tube will not work with only a certain percentage of the people. Just what percentage it is is a question unanswerable. The rod will not work when the base metals are placed before it. It will not answer to either copper or steel."

We discern some resemblance to the German rod we describe above—some hint at a uniform principle, not only of this rod but all other rods concerning which we have heard—in that the instrument's activities depend on the operator, who must be "of a nervous, high-strung temperament." But it does not draw the line at the infirm and aged as does the machine before mentioned.

"The rod came into the possession of the Connecticut man through making the acquaintance of an old farmer who lived high on a mountain top. This elderly farmer claimed that for nearly fifty years he had experimented with it. It worked perfectly with his wife, a woman of seventy years."

Nevertheless, the rod appears sensitive especially to women, and prefers blondes:

"The man who has this rod is a well-known Hartford, Connecticut, citizen. He does not exhibit the rod to the general public, only to his friends. He has studied it and has tried out all kinds of people, and declares that he believes women, particularly blondes, are more sensitive to its magnetism than brunettes."

What kind of magnetism is this to which blondes are more sensitive than brunettes? We ask this, because we have always believed that brunettes also were sensitive to gold, silver and platinum. Concerning this, the writer observes:

"If it is personal magnetism, it is something that should interest Science. It appears to be a magnetism and a strange one at that."

So far it has not been tested out in the mining districts, but only in town:

"Let a sensitive operator simply carry the rod past the window of any store or as one goes through a city street, the rod will pull so that any person accompanying the operator can feel it. The pull only occurs, however, when the operator is passing a bank or a jewelry store."

Why indeed, steal, hold up people, and sell fake stocks, when jewelry stores are everywhere?

One disadvantage the Connecticut instrument has as compared with the German instrument. The latter reacts to iron and manganese; the former will not work on base metals at all, neither copper nor steel. Therefore the Connecticut man should perfect his instrument before it is placed on the market, for since gold, as the Yale professor insists, will be made from base metals, the problem is not to find gold but the raw materials.

How fast they swim! [illegible]

The "Journal" To Publish Annual Progress Number

STOCK TAKING, inventories and from time-to-time appraisals are good things in an individual business—successful men consider them vital; the unsuccessful can sometimes trace their failure to this absence of a quantitative show-down. If this show-down is good for an individual business, how much more vital is it for an industry? That is just what we, in our annual numbers, do for the mining industries. Admittedly such appraisals are more or less incomplete, but the composite of them all is a barometer of the annual status of mining.

The annual this year will comprise five parts—Industrial Analysis (Standpoint of Mining), Industrial Efficiency, Current Problems, Editorial, and Market Comment. There will be a strong looking-forward element, constructive suggestion as to improvement in methods that will result in increased efficiency and greater economies. Men who are leaders in their respective lines will give you their best thought. As a mining engineer, you cannot afford not to give this Annual Number extended consideration and careful thought. If you are a superintendent, operator, or foreman, you will get a better perspective of your industry than in any other way. If you are a business man or manufacturer you will find the Annual an authoritative appraisal and a mine of information and excellent suggestion.

In the Industrial-Analysis section, H. A. C. Jenison will cover "Copper Mining"; Clinton H. Crane, "Lead Mining"; Arthur Thacher, "Zinc Mining"; Sidney J. Jennings, "Gold Mining"; F. E. Wormser, "Silver Mining"; D. E. A. Charlton, "Iron Mining"; John D. Northrup, "Petroleum."

In the Industrial-Efficiency section, Arthur Notman will present "Training Miners for Efficiency"; Benjamin F. Tillson, "Efficiency in Drilling and Blasting"; Charles A. Mitke, "Standards in Mining"; J. R. Finlay, "Reduction in Costs"; Guy H. Ruggles, "Trend in Milling Practice"; A. G. McGregor, "Trend in Smelting Practice"; Chester K. Gilbert, "Utilization of By-products in Mining."

In the Current-Problem section, H. B. Fernald will present "The Burden of Mine Taxation"; F. R. Raiff, "Mining Prosperity and the Railroad Problem"; Allen H. Rogers, "How Should the Mining Engineer Be Trained"; H. G. Moulton "Licensing the Mining Engineer"; Marion C. Rhodes, "What Can Legislation Do for the Mining Industries"; Samuel D. Nicholson, "The Need for a Department of Mines."

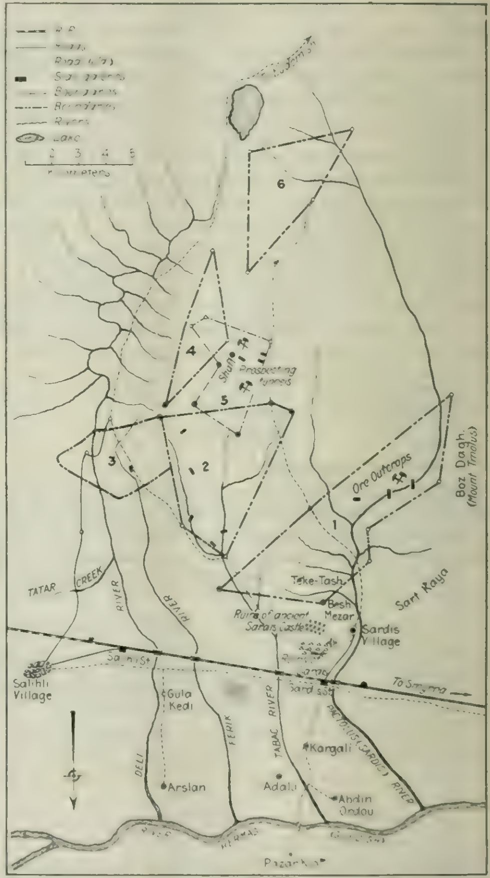
In our Market Section we will present forecasts for the coming year for each of the major metals by leading men in the metal markets. W. M. Foote will present "Marketing Non-Metallic Minerals" and A. R. Ledoux "The Metal Marketing Problem for the Miner." R. B. Ladoo will cover "The Future of the Non-Metallics." Our statistical tables and charts will be found in this section.

This unusual and complete number will be our issue of Jan. 21, 1922. It should be in the hands of every mining man and everyone interested in the mining industries. Place your orders for copies early, as the number we will print is limited closely to our normal requirements.

WHAT OTHERS THINK

Gold Mines at Sardis

Referring to the article "Mining as Seen by Herodotus" in the Oct. 15 issue of *Engineering and Mining Journal*, I would call attention to the fact that the gold mines at Sardis (see map) were not exhausted at that time. Analyses of the ores of the district show the following gold content: Average sample No. 1, taken from the shaft and being quartz with iron pyrite, contains 5 gr. gold to the ton; average sample No. 2, taken from the different tunnels around the shaft and being chiefly iron pyrites, contains 9.87 gr. gold to the ton; medium sample No. 3, taken from galleries along the Pactolus River and being chiefly ochre, contains 25.29 gr. gold to the ton.



It is unfortunate that these mines are not still being worked. This is due to lack of capital and to the World War, during which the Greek and other Christian owners of these mines were forbidden to do any work whatever.

P. A. GEORGIADES.

Constantinople.

1—ENTRANCE TO VETA GRANDE MINE, IN NAYARIT MOUNTAINS, MEXICO, SHOWING DRY MASONRY BUILT BY INDIAN LABOR

2—PORTAL AT MONJARAS MINE, SHOWING RAIL. 3—TYPICAL MINING CAMP IN NAYARIT—THE BORDER STATES OF JALISCO AND NAYARIT

Recent Developments in Mining in Jalisco And Nayarit, Mexico

Great Activity Evident—Railway and Road Building in Progress—A Route Shorter Than Via Panama—Mining Camp Being Reopened—Geology Complex—Glimpses of Native Life

BY HENRY M. PAYNE

Written for Engineering and Mining Journal

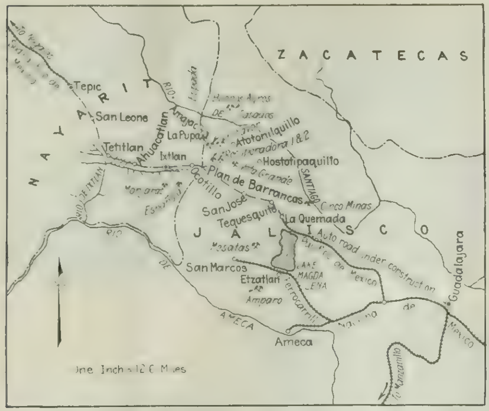
THE CHANGE from paper to metallic currency in Mexico and the slowly rising price of silver have resulted in marked activity in the mining states of the republic. This is especially true in those districts which until recently have been inactive on account of bandits and revolutions. The present government seems to have been markedly successful in re-establishing industry and in putting down brigandage, so that a general air of stability and confidence prevails. Regular deliveries on an order for ninety locomotives are being made to the National Railways, and orders have been placed for 150 passenger cars, 3,000 freight and ore cars, and 25,000 tons of heavy steel for use on the main lines.

Probably the greatest activity in the republic is in the states of Jalisco and Nayarit. The last-named state was formerly the Territory of Tepic. The Southern Pacific Railway of Mexico extends from Nogales to Tepic City, on the west coast, through Guaymas and Mazatlan. For some time trains have been operated only north of Ruiz, on account of the destruction of the Santiago River bridge by bandits. This has now been rebuilt and over 2,000 men are employed on the extension of the line from Tepic towards Ixtlan del Rio.

Ixtlan del Rio, a city second in size only to Tepic, the capital, is the principal merchandising center of a vast mining area in the Nayarit Mountains, whose summit forms the boundary between the states of Jalisco and Nayarit. Excellent stores, a municipal lighting plant, schools and residences make it the only modern town between Tepic and Guadalajara. The approach to the city from the east is over the old military road built by Santa Ana and rebuilt by Maximilian. Hidden in the clouds directly back of the city is Mount Ceboruco, an extinct volcano. Leading into the city from the south across the Ixtlan River is the road from the Monjaras and Española mines. An excellent stone bridge built by the Spaniards was dynamited about six years ago so that it is now necessary to ford the river.

On the southern end, the Southern Pacific Railway of Mexico has a line in operation from Orendain Junction, where connection is made with the National Railways for Manzanillo and Guadalajara. The present westerly terminus of this line is La Quemada, on the north shore of Lake Magdalena, which point the Tepic-Ixtlan extension will ultimately join. When this link, approximately 100 miles long, has been completed, the commercial routes of North America may undergo some startling revisions. There will then exist a continuous trunk line from Seattle, Wash., to Mexico City and Vera Cruz, with direct steamer connection for New York, offering a far shorter and quicker route than through the Panama Canal.

There is no region of the tropics in the Western



MINING REGION OF NAYARIT AND JALISCO IN NAYARIT MOUNTAINS

Hemisphere where climate, elevation, and soil are more admirably combined for the production of fruit and food, sugar cane and vanilla beans, where frost is unknown and labor abundant, than the district under review. The crossing of the Nayarits, however, is one of heavy construction and tunneling and although many thousands of tons of steel and other construction supplies are at La Quemada, it will be at least three years before the gorges or *barrancas* at the head of the Amajac River have been crossed.

To provide for earlier transportation facilities to the mining districts, the governments of Jalisco and Nayarit are now building an automobile road fifteen meters wide between Guadalajara and Ixtlan del Rio, on which only automobiles and automobile trucks will be permitted, toll gates being established at intervals. The ox team and native plow, which is somewhat like a single-toothed harrow, are used to loosen up the surface, after which a group of laborers with shovels and wheelbarrows complete the grading. One of the first imports into Mexico should be modern agricultural implements and tractors. The accompanying map shows the projected railroad line and the new state highway through this district.

Early Spaniards Operated in Nayarit, According to Humboldt

Referring to Mexico as the "treasure house of the world," Baron von Humboldt, in 1803, mentioned the Nayarit Mountains as the source of much of the wealth which supported the Spaniards for the three centuries from 1521 to 1821. Prior even to this, the Aztecs had worked these deposits, and from the ores so obtained many large gold and silver vessels and ornaments were made, to fall subsequently into the hands of the Spaniards. Mining methods were necessarily crude, with the result that on many properties today excellent returns are had from reworking abandoned tailings.

A few years ago there were found in the church at the Indian village of Hostotipaquillo parts of a Spanish manuscript written by a priest in Valera, who was in Mexico at the time of the Conquest. The first part was historical and described various geological changes in Yucatan, Panama, and Mexico, and also mentioned the burial mounds near Ixtlan del Rio and Soatlan. These mounds have since been opened and found to contain hieroglyphic tablets, golden ornaments, silver utensils, and the skeletons of early rulers.

The second part described many mines in what are now the states of Sonora, Zacatecas, Jalisco, and Nayarit, but gave no definite locations of the properties. About three years ago, in the same Indian village, a third portion of this manuscript was found, which detailed the exact location of the original workings of six extremely rich mines. To date, four of these have been relocated and are now being opened up by American engineers and capitalists. All are within a few miles of one another in the main dividing ridge between the Ixtlan and Amajac rivers, which flow into the Ameca and Santiago, respectively.

Rail Transportation Available for These Properties

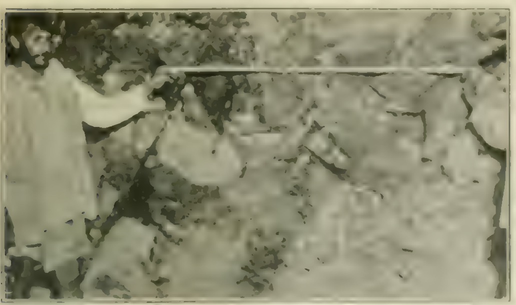
Upon the completion of the railroad and automobile road already referred to, these properties and about six others, now operating, will all be directly upon or within close haulage distance of direct transportation to Guadalajara. At present, ore and bullion are sent by pack train to San Marcos and La Quemada and thence by rail.

The mineralization of this region is unique and consists of five parallel veins and four intersecting veins, one of which is so wide that it has been named the Humboldt vein, after the famous geologist. On the southwest side of the mountain are the Falls of Monjaras, a Mexican Yosemite. At the base of this waterfall the Humboldt vein is exposed transversely, and extends in width between the two handkerchiefs as seen in the illustration.

An Antigua Relocated

The Spanish description of one of the old properties located it as being near these falls. A minute search of the entire mountain side eventually brought to light

INDIAN CARRYING MINE TIMBER UP MOUNTAINS



LARGE SILVER VEIN IN MONJARAS TUNNEL

old tailings, overgrown with the tropical vegetation of centuries, and further investigation uncovered a series of openings in the Fragua vein, extending about 300 ft. into the mountain.

The geology of the region is decidedly complex. The original stratigraphy was regular and clearly defined over the entire area, previous to volcanic disturbance. When the great eruptions took place these sedimentary layers were uptilted, until they now maintain almost vertical positions. The breakage, however, has been in gigantic areas rather than localized, with the resulting parallelism which forms whole mountains of uninterrupted strata. Subsequent erosion has exposed intrusive eruptive cores carrying uniformly high values and sharply defined foot and hanging walls. The andesites, diorites, and porphyries are typical of the igneous formations usually found in volcanic regions.

Gold, copper, and zinc occur in limited quantities, but the silver ores predominate, usually as argentite, cerargyrite, or native silver. These deposits are so extensive and the outcrops so continuous that a single vein may be traced from mountain to mountain. In one occurrence the knobs of three successive hills are formed by one vein.

One of the illustrations shows a flashlight in the main tunnel at the Monjaras mine. The hanging wall and a portion of one of the wide veins may be seen. Ventilation is obtained by a gasoline-driven fan connected to an 18-in. pipe which carries the air in to the face, as shown in another view. Labor is everywhere abundant, and in general it may be said that the Mexicans and the Indians of the west coast make excellent workmen. They are skilled equilibrists and carry prodigious loads for long distances up steep mountain trails. A view of an Indian carrying a stick of timber up a mountain is shown. Timbers of this size are frequently packed in this manner for miles.

On account of the climate, the item of miners' houses is a small one. Grass and bamboo pole houses as shown in the accompanying view of a mining camp cost about $50 Mexican or $25 gold, and serve whole families. The cooking is done on an open fire out of doors, and the food consists principally of *tortillas* and *frijoles*, with occasional venison, wild turkey, or goat meat. The miners wear light cotton clothing when exposed to the sun, but underground the "gee" string of the tropics is the usual dress.

LA PUPA, AN ABANDONED CAMP

The vicissitudes of small mining camps during the succeeding Villista-Carranzista raids form interesting history. On the lower Amajac River the town of La Pupa was an enterprising mining settlement ten years ago. As a result of a series of raids, however, the mines were closed, and the mill, church, and village abandoned. Today the main street is overgrown with weeds, the

1—MAIN STREET, LA PUPA, NAYARIT MOUNTAINS, ABANDONED TEN YEARS AGO [illegible]. 2—FIRE [illegible] TAKING SAMPLES FOR ASSAY. 3—MINERS COMING OUT OF SHAFT. 4—AT FOOT OF [illegible] FALLS. [illegible] TWO HANDKERCHIEFS DENOTE WIDTH OF [illegible] OUTCROP houses are deserted, and the church is in ruins. Along the roads in all directions may be seen wayside crosses where victims of the raids met their fate and were buried.

Early Spanish Influences Persist

An interesting sidelight on Mexico is the persistence with which the religious teachings of the early Spanish priests have been transmitted from generation to generation among the Huichole Indians. It is most unusual for an Indian, even today, to pass one of these mounds without removing his sombrero, and if on foot depositing another stone and saying a prayer as he passes. The trails (for there are no roads) become densely overgrown in a fortnight, especially during the rainy season, and it is necessary to take along one or two extra *mozos* to clear the path with machetes.

At La Venta, on the summit of the Nayarits, is an old hotel. In the plaster around the patio may be seen the marks of the bullets of the firing squads that infested the district during the revolutions.

The new automobile road, when completed, will be one of the scenic highways of the world. Varying in altitude from 7,000 to 11,400 ft. and embracing the vast watershed of the Santiago River system, the traveler is greeted by a continuous panorama. Many varieties of cacti abound, the most beautiful of which is the "organ" cactus which attains tree height. At the Recuperadora mine, one of these plants, growing up through the ore dump, forms a prominent landmark.

The native Mexican, like his Indian co-laborer, has no use for chairs or tables, but squats with aboriginal comfort. In one of the views may be seen the engineer's assistants "bucking" samples of ore in preparation for assay.

Conditions in Mexico, in General, Improved

As a result of my investigation of economic conditions in Mexico, it would appear that our sister republic is today in better condition than for some years. Weary of fighting, anxious to settle down to work and food, the native Mexican has learned a valuable lesson in citizenship; he is beginning to realize that he who will not work cannot eat.

Many problems of reconstruction, of finance, of taxation, of international relations, remain to be worked out. But good will is everywhere evident, and the improvement in railroad service and equipment, the building of automobile roads, and the continued operation of such mines as the Cinco Minas, El Favor, Amparo, Casados, and Mesatas, during all the troubled period, indicate a confidence in the future which is probably not misplaced. With the downfall of Russia and consequent inaccessibility to Siberian mineral wealth, it is probable that additional American capital will seek investment in Mexico.

Bureau Testing Low-Grade Silver Ores

Microscopic studies of the low-grade silver ores from the Ontario mine at Park City, Utah, made at the Intermountain Experiment Station of the Bureau of Mines have given information that is expected to be of considerable value in devising means for effecting a satisfactory recovery of the lead and silver in this type of ore, which is typical of a large tonnage of similar material in the Park City district that has been very difficult to treat.

Production of Tin in Burma

"The annual production of tin in the world prior to the war was from 120,000 to 125,000 tons, and as far as can be gathered, the average annual production for the three years ended 1916 was 123,000 tons, of which the British Empire produced 54.5 per cent," says the *Chamber of Commerce Journal* (London) in quoting from an article in the "Bulletin of Indian Industries and Labor." The Federated Malay States furnished the largest contribution both to the empire and to the world's supply, and in 1918 the output amounted to 37,370 tons. For the same year it is estimated that Burma turned out ore containing at least 1,261 tons of metallic tin. The imports of tin into India during 1918 were 1,299 tons.

This shows, says the *Journal*, that Burma is capable of producing sufficient tin to make the Indian Empire self-supporting as regards this metal, provided the ores be smelted in India. Continuing, the *Journal* points out:

> "The potentialities of the Tenasserim division of Lower Burma as a tin-producing region are fairly well known, but much remains to be done in the better equipment and further development of the deposits. Alluvial deposits especially offer attractive possibilities, and the officers of the Geological Survey of India have repeatedly drawn attention to areas which they considered worth the cost of testing. In the more isolated portions of Amherst, Tavoy, and Mergui districts, lying between the regions where deposits of both tin and tungsten ores are worked, the searches of the prospector should be especially directed to the margins of the great granite intrusions for veins carrying cassiterite, and to the valley gravels and sands of the middle and lower courses of the streams which drain them for alluvial deposits of tinstone."

Tin Exports From Federated Malay States

In September, 1921, 2,338 tons of tin was exported from the Federated Malay States, as against 3,051 tons in August, according to data supplied by the Malay States Information Agency to the *London Chamber of Commerce Journal*. The total exports of tin from Jan. 1 to Sept 30, 1921, amounted to 25,050 tons, which is a small decline from exports for the two preceding years, as shown by the following table:

Months	1919 Tons	1920 Tons	1921 Tons
January	3,765	4,265	3,298
February	2,734	3,014	3,111
March	2,819	2,770	2,190
April	2,858	2,606	2,692
May	3,407	2,741	2,884
June	2,877	2,940	2,752
July	3,756	2,824	2,734
August	2,956	2,786	3,051
September	3,161	2,734	2,338
Totals	28,333	26,680	25,050

Lead Mining Active in Swatow District

The Chuling mining works, which is operating a lead mine in Chenping district, recently made its first shipment of lead, according to Consul M. S. Myers at Swatow, China, in *Commerce Reports*. Smelting by native methods is carried on at the mine, the present capacity of the furnaces being three short tons per day. It is planned to double this furnace capacity at an early date. A high-grade soft lead, running between 99.97 and 99.98 per cent pure, is produced. It is shipped in slabs weighing 140 catties (about 187 lb.) each. About 115 short tons has already been exported. A ready market for this product is found in South China.

The Hollinger Mine

Ranks With New Modderfontein and Government Areas Among the World's Leading Gold Producers

BY ALEXANDER GRAY

Written for Engineering and Mining Journal

THOSE INTERESTED in the relative standing of the world's largest gold mine will appreciate a review of the details of the work at the Hollinger in 1921, and a comparison of the status of Canada's premier gold producer with the New Modderfontein and the Government Areas, in the Witwatersrand, which, with the Hollinger, comprise a trio of the three greatest mines of their kind. Each company mills more than a million tons a year. So close is the contest for leadership in output that the final Hollinger figures will be necessary before either of the trio can be awarded the "Medal of Honor, With Palms."

Given immunity from power shortage, Hollinger Consolidated in 1921 may crush sufficiently more than a million tons to exceed the total of 1,083,000 reported by New Modderfontein for the year ended June 30. If that total is passed, the Canadian company will be in the lead as to the tonnage milled. Whether or not it will rank first as to profits from mining and milling operations—apart from the premium upon gold—cannot be determined until the Hollinger annual report is forthcoming. At any rate the working revenue of the Hollinger—including the gold premium—would top the score were the premium upon Canadian gold the same as was realized by the two outstanding Witwatersrand companies. The bonus obtained by New Modderfontein over the standard price for gold in the year ended June 30 was 44.2 per cent, whereas the Hollinger premium in this calendar year may be about a quarter of that figure.

In point of tonnage milled in a year, as between the Hollinger and the New Modderfontein, operating results necessarily are contingent upon the grade of ore treated. The 1920 Hollinger average was $9.93 per ton. The New Modderfontein average for the year ended June 30 was almost the same. Seemingly the New Modderfontein production was about $10,600,000. But the Hollinger 1921 grade hardly will be maintained at the 1920 average; consequently the grand total of its production for this year may not attain to that of New Modderfontein. However, as Hollinger costs are lower than those of New Modderfontein were last year, the indications are that the Hollinger profits will be larger this year than those of its South African compeer in 1920-21.

That being so, with the milling record within reach of Hollinger—if not actually secured—and with the company's current profit, not counting the premium, at the head of the list, the comparative ore-reserve position of the respective companies is of interest. In June, New Modderfontein ore reserves were estimated at 8,884,600 tons of 8.4 dwt., at $76,000,000. Development is proceeding with satisfactory results, the ore extracted being more than replaced for the time being. That part of New Modderfontein area that remains undetermined affords a further speculative factor, no doubt of ample proportions, whereas Hollinger vein structures do not lend themselves so readily to estimates beyond known quantities, however confident may be the management that the upper workings of the mines are far removed from exhaustion.

Not long ago a responsible member of the staff told the Hollinger directorate that if he was given another thousand men the management could be profitably employed for five years in the development and mining of the section above the 425 level; that a further five years with a correspondingly large crew could be devoted to lower levels, and that the 1,250 level would be ready for stoping in a third five-year period. After two years had elapsed, the management, at the end of 1920, admitted there was 3,063,153 tons above the 800 level, of which 1,433,400 tons was above the 425 level, and that estimate set aside all ore of $6 and under.

At the close of the ninth year of crushing, when labor was scarce, it was necessary last year to mine, below the 425 level, only 261,377 tons of the 649,013 tons milled. Assuming that the greater part of the tonnage milled continues to come from the upper levels, the fact that there is nearly as much ore in reserve above the 200 level as is allotted to the section below the 800 level suggests more than need be assumed.

Perhaps a better index to the attitude of the Hollinger directorate and management is their fixed purpose to increase their milling capacity to the extent of a further 2,000 tons per day. New Modderfontein's crushing capacity now is 105,000 tons per month. Latterly, the Hollinger has exceeded this, a stamp duty of as high as seventeen tons a day being a measure of operating efficiency. This became possible by the installation of secondary crushing facilities, rolls, and ball and tube mills, demonstrating that on such ores the use of stamps hereafter can be discontinued.

General Manager Brigham is fully convinced that stage crushing of the newer sort as practiced at other plants in the Ontario North Country will obviate the more expensive installations adopted by the Hollinger and Dome companies. Before Hollinger has increased its milling output, though, more tanks will have to be provided and other metallurgical features augmented. Meanwhile, and of acutely urgent importance, is the matter of an assured supply of hydro-electric power. As it is, costs are high and must be brought down if Ontario gold mines are to operate advantageously.

Unfortunately, an agrarian provincial government fails to recognize the relationship of such mines to the common weal. To crush a million to a million-and-a-half tons annually is an undertaking of magnitude. Adequate power is a prerequisite. Because the mines of the Hollinger company are capable of unprecedented production, and might ignore ordinary factors of costs, comparisons are somewhat disadvantageous for other companies by whom lower costs and cheaper supplies would be welcomed.

At the moment, the power problem is a deterrent to further expansion. Otherwise, Hollinger properties in their upper levels demand aggressive development before deeper operations are extensively undertaken. Approximately half a million tons, worth about $5,000,000, is broken in stopes. Therefore it rests with the government and power companies and organized labor to place the Ontario gold industry upon a firmer footing, a footing that will be a better incentive for the investment of more new capital throughout districts in which the precious metal is widely distributed. Few precious metal mining companies can point to a combined liquid treasury and reserve of broken ore equivalent to 40 per cent of the nominal value of issued capital.

The Santa Barbara 500-Ton Mill for Concentrating Lead Carbonate Ores

Carefully Planned Flow Sheet at the American Smelters Securities Concentrator Provides Coarse Reduction in a Gyratory and Disk Crusher, Grinding in a Rod Mill, and Tabling of Closely Sized Pulp

BY FRED M. HEIDELBERG

Written for *Engineering and Mining Journal*

THE NEW MILLING PLANT of the American Smelters Securities Co. at Santa Barbara, Chihuahua, Mexico, with a daily capacity of 500 metric tons, has just been finished and is now being brought into co-ordinated operation. This plant was built to treat the carbonate ores of the mines in the district, besides several old and weathered mine and mill tailing dumps, and is supposed to embody all the improvements that modern milling practice affords for the treatment of this class of material. Lead carbonate is the principal constituent of value in the material to be treated. Gold and silver occur in small but paying quantities, and copper and zinc are present in minute amounts. The valueless material in the first ore to be treated is estimated to contain 60 per cent silica, 7 per cent lime, 9 per cent iron, and 3 per cent sulphur.

The determination of the flow sheet required much time and study. Representative samples were sent to the company's test laboratory and were subjected to every possible treatment that was considered of any value. A record of each test was systematically kept, and smelter balance sheets were prepared from the results as though that class of product had actually been sent to the smelter.

It was not considered safe to construct a mill from the flow sheet of the test laboratory, for conditions there were more nearly ideal than would obtain in a large mill. Consequently, a large shipment of this same ore was sent to the company's test mill, so that a continuous test of several weeks could be made under as nearly actual operating conditions as possible. The test mill was so arranged that the ore would be treated with the same flow sheet as was found most desirable in the test laboratory. The results of the test mill then gave reasonable assurance that the same results could be obtained in a mill under actual operating conditions, and that the experimental flow sheet could be adopted on a large scale. The final mill flow sheet was then formulated, in which was determined the number of machines required to handle the tonnage to be treated under each operation. This flow sheet is shown in Fig. 1.

Special attention is called to the method of obtaining the tonnages of the fine-grinding department. Here, there is an accumulated return to the rod mills from the screen oversize. To determine the amount of this return, several assumptions were made. First, that all ore be crushed to minus 2 mm. Second, that the

TABLE I. ELEVATOR DATA

	Material						Belts		Buckets (18-In. Apart)				
	Solids in 24 Hours		Water in 24 Hours		Total Material								
Elevators	Metric Tons	Cu.Ft.	Metric Tons	Cu.Ft.	Cu.Ft. in 24 Hours	Cu. In per Min.	Size, In.	Speed per Min., Ft.	No. per Min.	Size, In.	Volume Cu.In. as Listed	Av. Vol. Cu.In. Material Elevated per Bucket	Percentage Av. Volume Material Elevated per Bucket to Volume as Listed
Screen oversize (2)	670	14,740	968	34,074	48,814	58,579	2–14	390	520	12x6x6¼	246	112	45.6
Screen undersize (2)	525	11,550	2,100	73,920	85,470	102,564	2–18	390	520	16x7x7¼	467	197	42.2
Sand tailing (2)	285	6,270	2,321	81,699	87,969	105,563	2–18	390	520	16x7x7¼	467	203	43.0
Slime (2)	180	3,960	720	25,344	29,304	35,165	2–14	390	520	12x6x6¼	246	68	27.7
Sand middling (1)	40	880	120	4,224	5,104	6,125	1–18	390	260	16x7x7¼	467	24	5.1
Concentrate (1)	67	1,072	353	12,426	13,499	16,198	1–18	390	260	16x7x7¼	467	62	13.3

Weight of ore = 100 lb. per cu.ft. = 22 cu.ft. per metric ton.
Weight of water = 62.4 lb. per cu.ft. = 35.2 cu.ft. per metric ton.
Weight of concentrate = 137.5 lb. per cu.ft. = 16.0 cu.ft. per metric ton.

TABLE II. MOTOR LIST

					R.P.M.					
Location	Machines Driven	Total Est. Hp. Req'd.	No. of Motors	Rated Hp.	No Load	Full Load	Pulley	Frame No.	Type	Form
Head of Conveyor No. 1	Conveyor No. 1	8	1	15	900	865	10x6¼	322	KT	B
Crushing plant	No. 5 gyratory crusher, 48-[illegible] [illegible] disk crusher, [illegible] and screening	30 60 10	1	100	720	690	21x9	15	I	K
Fine-ore bins	Conveyor No. 2	15	1	25	720	690	13x9¼	336	KT	B
Fine-crushing floor	Belt feeder and [illegible] 2 trommels 2 Duplex [illegible]	4 4 4	1	15	900	865	10x6¼	322	KT	B
Rod mills	2 5x10 rod mills	180	2	100	600	570	18x17	15	I	M
Upper elevators and screens	8 Cole screens 5 elevators 1 mech. split [illegible]	8 50 15	1	75	720	690	16x17	14		
Table floor	30 Deister tables and [illegible]	24	1	25	720	690	13x9¼	336	KT	B
Lower elevators	5 elevators 10 Deister tables 2 mech. split [illegible] 1 class "C" Duplex [illegible]	30 7 15	1	75	720	690	16x17	14		
Slime tables	Model "D" classifier	3	1	10	900	865	8x5¼	312	KT	B
Pump house	4 centrifugal pumps	20	4	15	900	865	Direct.	322	KT	B
	1 centrifugal pump (return water)	5	1	10	900	865	14x7	312	KT	B
	3 30-ft. Dorr thickeners	6	3	3	1,200		4½x4½	160	KT	B
Incline tram	Incline tram		1	22	900	865		10	L.T.C.	M

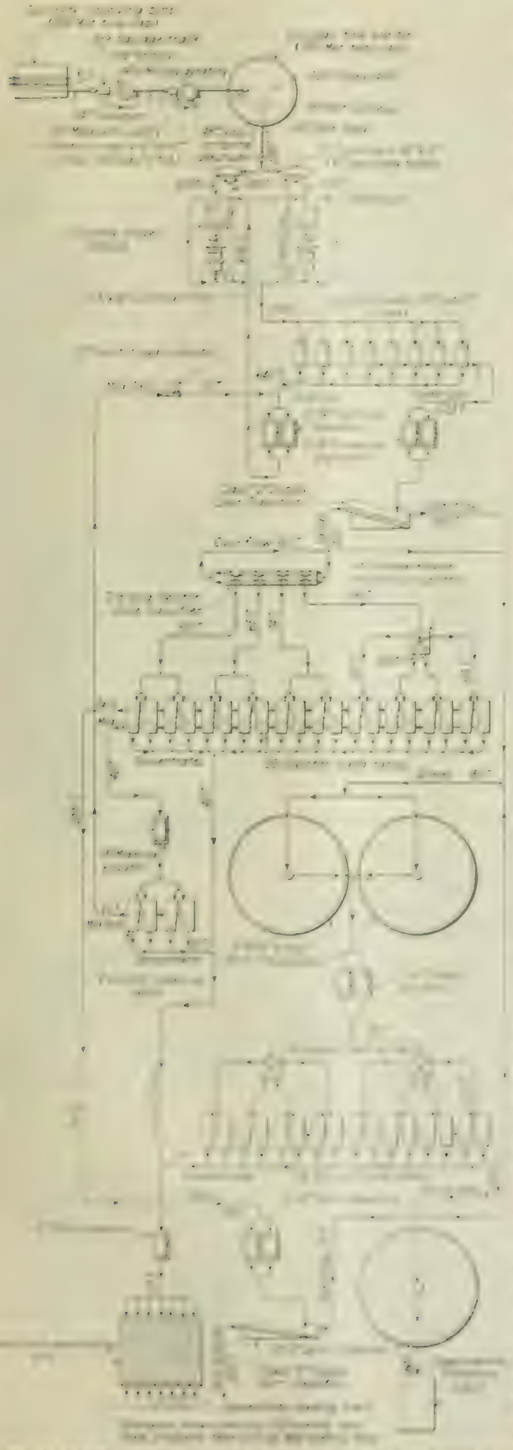


FIG. 1. FLOW SHEET OF THE [illegible] MILL AS BUILT

rod mills crush all feed to 50 per cent minus 2 mm. Third, that the feed to the trommels would be 40 per cent oversize, which would be fed to the rod mill direct, and 60 per cent undersize, which would go to the screens, with an assumed sizing of 25 per cent minus 2 mm. and 75 per cent plus 2 mm. Fig. 2 shows how this was derived by assuming definite returns. It will be seen that instead of the 500 tons' feed to the rod mills that would ordinarily be considered, the actual load of 870 tons accumulates for a 24-hour period. Practical operations can approximate these results or they can be made greater or smaller as conditions dictate.

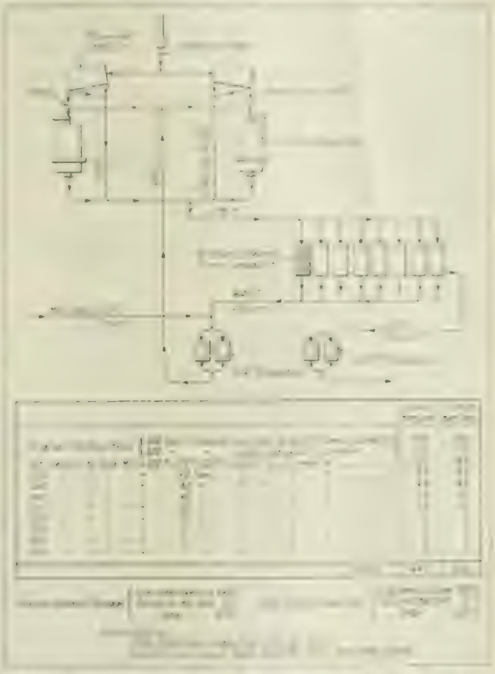


FIG. 2. CALCULATION OF TONNAGES: CRUSHING AND SCREENING DEPARTMENT

The water flow sheet as shown in Fig. 4 was also formulated to give the necessary information for water consumption and also pulp loads. The water added at a machine was assumed on the maximum actually required in ordinary operation. The machines taking the largest quantities of added water are the hydraulic spigot classifiers and the tables. The screen overflow requires the next largest amount of water.

Some of the more important pulp-dilution assumptions are as follows:

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		

The total water added is [illegible] metric tons per 24 hours, or 1,278 gal. per minute, uniform flow. Total water recovered is [illegible] metric tons per 24 hours, or 1,168 gal. per minute, leaving a loss of [illegible] metric tons or 110 gal. per minute. The ratio of tons of water to tons of ore in circulation is [illegible]. The ratio of gallons of water per minute to tons of ore in circulation is 2.55.

An elevator data sheet, as shown in Table I, was formulated from the mill flow sheet and the water flow sheet. The cubical contents of both the ore and the water in the pulp were used in obtaining the capacities of the elevators. The weight of the solids, or ore, was figured at 100 lb. per cubic foot, or 22 cu.ft. per metric ton, and water was figured at 62.4 lb. per cu.ft., or 35.2 cu.ft. per metric ton. Concentrate was figured at 137.5 lb. per cu.ft., or 16 cu.ft. per metric ton.

The motor list had to be prepared ahead of the usual time, because of poor deliveries of that class of electrical material at the time this mill was designed. A tentative sketch of the proposed mill was made, to get the proper grouping of machines to be driven by each motor. Table II shows this motor list as it was prepared; is an excellent reference sheet, giving all the necessary information in an easily obtainable form. The probable horsepower of each machine is recorded, besides all information describing the motor.

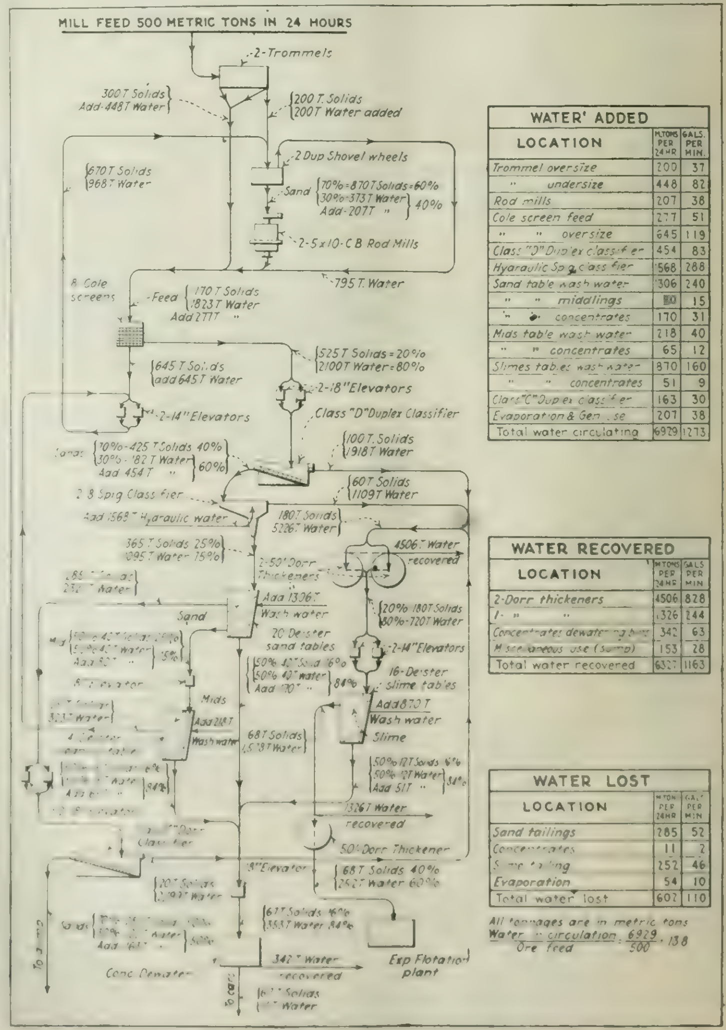
After the preliminary work just described had been done, the results were given to David Cole, a consulting engineer of El Paso, for use in designing the mill. Mr. Cole is a veteran in milling practice, and there are few mills in the Southwest that do not bear some evidence of his influence.

The general layout of the entire plant is shown by Fig. 4, which gives the relative position of all departments entering into the treatment of this ore, besides many dimensions that may be of value to the reader. All dimensions are given in feet and inches, and all elevations in meters. The mill proper is shown in plan by Fig. 5 and in elevation by Fig. 6. These drawings will enable the reader better to understand the more detailed description of the various departments of the mill that follow.

The ore is brought from the mines and dumps in the regulation ten-ton side-dump cars, on a narrow-gage track that leads over the receiving bin. This bin, shown in Fig. 7, is of concrete and is of flat-bottom construction, with inside dimensions 17 ft. wide, 13 ft. high, and 60 ft. long. The wall is a tapering reinforced concrete slab 4-in. thick at the top and 9 in. at the bottom. This slab is supported every 15 ft. by reinforced beams 15 x 22 in., with a tiebeam across the top which is of sufficient strength to carry the ore trains. Parts subjected to wear will be provided with a timber protection. Eight openings in the bottom of the bin feed the ore into a traveling hopper which delivers it on to a 24-in. belt conveyor, the head end of which discharges the ore into the coarse-crushing plant.

The coarse-crushing plant consists of a building 77 ft. long by 30 ft. wide, in which are the No. 5 McCully gyratory crusher and the 48-in. Symons horizontal disk fine-reduction crusher. The basement contains the crusher discharges and the drives. The operating floor is proportioned to provide for the repair of the crushers. Trolley beams and chain blocks over the crushers are provided to facilitate the moving of heavy parts.

The 24-in. conveyor from the receiving bins feeds the ore on a standard bar grizzly, set for 1½-in. product.



WATER ADDED

LOCATION	M. TONS PER 24 HR	GALS. PER MIN.
Trommel oversize	200	37
" undersize	448	82
Rod mills	207	38
Cole screen feed	277	51
" " oversize	645	119
Class "D" Duplex classifier	454	83
Hydraulic Spig classifier	1568	288
Sand table wash water	1306	240
" " middlings	80	15
" " concentrates	170	31
Mids table wash water	218	40
" " concentrates	65	12
Slimes tables wash water	870	160
" " concentrates	51	9
Class "C" Duplex classifier	163	30
Evaporation & Gen. use	207	38
Total water circulating	6929	1273

WATER RECOVERED

LOCATION	M. TONS PER 24 HR	GALS PER MIN
2-Dorr thickeners	4506	828
1- " "	1326	244
Concentrates dewatering bins	342	63
Miscellaneous use (sump)	153	28
Total water recovered	6327	1163

WATER LOST

LOCATION	M. TON PER 24 HR	GALS PER MIN
Sand tailings	285	52
Concentrates	11	2
Slime tailing	252	46
Evaporation	54	10
Total water lost	602	110

All tonnages are in metric tons

$$\frac{\text{Water in circulation}}{\text{Ore feed}} = \frac{6929}{500} = 13.8$$

FIG. 3. WATER FLOW SHEET AND SUMMARY

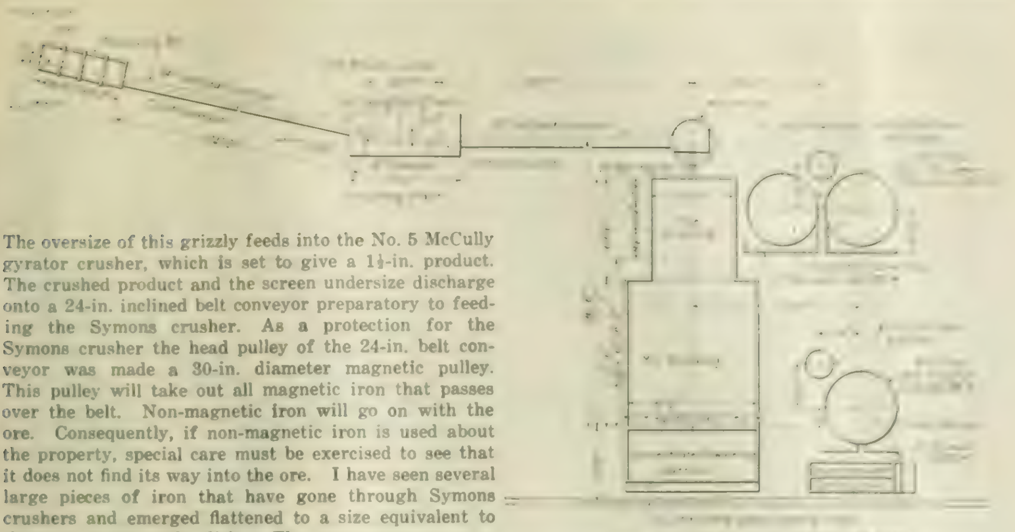


FIG. 4. GENERAL LAYOUT OF MILL

The oversize of this grizzly feeds into the No. 5 McCully gyrator crusher, which is set to give a 1½-in. product. The crushed product and the screen undersize discharge onto a 24-in. inclined belt conveyor preparatory to feeding the Symons crusher. As a protection for the Symons crusher the head pulley of the 24-in. belt conveyor was made a 30-in. diameter magnetic pulley. This pulley will take out all magnetic iron that passes over the belt. Non-magnetic iron will go on with the ore. Consequently, if non-magnetic iron is used about the property, special care must be exercised to see that it does not find its way into the ore. I have seen several large pieces of iron that have gone through Symons crushers and emerged flattened to a size equivalent to the space between the disks. The unnecessary wear on the disks and the probable damage to the bearings are sufficient reasons for taking precautions.

The plate screen takes its feed from the 30-in. magnetic pulley. This screen is nothing more than a manganese steel plate, full of 1⅜-in. holes. When inclined at 40 deg. this plate will give an undersize of minus ¾ in. The oversize from this screen feeds the 48-in. Symons crusher, the disks of which will be set to give a product of minus ½ in. if possible. The screen undersize and the crusher discharge fall on an 18-in. inclined belt conveyor which delivers the product to the mill bin.

REDWOOD TANK USED FOR MILL BIN

The mill bin is a departure from the ordinary bin construction, in that it is a redwood tank, 30 ft. in diameter by 24 ft. high, and is lined with timber to take the wear of the ore. On the bottom of this tank is a hopper with a gate through which the flow of ore is regulated to the belt feeder by means of a hand wheel on the hopper. The belt feeder is a short inclined 24-in. belt conveyor that discharges on to a hog-back splitter, one-half of the ore going to each of two trommels.

The trommels are of the revolving-screen type, 48 in. in diameter, and 6 ft. long. The screen is a plate with ½-in. punched holes, which will give a product of minus ½ in. The undersize goes to the Cole screens to be sized while the oversize goes into the duplex shovel wheel.

The duplex shovel wheel acts as a dewaterer and a chip screen. The construction is simple and inexpensive. If necessary it can be made by putting paddles on an ordinary pulley and placing it in a spitzkasten. In this particular operation the wheel was a special design of cast iron 30 in. diameter by 8 in. wide, with brackets to take the paddles, which were of ⅜-in. plate by 10 in. wide. The spitzkasten was built of wood. Fig. 8 shows the general construction and detail of the shovel wheel. The overflow goes to the Cole screens, so that any slime may be saved, and the sand is fed direct to the rod mill.

The Cole-Bergman rod mill is 5 ft. in diameter by 10 ft. long. Although this mill is of a new design and few data as to its performance are at hand, Mr. Cole gave every assurance that a cheaper power cost could be obtained with this machine than with any other. This mill is to turn at 19.8 r.p.m., and is driven by a 100-hp. motor with a Lennox drive, which allows the motor to be placed within 5 ft. of the pulley on the rod-mill pinion shaft. The mill is to be operated under such conditions that it will grind to 50 per cent minus 2 mm., unless conditions warrant different results. It may be of interest to state that plain liners cannot be used in a rod mill, for the load will oscillate back and forth and wear out the liners in a few days. This actually happened when this mill first was started. A new design of liner, as shown by Fig. 9, with large offsets that would keep the load from oscillating, was then put in, and the trouble stopped.

The 2-mm. screening system consists of eight Cole oscillating screens. These screens are of low first cost, easily constructed and repaired, and are good screens when running wet, as the water is being constantly thrown against the bottom of the wire cloth, thus aiding in getting the particles through the mesh. The feed to these screens consists of the entire output of the rod mills and the trommel undersize. The undersize from these screens is elevated by two 18-in. belt elevators to a Class "D" Dorr classifier preparatory to tabling. The oversize is elevated by two 14-in. belt elevators and returned to the shovel wheels to be dewatered and ground further.

It is to be noted in Fig. 2 that of the trommel undersize of 300 tons, 225 are plus 2 mm. If this condition is approximated it will probably be better to screen the trommel undersize to minus 2 mm., and pass the plus 2-mm. product directly into the shovel wheel, or to replace the trommels entirely with 2-mm. screens and pass all the oversize into the shovel wheels. This will eliminate the elevating of 225 tons a day a distance of about 50 ft. by the two 14-in. elevators, will reduce the wear on the bucket system, and also reduce the amount of water necessary to make this coarse material flow.

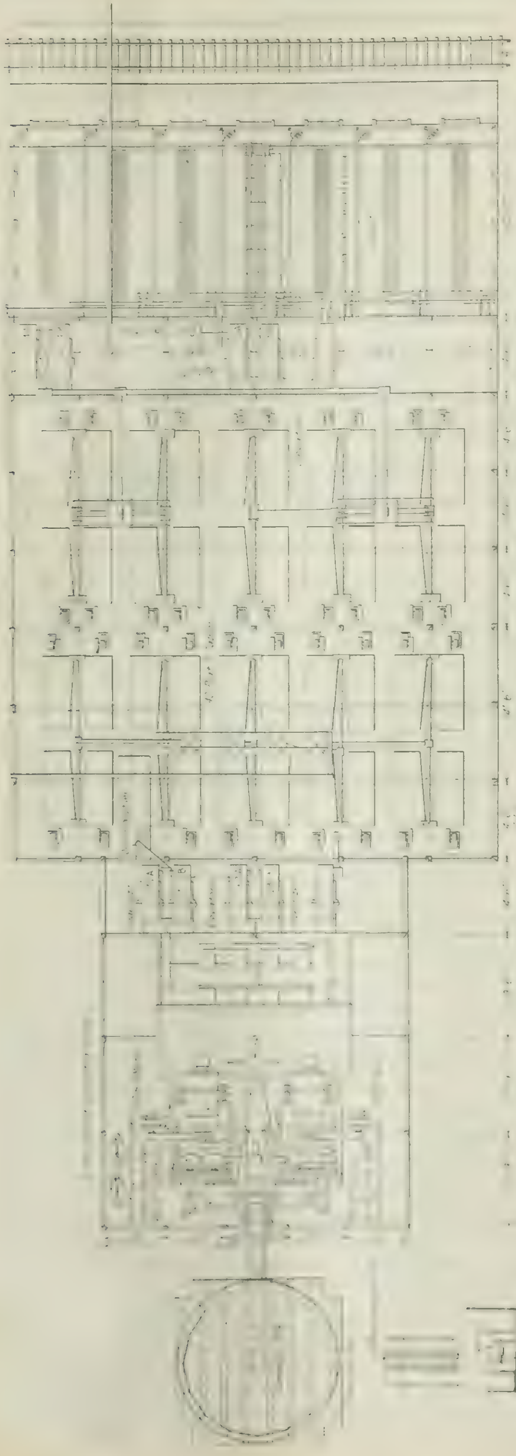


FIG. [illegible]. PLAN SHOWING GENERAL ARRANGEMENT, CARBONATE MILL, SANTA BARBARA UNIT, AMERICAN SMELTERS SECURITIES CO.

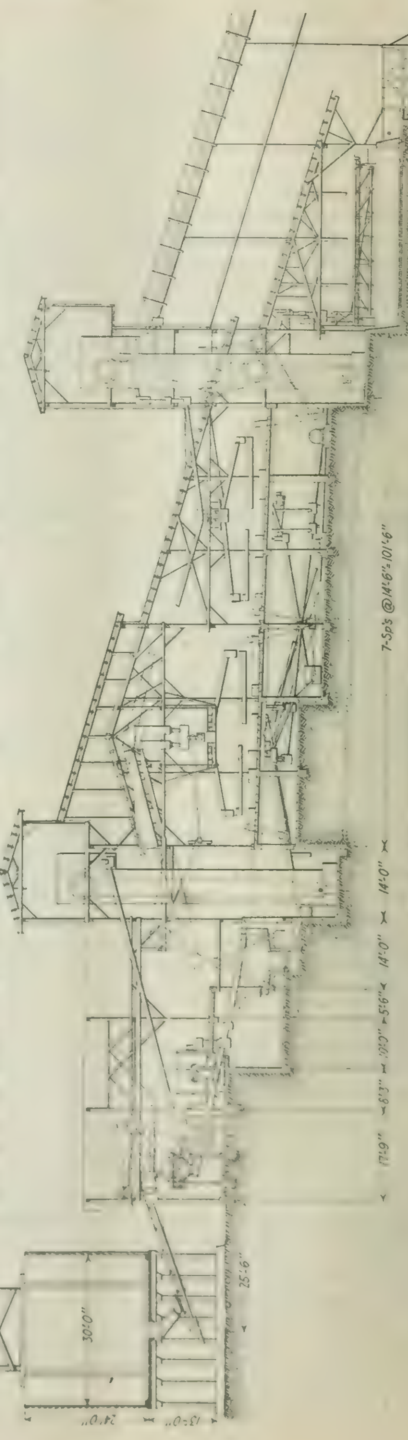


FIG. 6. SIDE ELEVATION OF CARBONATE MILL

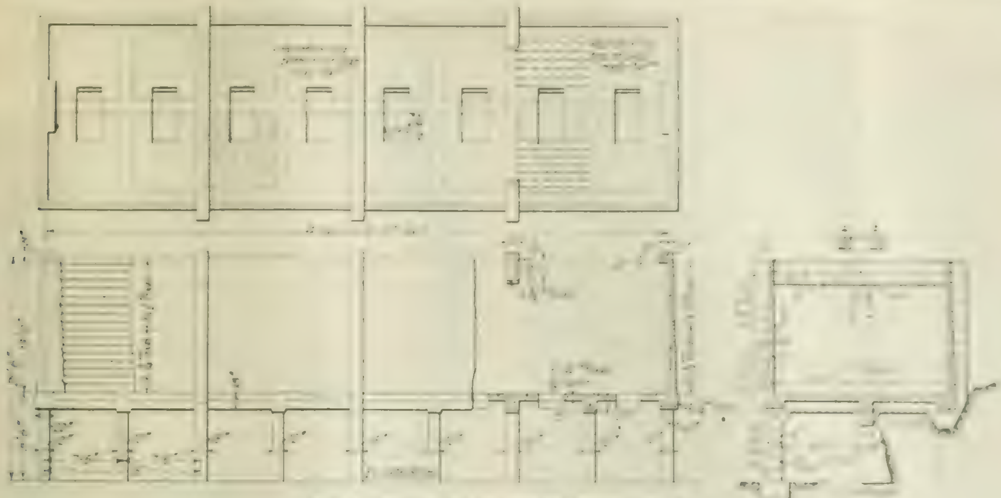


FIG. 7. DESIGN OF CONCRETE RECEIVING BIN

The classifying system for preparing the pulp consists of one Model "D" Dorr classifier and two launder classifiers each containing eight Deister hydraulic cone classifiers. The function of the Dorr classifier is to remove the slime from the pulp. The exact size of classification will be determined during operation. The sand from the Dorr classifier is fed into the launders to be sized by the hydraulic cone classifiers. About four sizings will be made. This was considered necessary, because experience in tabling has shown that the separation is better when the pulp fed to a table has narrow size limits. The overflow from the Dorr classifier and the launder classifiers is conducted to two 50-ft Dorr thickeners to be thickened preparatory to treatment on the slime tables.

The tabling system is the only means of separation originally intended for this mill. Three classes of material are to be treated by the tables—viz., sand, middling (in size), and slime. The Deister Plat-O table was chosen because the same table could be adapted to the treatment of these three classes of feed. It was therefore possible to simplify the scheme, besides reducing the expense of repair parts that would be necessary were several kinds of tables used. Right-and-left-hand tables were used to give a better grouping for a minimum space, and better operating conditions could be secured because of the reduction in the number of operating aisles.

The sand tables, twenty in number, receive their feed from the sized pulp from the classifier launder. The first sizing, representing the large particles, is fed to a four-way mechanical splitter, each split supplying material to a pair of tables. Thus eight tables are supplied with the first sizing. The second, third, and fourth sizings are each fed to a group of four tables by means of two half splits. There are three products from the sand tables: concentrate, middling, and sand tailing. The tailing is elevated by two 18-in. belt elevators to a Model "C" Dorr classifier, the function of which is to dewater the tailing, besides reclaiming any slime that may be present. The classifier overflow goes to the two 50-ft. Dorr thickeners, and the sand is taken to a storage dump for probable future treatment. The middling from the tables is returned to the rod mills to be reground, after it has been put over four middling tables, where any valuable constituents are removed.

The slime tables, sixteen in number, treat the thickened product from the two 50-ft. classifier-overflow Dorr thickeners. This thickened pulp is laundered to two 14-in. belt elevators that elevate it to a distributing launder. The pulp is halved to two four-way mechanical splitters, each cut of the splitter supplying a pair of tables. There are two products from these tables, concentrate and slime tailing. The tailing is to be thickened in a 50-ft. Dorr thickener, from which it will eventually be taken to be treated in an experimental flotation plant.

CONCRETE FILTER TANKS DEWATER THE CONCENTRATE

The concentrate dewatering system is worthy of note, as it is a departure from usual practice. It is situated at the lower end of the mill and consists of seven con-

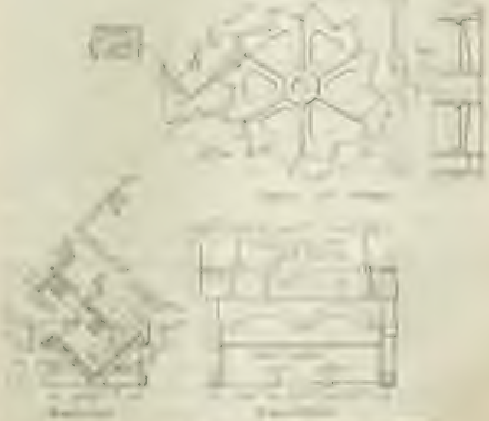


FIG. 8. [illegible]

crete tanks, approximately 4 ft. 6 in. high, 12 ft. wide, and 35 ft. long. A steel door is provided in one end of each tank to allow concentrate to be taken out with wheelbarrows. The bottom is provided with a steel grating 3 ft. 2 in. wide by 28 ft. 2 in. long, upon which is placed coco filter matting for drainage. A filter is also provided in one corner of each tank to drain the water vertically. Outside these tanks is a concrete platform, level with the bottom of the tanks and even with the floor of railway cars on the loading track, which allows the concentrate to be wheeled directly into the cars.

The concentrates from the sand, middling and slime tables are all collected onto a shaking launder delivering to a short 18-in. belt elevator which elevates this material sufficiently to discharge it to a traveling launder. This distributes the concentrate over the seven tanks. The launder from the elevator extends over one end of the tanks, and at seven different points there are tongues to divert the concentrate from the launder to 4-in. pipes. These discharge into the traveling launder, so that any tank may be filled by setting the diverting tongue in the main launder to feed into it. The traveling launder is provided with six pipe discharges, so as to give an even distribution in the tank and not allow the concentrate to pile up in one spot. The end of this launder is open, making it possible for the concentrate to be deposited near the end of the tank.

The construction of the traveling feature of this launder is simple. The launder is supported on a pair of trusses, which are carried by a pair of crane wheels at each end. These wheels travel on 16-lb. rails supported on 6 x 8-in. beams spaced 29 ft. 8 in. centers. A crank and gear arrangement at one end provides the means for moving the traveling launder from one tank to another.

SUPPORT FOR SHAKING LAUNDER OF NOVEL DESIGN

The shaking launder, into which all concentrates gather, is a somewhat novel feature developed by experience. Fig. 12 shows the support of this launder as designed by Mr. Cole. A strap about the launder is bolted to a 1 x 8-in. maple board, which is reduced in cross-section both in width and breadth near the middle. This gives a flexible support for the launder and eliminates the endless trouble experienced in other methods of supporting shaking launders. The shaking is obtained with a head motion similar to table head motions, except that it must be very much heavier if the launder is of any length. A shaking launder is used where sufficient fall cannot be had to use an ordinary launder. In this particular operation the slope is $\frac{3}{4}$ in. to the foot.

The elevator details may be worthy of note. The same general specifications were used in all the elevators, only the belt and buckets varying in size. The boot is of concrete and is provided with a 6-in. pipe for washing when necessary. The corners of the housing are made of 2 x 12's, to which are nailed the tongue-and-groove siding. The inside dimensions of the housing are 2 ft. 8 in. wide and 6 ft. 7 in. broad inside the 2 x 12's at corners. The discharge box is 3 ft. 2 in. wide and extends 6 ft. below the center of the head pulley. The outlet is 1 ft. 9 in. above the bottom of the box. This box is made unusually large, so that all wear may be taken by the contained pulp. A pulp drain shed is provided over both shafts where they go through the housing, to keep the shafts clear of water and sand. All head pulleys are 48 in. in diameter, $\frac{5}{16}$ in. crown, with a 3-in. flat space on face on center of pulley, and are keyed to a $4\frac{15}{16}$-in. x 7-ft. 2-in. shaft by two $1\frac{1}{4}$ x $\frac{3}{4}$-in. keys placed 120 deg. apart. Bearings were provided on 10 x 12's spaced 4 ft. 6 in. centers. All tail pulleys are 36 in. in diameter, with a $\frac{3}{8}$-in. crown, and flat space of 3 in. on center of face. These pulleys are supported on a $3\frac{15}{16}$ x 5-ft. shaft with bearings at 3 ft. $11\frac{1}{2}$-in. centers. A 60 x 10-in. pulley on the head pulley shaft provides for driving the elevators without gear reduction.

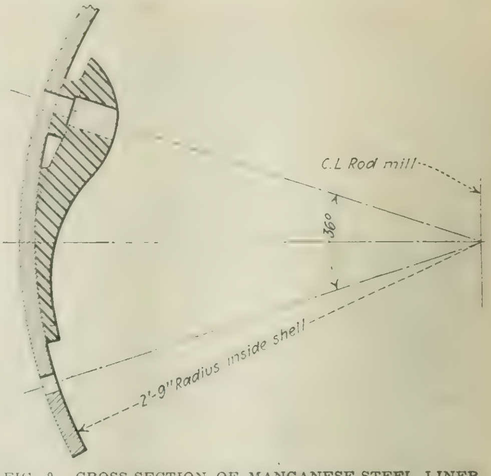


FIG. 9. CROSS-SECTION OF MANGANESE-STEEL LINER FOR 5 x 10-FT. COLE-BERGMAN ROD MILL

The thickening and water-reclaiming system consists of the two classifier-overflow Dorr thickeners, the slime-tailing Dorr thickener, and the concentrate-water settling tanks. By consulting the water flow sheet, Fig. 3, it is seen that the pulp to the classifier-overflow thickeners in twenty-four hours is estimated at 180 metric tons of solids and 5,226 metric tons of water, and that a recovery of 4,506 tons of water will be obtained. If each tank takes half the pulp, the speed of rise in the tank of recovered water will be 55 cu.ft. per minute, which is equivalent to a velocity of about $\frac{11}{64}$ in. per minute, or, if all pulp goes to one tank, the velocity would be $\frac{11}{32}$ in. per minute, which is the maximum.

For the Dorr thickener handling the slime tailing, the pulp in twenty-four hours amounts to 168 tons of solids and 1.578 metric tons of water, of which 1,326 tons is recovered. The recovered water in this operation will have a speed of rise of 32.4 cu.ft. per minute, or a velocity of less than $\frac{1}{8}$ in. per minute.

All the thickeners are of redwood, with outside diameter of 50 ft. and staves of 10 ft. They are supported about 3 ft. from the ground on heavy timbers, to allow for drying and repairs. The mechanisms were furnished by the Dorr company and are driven by a 3-hp. motor with a speed of 1,200 r.p.m. A reduction is obtained sufficient to give the blades in the tank a speed of one revolution in about twelve minutes. The mechanism is supported over the tanks on trusses of 8 x 10's. The overflow from each set of thickeners is conducted to a 20-ft. diameter clear-water tank, from which the water is pumped back into the water system.

The duplex settling tanks for the concentrate are of concrete, each about 4 ft. deep, 10 ft. wide, and 60 ft. long. At the overflow end the outside walls extend to make a tank 4 ft. x 4 ft. x 20 ft. 6 in. long. Adjacent to this is the pump house, in which are centrifugal pumps for returning the water to the water system. The pulp from the concentrate dewatering system is conducted to these settling tanks, first running into one and when that is full the ladened water is turned into the other.

Ample Provision Made for Water at Constant Pressure

The water system need only be outlined. The water flow sheet shows that 6,929 metric tons have to be maintained in circulation for the twenty-four hours, and that 6,327 tons are reclaimed and 602 tons lost. Approximately all the water recovered comes from the classifier-overflow thickeners, the slime-tailing thickener, and the concentrate-water settling tanks. A large storage tank, built of rubble masonry, has been constructed on the hillside to keep the necessary amount of water in reserve at a proper pressure. Make-up water is supplied by the mine pumps. Two lines lead to the mill, and all mill pumps discharge into one or the other of these lines. All fire connections are directly on these lines. The mill supply water, however, is kept at a constant pressure by means of two separate pressure tanks placed in the highest part of the mill. They are connected to the supply lines and kept full by means of float valves. All the water for milling operations is drawn from these tanks, thus insuring ideal conditions for constant water feeds.

The mill building may be described as a wooden superstructure supported on a concrete substructure.

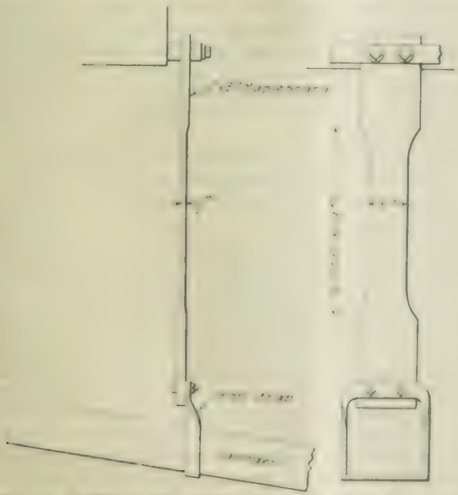


FIG. [illegible]. METHOD OF SUPPORTING SHAKING LAUNDER

The table floor is of reinforced concrete with slabs 5½ in. thick, reinforced both ways to take the load. The beams supporting these slabs are 12 x 18 in. Slab reinforcing is ½-in. and column reinforcing ¾-in. square bars. The columns supporting this floor are 12 in. square. The basement under the floor was so made as to provide for the requirements of the launders and drives. All floors on the ground are of concrete and slope ½ in. to the foot, so that they may be self-draining. A tunnel through the center of the mill connecting the two elevator pits provides for the proper drainage of the entire mill.

The superstructure is supported on 10 x 10-in. columns or posts that are surmounted by 10 x 10-in. struts. The trusses over the table floor are of 10 x 10's and cover a span of 43 ft. 6 in. Corrugated galvanized iron is used to cover the building throughout. Rubberglass sections were used instead of glazed windows.

Mountain of Sulphur in Pacific

Almost contemporaneously with the issue of the mandate of administration for the islands of Nauru and Ocean, famous for their extensive and rich deposits of phosphate of lime, was the rediscovery of the great sulphur mountain of Vanua Lava in the Banks group of the New Hebrides, according to an article in *Times Trade Supplement*. The special agent necessary to change phosphate rock to a soluble state is sulphur. Superphosphate is the powdered and soluble article sold to farmers as a fertilizer.

The mountain of Vanua Lava is one vast mass of sulphur. The height of the mountain, which forms an island in itself, is 1,600 ft., the area of the island being about 100 square miles.

Vanua Lava, as part of the Banks group, is included in the administration of the Condominium government of the New Hebrides. The Banks group lies between the fifteenth and the twentieth degrees of south latitude and is situated about 900 miles from the Queensland coast.

Twenty-five years ago a French company began operations on the mountain, employing competent engineers. The company built a long, substantial, coral-concrete wharf and a storehouse in a small bay at the foot of the mountain and constructed an aërial railway up the mountainside for nearly 900 ft. Hundreds of natives were employed in digging out the sulphur and hundreds more in carrying 50-lb. bags of sulphur to the railway terminus, whence carriers were sent rapidly to the storehouse on the bay. The first shipment of sulphur sent to France paid handsomely, but the company suddenly left the field, giving as a reason that malarial fever of a malignant type made it impossible for white men to live on the mountain island.

It was eventually stated, however, that the company had learned that the administration of the New Hebrides was not in a position to guarantee the company a monopoly, a prior right from an Australian engineer, the original discoverer of the commercial possibilities of the island, being in existence. Today this claim holds good, for Condominium has [illegible] commercial activities on the island. A British-Australian company is now endeavoring to begin operations and has opened up negotiations with the Condominium government.

Maine Molybdenum Tested

A study of the problem of milling Maine molybdenum has been completed at the Mississippi Valley Station of the U. S. Bureau of Mines. The "low-grade" ores were found to contain too little molybdenite to be of any commercial importance or worthy of further mill testing. Mill tests on the "high-grade" ores analyzing 1.3 per cent molybdenite showed a recovery of 90 per cent of the molybdenite content, a concentrate being made which analyzed [illegible] per cent [illegible]

The Permian Revolution in North America

An Extremely Important Geological Event Which Produced Immense Climatic, Geographic, and Geologic Changes in North America and the Study Of Which Gives a Wide Perspective on Ore Deposition in the Southwest

BY J. R. FINLAY

Written for *Engineering and Mining Journal*

THAT THE FOLDING of the Appalachian range in the East occurred in Permian times is a commonplace of geological literature, but thus far I have found practically no reference to parallel events in the West. Of course it is well understood that an important change took place about that time all over the continent; but little prominence is given to the fact.

In the summer of 1919 I found fossils of Pennsylvanian age in Holcomb Valley, a part of the San Bernardino plateau of southern California, in a region of widespread metamorphism. No one apparently had dared to assume that the crystalline marbles and gneisses of the coast region were Paleozoic. Patches of marble and large areas of highly crystalline schist, invaded by granite and pegmatite, twisted and folded, looking in every respect like the traditional "Fundamental Complex," occur all along the coast from San Francisco southeastward through the San Bernardino and San Jacinto mountains for a known length of 500 miles. The discovery of Pennsylvania fossils showed at once that here was the localization of a post-Paleozoic dynamic event of the very first order.

SOUTHERN CALIFORNIA BATHOLITH FORMED IN THE PERMIAN

It is well known that the Sierra Nevada batholith, to the northward of this region, and seeming to merge or have some connection with it, emerged at the end of Jurassic times. It is a question whether the southern California batholith is an extension of the same occurrence; the final determination must be left to future, and probably extensive, investigation. All I am warranted in asserting with confidence is that the southern area of metamorphism originated between the close of the Pennsylvanian and the close of the Jurassic; but it is only reasonable to give the bases for the impression, which seems to have an increasing support of probability, that the principal mountain building and the eruption of the great southern California batholith occurred about Permian times, as a part of the world-wide revolution of that age; and that the Sierra Nevada batholith was a later and somewhat divergent one, perhaps a recrudescence of the same regional causes.

One strong reason for supposing that the southern California batholith and the resultant range was formed about Permian times is that some great continental land barrier is required, apparently, to explain the climatic changes of that period. Desert conditions prevailed during, or at the end of, the Permian, all the way from the Grand Canyon to eastern Kansas. This is proved by positive chemical, stratigraphic, and paleontological evidence. Not improbably evidence might be found over a much wider area; or such evidence may have been destroyed in other regions by erosion or covered up by later sedimentation. Still the evidence of desert conditions on so large an area that it may reasonably be called a good fraction of the continent is undisputed and indisputable. Thus there is to be attributed to the later Permian a climatic situation very much like that of the present day. The corollary is that there must have been mountain barriers similar to those of the present.

ENORMOUS VOLUME OF WESTERN SEDIMENTS A GREAT FEATURE OF THE PALEOZOIC

But the mountain barriers of the Permian must have been formed by the upheaval of a tract that had remained undisturbed as a seat of sedimentation, prevailingly marine, without any considerable outbreak of volcanic activity, without enough tilting of the strata or enough erosion to produce any noticeable unconformity in all the long ages of Paleozoic time. These barriers emerged through a field of sedimentation that is certainly one of the greatest on the continent, and one of the most persistent; for in it from 30,000 to 40,000 ft. of Paleozoic strata have been measured in various places by geologists. It was a continental marginal field that had been established firmly by the great world revolution that intervened between the Algonkian and Paleozoic cycles.

No one can give these facts attention—the patent facts of enormous volume of sediment in the belt running from Los Angeles northward through Inyo County, Cal., into central and eastern Nevada, western Utah, and thence northward,—without being convinced that it is a big thing: one of the great geographic features of Paleozoic times.

The land barrier, which the investigator may presume to have interrupted this trough, cut across it at an angle, producing a new, or modified, configuration for the continent.

Whatever supersedes a big thing must be a big thing itself. Let us bear in mind that we are discussing the Permian revolution, well known to have been one of the capital events of world history; which brought to a close the great Paleozoic cycle and produced immense climatic, geographic, and geologic changes. In North America wide areas that had been sea basins for interminable ages became continental areas. Continents are not formed casually; they have certain characteristics, one of which is the existence of a dominant mountain axis. It is reasonable, therefore, to search for a dominant axis of the Permian continent. I think it is found in southern California and that further investigation will prove it to be a major feature of the succeeding history of the western part of the continent, and perhaps will give further knowledge of both general and economic geology.

It is clear that extensive belts or zones of deposition, particularly of clastic sediments, must border on correspondingly great areas of erosion. Elevated regions, and especially mountain ridges, are the loci of many times more active erosion than low-lying plains.

An ancient pressure ridge or batholithic zone of the first rank seldom contains magmatic orebodies of great economic importance. The crystalline core has generally been deeply eroded or even base-leveled. Ore deposits belong to a zone midway between the level of crystallization and the surface. The thorough metamorphism might be called a process of mineral integration and stabilization under great heat and pressure; ore deposition a process of mineral differentiation and segregation which is brought about by the escape and cooling of vapors or waters forced out by the crystallization that goes on below. If, therefore, erosion has reached the level of crystallization it will have swept away the zone of mineralization. Thus we should expect what we actually find—very little ore along the main axes, but a great deal along their extreme flanks and in outliers from them, in subsidiary batholithic intrusions.

It is germane to explain how this line of inquiry enters the field of economic geology. The best illustration is my own experience, although I have rarely claimed to be a geologist at all: it has enabled me to grasp the generalizations of the "magmatic" geologists. A steaming vent is one thing; its relation to earth movements, to the rock masses that it penetrates, to the formation of ore-deposits in extensive zones in which individual occurrences are apparently disconnected but really connected, is a much more important thing. I have found, for one instance, that the study of a nearly barren, or economically inconsiderable, area of batholithic intrusion like that of southern California (which I have called the Old Mohave Range) has been very enlightening by the comparison with important ore occurrences in other fields. For example, it enables me to find a logical economic starting point in Lindgren's generalizations on the ore deposits of New Mexico, where a group of intrusions of early Tertiary age follows a zone of mountain building through the whole length of the state; to perceive that geological processes have left this group in a very different stage than that of the metamorphic zone of the Permian; that only the superficial part has been exposed, and that it therefore contains possibilities for future discoveries which no longer exist in the deeply eroded parts of the older field.

Moreover, it is enlightening to perceive that the same influences have operated in the whole Cordilleran system, very likely from Alaska to Patagonia, making a practical tie between the ores of Butte and those of Leadville and Clifton, in that they are common offspring of the events which brought the Mesozoic era to a close, just as the events of Permian time brought the Paleozoic era to a close. Twenty years ago I took such statements with a grain of salt, relegating them to the vague theorizings of academic professors: "Ore in sight," "the estimation of ore deposits," "the cost of mining," were the practical things. I have been in situations where to mention a fault was to incur the suspicion of being a dangerous theorist—an impractical high-brow.

THE IMPORTANCE OF HAVING A PERSPECTIVE

Obviously, the scope of one's observations must run with the scope of one's activities. The mine foreman has little to do with the changes that go on in a continent; he is more interested in the changes shown by the round of holes. Within the sphere of a mine he is a better observer than a geologist, with longer and more anxious training. It is only when some phenomenon, foreign to his routine, invades his mine that he must give place to someone of wider observation. If one's business is to get out pay ore, his geological interest is reasonably confined to the difference between the foot wall and the hanging wall; what part of a vein is pay and what not pay.

When one faces a larger economic problem—let us say, for instance, the consolidation of all the mines of a district for the purpose of working that district as a whole—he enters upon a different stage; the vein to which he has heretofore given exclusive attention is merely a sample; its peculiarities become trivialities; he begins to look for the signs, the limitations and the origin of *all* the veins. The crack in the rock which had been his economic field now becomes a mere crack in the rock; he is astounded at the multiplicity and variety of cracks; he sees that all deposits are not in cracks; he begins to look for a general cause. He finds it in a batholithic intrusion and is very glad to find it. That sort of talk no longer causes the suppression of snickers; it is practical.

There comes to many a man a still wider stage, in which one has to do with the resources of a state or of a nation. He now deals with the development of districts, just as before he dealt with that of deposits. He now brings into play a new mental element; the historical element; general tendencies, advance or decline. If he cannot meet the historical point of view in this field he must remain a tyro and a muddler. The historical point of view is the observation of tendencies and of averages, of progressive and cumulative change; it is the mainspring of the science of geology, of all the sciences that deal with evolution; it is essential to the economist, to the management of great business, just as it is to the scientist or statesman.

It seems that all lines of effort, however specialized, have a final meeting place in the field of human interest. One may assert positively that the economic geologist who pursues his subject successfully will reach a stage where he finds general geology more practical than specialized geology. It is easy to define that stage: it is where it becomes important to see the proportion of things.

Bureau Studying Lean Iron Ores

The work of the Bureau of Mines on iron ores is directed chiefly toward devising means for utilizing extensive deposits of low-grade ores than cannot be smelted profitably by present methods. The North Central mining experiment station of the Bureau of Mines, at Minneapolis, Minn., has continued to co-operate with the state mining experiment station in an investigation of the reserves of low-grade ore in the Lake Superior district, and in milling tests of samples collected in the course of the field work. This work has also included experimental tests of low-grade iron ores in the southern districts. With the establishment of the mining experiment station at Birmingham, Ala., more extensive work has been made possible, and a comprehensive survey of the iron and steel industry of the Birmingham district has begun. The main object sought is to develop means of beneficiating the low-grade highly siliceous ores that occur in large quantities in that district. At Minneapolis the work has been more closely related to utilizing low-grade manganiferous iron ores of the Lake Superior district, particularly as regards the study of blast-furnace practice and the operation of the experimental blast furnace at that station.

Mining Engineers of Note

Hugh F. Marriott

AMONG THE ENGINEERS who have played an important part in the development of technical practice at the gold mines on the Rand, in South Africa, Hugh F. Marriott occupies a prominent position, as the fact of his election to the presidency of the Institution of Mining and Metallurgy in 1918 indicates. Mr. Marriott was born in London in 1869. He was educated at Bishop's Stortford Grammar School, famous for its association with Cecil Rhodes' early days. On leaving school he became a student at the Royal School of Mines, and following his graduation he went to Spain, where he worked in silver, lead, and copper mines. In 1891 he went to the Witwatersrand, South Africa, as assistant to Hennen Jennings. The Rand at this time was at the beginning of its fame, and Mr. Marriott was one of the first engineers to demonstrate the possibilities of deep-level mining. He brought out an invention for surveying boreholes by means of which it was found possible to ascertain the actual depths of reef deposits which previously had been considered to lie too deep for exploitation. During his fourteen years' stay in South Africa, Mr. Marriott was connected with mining work in all parts of that country. In 1905 he came to London as consulting engineer to Wernher, Beit & Co., and now acts in a similar capacity to their successors, the Central Mining & Investment Corporation, of London. This corporation, in conjunction with Rand Mines, Ltd., is responsible for the general and technical administration of a group of mines on the Witwatersrand which last year crushed 24,000,000 tons of rock, or 47 per cent of the total for the whole gold field.

HUGH F. MARRIOTT

Owing to his intimate knowledge of South African conditions, Mr. Marriott has been able to introduce on the Rand many improvements in metallurgy, such as the use of Nissen stamps in crushing, and the employment of Butters filters for the treatment of slimes. He also was responsible for the adoption there of the principles of English colliery practice which have resulted in the sinking of shafts with greatly increased hoisting capacity and speed, and enabled the centralization of underground transport throughout the mines of the Rand. In the evolution of shaft sinking, Mr. Marriott has always been a strong advocate of the circular shaft as superior to the rectangular type for deep-level mines. He has also made a persistent fight against the unsatisfactory system of calculating mine operation results on the per-ton-milled basis. As a remedy he brought forward the fathomage system, which is generally employed there in underground work. Mr. Marriott has accomplished much pioneer work in the investigation of underground temperatures and ventilation conditions at depth. In 1908 he introduced sand-filling on the Rand, as the cheapest and most satisfactory means of supporting the ground above the worked-out areas. During his term of office as president of the Institution of Mining and Metallurgy he initiated the formation of overseas branches of the institution in all parts of the British Empire. In 1920 he was appointed a governor of the Imperial Mineral Resources Bureau, which had been incorporated by royal charter in 1919 for the purpose of furthering the exploitation of minerals and metals throughout the British Empire. Mr. Marriott is also a fellow of the Geological Society of London and a member of the Institution of Civil Engineers, the Institution of Mining Engineers, the American Institution of Mining and Metallurgical Engineers, the Canadian Institute of Mining and Metallurgy, the Chemical and Metallurgical and Mining Society of South Africa, the Geological Society of South Africa, and the South African Institution of Engineers. Among his chief publications are "Borehole Surveying," "Deep Level Earth Temperatures," "Value of Rand Deposits," and "François Cementation Process."

During the Boer War Mr. Marriott attained the rank of captain in the Rand Rifles and raised the Rand Rifles Association to 500 members, a body noted for fine marksmanship. In the Great War he was appointed general manager of factories for the ministry of munitions in the Department of Explosives Supply, and held this post from May to November, 1915. He also commanded a company in the Old Boys' Corps which was organized in 1914 and did good service.

CONSULTATION

Preparation and Uses of Barytes

"I would like to know the various uses of barytes and how they influence the preparation of the material for the market. What is the general practice in the principal barytes fields in the production of a marketable product?"

Barytes, a natural barium sulphate, is one of the most useful of the non-metallic minerals. Its greatest application is in the manufacture of paint, either as a filler or a white pigment, as an inert base in colored pigments, or in the manufacture of lithopone, an intimate mixture of barium sulphate and zinc sulphide. There are many other uses of the mineral, as ground barytes and in chemical manufacture. Rubber goods may contain barytes as a filler, and it is employed in the manufacture of artificial ivory, oilcloth, paper, linoleum, and lithographic inks.

In the form of various barium chemicals it is highly important. Blanc fixe, a chemical product, is particularly useful, and although in chemical composition it is almost identical with ground barytes, its physical properties are different. Blanc fixe is the artificial barium sulphate, and is precipitated from a solution of a soluble barium salt, usually by means of salt cake. It is better for pigment purposes than ground barytes, and naturally commands a higher price. Other barium chemicals are used in the manufacture of optical glass and in the ceramic industry.

Although chemical purity is essential in the best grades of barytes, physical properties are important and influence its value. A white color is desirable, the whiter material commanding the highest prices. Uniformity in the screen size of the finished product is also important. Frequently, an inferior looking barytes through proper treatment may be transformed into a good grade.

The Southern and the Western are the two most important barytes fields in the United States. The Southern field lies in the states of Georgia, Tennessee, North and South Carolina, Alabama, and in general throughout the Southern States, whereas the Western barytes comes mainly from the State of Missouri. Missouri and Georgia are by far the two most important producing states, together in 1920 accounting for 85 per cent of the domestic production of 228,100 tons. The mines in both these fields are operated on a different system, the Missouri producers leaning toward smaller operations and depending upon hand work, whereas the Georgia operations, which are larger, use steam shovels. In part this is due to the different character of the ore that is usually found in both districts.

Barytes may occur as a hard crystalline mineral or as a soft material. The hard mineral has a characteristic glassy appearance, whereas the friable variety appears milky. The soft type is preferred by grinders, and is the mineral variety generally found in the Missouri mines. The Georgia deposits are of the hard crystalline nature. Tennessee is reported to contain deposits of both types.

Many small mines are responsible for the output of domestic barytes, open-pit operations being the rule. The Southern mines have been developed to a greater extent than those in the Middle West. After mining, either by hand or steam shovel, the ore, which may run between 25 and 30 per cent barytes, is taken to a washer, where it is crushed and log washers or other suitable devices are used to remove the clay and earthy impurities adhering to the mineral. It is then screened, the oversize going to a picking belt and the undersize to a jig. If the product is to be sold as ground barytes, a tube mill may be used to grind it, followed by water flotation. In grinding barytes it is well to use a medium that will not discolor the mineral.

Barytes, being an exceptionally heavy mineral, is easy to concentrate, and can readily be separated from impurities such as quartz and clay. If the ore when ground is found to be stained yellow owing to the presence of iron, it may be bleached with sulphuric acid or sold as an "off-color" product, in which event it would probably be used for dark-colored paints or other uses in which a white pigment is not essential. When bleached and floated it is known as a "prime white" material.

Keeping Qualities of Permissible Explosives

"Will you kindly tell me how long the mining powders may be expected to retain their qualities without marked deterioration under high temperatures (100 to 110 deg. F.) and low humidities? Under high temperatures (100 to 110 deg. F.) and high humidities?

"What effect has low temperature on the keeping qualities of mining powders? Ordinary temperatures?"

Under the high temperature range indicated, 100 to 110 deg. F, and low humidities, the mining powders may be expected to retain their qualities for one or two years, but under the same temperature conditions and high humidities this period is cut down to only a few months, according to one large manufacturer of explosives.

Low temperatures have no effect on the keeping qualities of mining powders, provided the temperature is above the point at which the powder freezes. Once frozen, then thawed, the powder freezes much more quickly than the first time. There is no other appreciable effect on the properties of the powder.

At ordinary temperatures, 60 to 80 deg. F., and ordinary humidities, mining powders may be depended upon to keep their strength for one and one-half to two years.

Water-Cooled Pipes for Blowing Copper

An inquiry was published in *Engineering and Mining Journal* of Nov. 5 regarding the possibility of using water cooled pipes for blowing copper. If the interested parties will look up U. S. Patent No. 1,352,912, issued Sept. 14, 1920, I am confident they will find a solution to their trouble.

ALLEN E. PARTRIDGE

Cleveland, Ohio

HANDY KNOWLEDGE

Neighborly Chats With the Foreman

Handling Men

By Duncan MacGregor

Written for Engineering and Mining Journal

Remember, Jim, you were once a workman yourself. You had to take orders from shift bosses and foremen for quite a time, as I remember. This last trouble you have brought to me leads me to believe that you have forgotten that fact. In a way the mine is your client, and a considerable part of the superintendent's responsibility is also yours. You can't overlook either of these facts, but if you would junk your likes, dislikes, and prejudices, and think sometimes from the angle of the men you are looking after, you would be a little more careful about breaking loose the way you did. Keeping control of yourself is one of the big factors in keeping control of your men. Just when you feel yourself going up in the air, throw your foot on the clutch and put on the brakes and say, "We'll talk about that tomorrow."

One of the handiest ways to get at a man is to ask him, "What do you think about it?" or, "How would you do it?" It's a good plan to get your men to think along the lines you have to. Perhaps you will not be altogether pleased with the scheme he suggests, and then you can ask him: "What do you think of this plan?" It's a safe bet that he will fall for your plan or point out some weakness you have overlooked.

Of course, quick decisions are often necessary. If you have to handle a fire, a cave, or an accident, you can't take time to ask questions, but there are other times when you can stir up a little interest by showing some interest in your men. When you want to fire a man, think it over for a spell. Try him in several different jobs before you are definitely through with him, if you can see anything of value in him.

Your men and yourself are in a common cause to make the mine pay and to prevent accidents. Your principal hold will depend largely how honestly and systematically you deal with your men on a man-to-man basis.

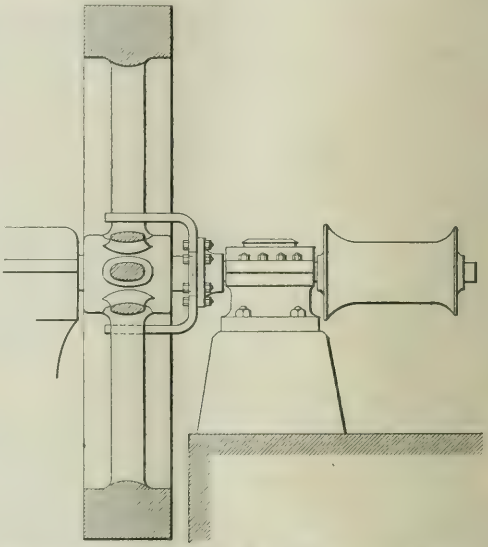
A Coarse Ore Transfer

By James T. Kemp

Written for Engineering and Mining Journal

The transportation of material in mixed sizes from place to place is one of the ever-present problems of the smelter man. Small tonnages and fine stuff offer fewer difficulties than coarse materials in moderate tonnages. A great variety of inexpensive conveying apparatus is available for handling lumps up to 10 or 15 lb. weight. Large tonnages of coarse materials necessarily require heavy equipment. There are often operations in which the size of the material would require heavy machinery, but the tonnage does not warrant its installation. One such problem and its satisfactory solution is here described.

Ore was to be gathered from an 80 x 40-ft. sorting floor in one building, weighed, and carried about 150 ft. across a railroad track at grade to a crusher in another building. Single chunks weighing as much as 1,000 lb. had to be handled frequently. The movement of ore was irregular, occasionally reaching 50 tons a shift. The size of the larger pieces precluded the use of a conveyor; therefore a narrow-gage railroad was selected. It was built from the side of the sorting floor to the crusher and elevated at the end so that a car would dump directly into the crusher. The scale was placed in a lean-to outside the sorting floor. A V-bottom dump car with a removable body was adopted. Three bodies were provided, to allow loading at several places simultaneously.



WINCH HEAD OPERATED BY FLYWHEEL BY MEANS OF TWO-PRONGED SPIDER

The crane in the main building served the sorting floor and was used to pick up the dump-car bodies, to place them conveniently on the floor for loading, and to replace them on the car truck as they were filled. The crane was also used to pick up all pieces of ore too large for a man to lift. Loaded cars carried two tons. They were pulled to the crusher by a ¾-in. hemp rope run through a snatch block to a winch head driven from the crusher shaft. The empty car was easily pushed back by one man. As the rope was hooked to an eye in the end of the car frame, it could be quickly detached and pulled clear of the main yard track to permit a train to pass. The yard tracks were only notched for the flanges of the dump-car wheels.

The winch head was taken from a discarded hoisting engine. It was keyed on a short piece of shafting and overhung a heavy bearing which was mounted solidly on a concrete pedestal. One-half of a shaft coupling was keyed to the end of the shaft facing the crusher flywheel hub and carried a two-pronged spider cut from 1-in. plate. The spider was bent U-shaped so that the prongs projected between the spokes of the flywheel. A heavy guard of pipe and woven wire was built around the flywheel to prevent the operator or the rope from getting caught.

This haulage system proved entirely satisfactory. No difficulty was experienced with the loose hemp rope. The installation was compact and inexpensive to install. One man attended the crusher, moved the car back and fourth, and did the weighing without assistance.

Grain vs. Flesh Side for Leather Belts

The question of whether a leather belt should be run with the grain or flesh side next to the pulley has been much debated. It has seemed to some that a closer contact with the pulley could be had by putting the grain side of the belt next to it. Others have contended with equal conviction that the flesh side, being tougher, was better able to withstand friction.

During the last summer, tests of the capacity of the grain and flesh sides of leather belts were begun by the Leather Belting Exchange in its research laboratory at Cornell University. They were under the direction of R. F. Jones, director of the laboratory. Covering a period of more than two months, continuous tests were run on the testing apparatus belonging to the Exchange, which is being operated under the supervision of Cornell University, using five 4-in. single belts, 30 ft. long, of different manufacture. They weighed from 16 to 18 oz. Every effort was made throughout the tests to standardize conditions and to reduce the probable error to a minimum, and this unquestionably was accomplished. All five belts were run long enough previous to the experiments to have been thoroughly "run-in," and had reached a condition of constant capacity when the records were taken.

The method of procedure was to take horsepower readings from the belts first when running on the grain side, and then when running on the flesh, the power being gradually increased until about 4 per cent slip had been reached.

In considering the results, it must be remembered that a leather belt is at its lowest point of capacity when new, largely because of the elasticity of the leather and the newness of its surface. Leather belts are well stretched in the process of manufacture, so that when the belt is put on the pulley there may be as little stretch as possible consistent with thorough lubrication and retaining the natural life or elasticity, which is such a valuable property of the leather belt. When a new leather belt is placed on the pulleys, however tightly, it will elongate under load; but after the tension of the load has been removed it returns very nearly to its original length. This stretch is an annoyance when installing a new belt, but it is of the nature of a safety valve, protecting both belt and machinery.

The newness of the surface, however, makes it necessary to "run in" the belt when testing it. That is, to run it for a sufficient time to permit the belt to attain its maximum capacity in transmission. As an illustration, one belt under test at the Cornell laboratory transmitted 12 hp. when first put on the pulley at a slip of 1.2 per cent. After five hours' running it reached 19 hp. with the same percentage of slip and the same tension. At the end of thirteen hours it transmitted 24 hp., and reached 31 hp. after twenty hours with a slip of 1.6 per cent. According to horsepower tables, its scheduled transmission should have been 26 hp.

Inasmuch as the belts used in the tests seemed to be typical, and the apparatus at hand was such as to give the most accurate readings of performance, the results should be scientifically acceptable.

A summary of all of the results is clearly in favor of the grain side from the standpoint of power transmission. In fact, it may be concluded from it that under reasonable shop tension, the flesh side will average only 50 to 60 per cent as much horsepower as the grain side. At higher tensions the flesh side will do better, averaging from 50 to 100 per cent as much power as the grain, depending upon the belt, the tension, and the conditions of service.

A curve plotted from the readings taken when the belts were running on the flesh side is similar both in shape and capacity to that given by many of the leather belt substitutes. All that can be said of the test belts run on the flesh side is that the data obtained from them were more uniform than when running on the grain.

The grain tests showed an almost curveless gain in horsepower up to 53 hp. transmitted, when the slip reached about 3 per cent for belts running at a slow running tension of 432 lb. In the case of the test belts operated at a slow running tension of 288 lb., the 3 per cent slippage was reached at about 44 hp. With the belts running on the flesh side, however, the 3 per cent slippage mark was reached at 28 hp. when operated at a slow running tension of 432 lb., and at 16 hp. when the tension was 288 lb.

Safety Device for Station Gate

BY ROY H. POSTON

Written for Engineering and Mining Journal

Mine station gates are often left open when the cage is in motion. To obviate this possibility the wiring of the signal bell at one shaft is so arranged as to make it necessary for the station gate to be securely closed before a signal can be given to the engineer.

Part of the electric circuit is attached to the gate and part to the shaft timber. Contact is made through contact plates and contact fingers, the latter being simply discarded contact fingers from an electric controller, and the former small copper plates. A snug-fitting latch is placed on the gate to hold it securely.

Examining Minerals in Ore Pulp

BY ALFRED T. FRY

Written for Engineering and Mining Journal

To examine a sample of ore pulp under a microscope use a clean slide not greased. Drop a small patch of sample upon it, apply a piece of blotting or filter paper to the edge to absorb superfluous moisture, then turn the slide glass side up, and examine with the microscope. It is advisable to exercise care in shaking the slide before mopping up the water, as it may result in concentrating mineral next to the glass.

It is often preferable to remove slimes from a sample by gentle washing or elutriation before examination, as with a low power instrument, these particles are not easily recognizable and interfere with the visibility of larger grains. (See *Engineering and Mining Journal*, Dec. 24, 1921, p. 10[illegible].)

THE PETROLEUM INDUSTRY

California Production for November Shows Increase

Daily average production of petroleum in the United States increased 110,268 bbl. during November, as compared with October, according to the U. S. Geological Survey. The greatest increases were in California, owing to the termination of the strike in the oil fields, and in Texas as a result of developments in the Mexia field. Gains in daily average production are also recorded for Wyoming, Oklahoma, Kentucky, Pennsylvania, Ohio, Tennessee, and Colorado. Decreased daily average production is reported for Kansas, Louisiana, Arkansas, Illinois, Montana, West Virginia, New York and Indiana.

The number of producing oil wells completed during the month increased 151 over the number completed in October, and amounted to 903.

Daily average imports of petroleum increased 59,725 bbl., and 12,993,763 bbl. were imported during November. Daily average exports of crude oil increased by 4,722 bbl.

Estimated daily average consumption during November was 1,550,367 bbl., a gain of 92,173 bbl. during the month.

The California oil production for November of 8,808,468 bbl., which averaged 293,616 bbl. per day, shows an increase of 65,751 bbl. over the October daily production of 227,865 bbl., according to the Independent Oil Producers Agency. The daily production for the current month is 17,118 bbl. less than the November, 1920, production.

Shipments during the month averaged 296,443 bbl. daily, 15,425 bbl. less than the daily shipments during November, 1920, and 6,754 bbl. less than the November, 1919, shipments.

Stocks were reduced 84,819 bbl. during November, leaving a surplus for the year to date 10,327,405 bbl. Stocks on hand Dec. 1 amounted to 29,946,251 bbl., 9,994,413 bbl. greater than the Dec. 1, 1920 storage.

Seventy-five rigs were erected, 519 wells active drilling and 15 holes abandoned during the month. Fifty wells were completed with an initial daily production of approximately 12,000 bbl., and 9,240 wells were producing during the month.

A Diamond-Drilled Oil Well

SPECIAL CORRESPONDENCE

The first producing oil well ever brought in, in any field, by means of a diamond core drill was recently completed in the Tampico district. This is well No. 6 on the Panuco Boston property, and was brought in at a depth of 2,153 ft. and is flowing 1,200 bbl. per day. The hole is 3½ in. in diameter at that point. It was standpiped and chopped down to 1,400 ft. with a "fishtail" bit and 4-in. casing, through the overburden and soft material. From 1,400 to 2,153 ft. a diamond bit was employed, and a high percentage of core recovered, giving the geologist accurate information as to the thickness and character of the oil sands.

Recent Completions in Mexia Field

SPECIAL CORRESPONDENCE

The Prairie Pipe Line Co. is building an 8-in. pipe line from Mexia to Hensley station, in Jack County, Tex., a distance of 150 miles. Four pumping stations will be built, one each at Mertens, Weatherford, Cleburne, and Mexia. The Sinclair interests have contracted with the Chicago Bridge & Iron Works for fifty 80,000-bbl. tanks. These are to be placed in one tank farm for Mexia crude-oil storage.

Recent completions of interest in the Mexia field include the Humphreys-Mexia No. 1 Berthelson well, flowing 100 bbl. pinched in from 3,115 ft; the same company's No. 1 Mills, flowing 2,000 bbl. from 3,105 ft.; Magnolia Petroleum Co.'s No. 1 Mills, 10,000 bbl. from 3,050 ft.; and Woodbine Oil Co.'s No. 1 Slaughter, 15,000 bbl. from 3,025 ft.

North of the Mexia field near Currie, the Meador well of the Mex-Tex Oil Co. recently began flowing 400 bbl. of 42 deg Bé. oil. This is believed to be on a separate structure from the Mexia field.

Spokane Oil Bubble Broken

SPECIAL CORRESPONDENCE

Another chapter in the recent Spokane oil boom was closed on Dec. 19, when Mr. and Mrs. A. L'Ecuyer, local residents and owners of property in a residential section of the city, where an oil seep was discovered last spring, were acquitted in the Federal court of a charge of using the United States mail with intent to defraud. The claim was advanced that the spring had been "salted," and L'Ecuyer, as president of the Eastern Washington Oil Co., had made use of the mails in furthering sale of stock in his company. Evidence presented by the Government officials in the shape of testimony of chemists, showed oil from the spring to be 40 per cent kerosene and the balance a saponifiable oil, very much like cottonseed oil.

Oil-Well Machinery Exports Decrease

The value of oil-well machinery exported in November is reported by the Department of Commerce to be $320,828. This is a little less than half the value of the exports of oil-well machinery in November of 1920. The value of all other mining machinery exported during November was $324,775. A year ago exports under this latter item were valued at $654,277. The exports of pumps and pumping machinery during November were valued at $343,629. This is about one-fourth of the value of pumps exported in November of 1920.

Red River Boundary Settled

SPECIAL CORRESPODENCE

The latest development in the Texas-Oklahoma dispute over the Red River boundary, involving oil lands of value, is a contention set up by the Government in a brief before the Supreme Court, filed on Dec. 2, that the owner of the Red River bed is the United States.

ECHOES FROM THE FRATERNITY

SOCIETIES, ADDRESSES, AND REPORTS

Separation Problems Under Study by Bureau of Mines

Plans have been formulated by the U. S. Bureau of Mines for a complete survey of the milling problems of the tri-State district of Missouri, Oklahoma, and Kansas, with the object of improving the recovery of zinc in the mills. Other problems that may be considered are the recovery of zinc from tailings, determining the amount of sphalerite made excessively fine by the blasting, and removing lead from the "flotation zinc." This work is being conducted in co-operation with the Missouri School of Mines and Metallurgy.

It has been brought to the attention of the Bureau that zinc has been encountered in increasing amounts in the fluorspar ores of southern Illinois and Kentucky. The ordinary treatment by jig and table concentration results in a considerable loss of fluorspar, and zinc cannot be removed by this method, because the zinc and the fluorspar differ so little in specific gravity. Experiments at the station resulted in developing two improved methods. One, employing electrostatic separation, takes out the lead, gives a marketable zinc concentrate and also a spar product of practically any grade desired—99 per cent calcium fluoride having been made in the tests. This fact makes possible the production of acid spar (98 per cent CaF_2) from the gravel spar (85 per cent CaF_2) now produced. Acid spar commands a much higher price than gravel spar. The second method employs flotation. Tests gave a higher recovery of zinc than was obtained by electrostatic separation, but the spar product is lower grade and finer grinding is necessary. The method, however, is a great improvement over earlier methods, and as compared to electrostatic treatment is preferable in stormy weather. A large company, whose representatives assisted in the tests, has adopted it for treating this type of ore.

Plans were formulated for an investigation by the Bureau of Mines of proposed methods for the electrothermic metallurgy of zinc, and their possible application in the United States with a view to increasing the recovery of metal and lowering the cost of production, which, with the standard retort process, is so high that it endangers the position of zinc as a cheap metal.

The processes so far proposed may be divided into two types: (1) Electrothermic dry distillation, which may be conducted in large units, but follows closely the metallurgical principles of the retort process in chemical and physical reactions; (2) electrothermic smelting, in which the ore is fed continuously into the furnace, the zinc vaporized, and the residue smelted to liquid products which are drawn off. The Survey research investigations will include both types.

There is a lack of fundamental data for working out new metallurgical methods for zinc. Such data will have value in the electrothermic metallurgy of zinc and also in the retort process. Study is being made by the Bureau of Mines of the physics and chemistry of the reduction of oxidized-zinc compounds, the condensation of zinc vapor, and behavior of the metals commonly associated with zinc—such as cadmium, lead, and silver—during distillation and condensation. The electrothermic metallurgy of zinc also offers possibilities in the treatment of complex ores of zinc, lead, copper and silver.

The Mississippi Valley Experiment Station devised a method for treating certain residual concentrate from zinc retorts. This concentrate is not amenable to ordinary retort distillation, which results in a low recovery of zinc and a rapid destruction of retorts. Briquetting the material before distillation resulted in 97 per cent extraction; retort destruction is practically nil and larger charges can be handled. This work is to be continued on a large scale at Fort Smith, Ark.

Loss of fines in the tailings of zinc mills in the Wisconsin district has long been a vexing problem. Since 1911 some of the mining companies have made an earnest effort to utilize the fines, but without satisfactory results. In January, 1921, at the request of the operators, the Bureau of Mines took up this problem. Examination showed that the minus 20-mesh material is the one most amenable to profitable re-treatment. The evidence so far gained is that by screening the tailings on a 20-mesh screen, 65 per cent of the zinc content will be concentrated in the fines, and the fines will amount to 25 per cent of the whole; that is, the ratio of concentration will be 4 to 1, and the recovery 65 per cent. Laboratory tests indicate that concentrating tables placed in the mills to treat the fines will recover 90 per cent of the zinc content in a low-grade concentrate assaying about 30 per cent zinc, and that this concentrate can be graded up to 62 per cent zinc in central plants where flotation and gravity concentration are combined. It is estimated that this practice would have added about $1,000,000 annually to the value of the zinc output had it been in operation in 1917. Two by-products, marcasite and ground limestone, would have been available for sulphuric acid and for agricultural purposes, respectively, according to the results of the tests.

Treatment of Mixed Copper Ores Discussed

The San Francisco Section of the American Institute of Mining and Metallurgical Engineers held a meeting at the Engineers' Club Dec. 27, following a dinner. H. W. Morse spoke on "The Present Status of the Treatment of Mixed Copper Ores." Mr. Morse has been connected with some of the larger recent installations in Arizona and the subject was of great interest to those attending.

Fires Discussed at Utah Meeting

At the December meeting of the Utah Society of Engineers held at the Salt Lake City Commerial Club, the speakers were W. H. Lovesy, traffic manager of the Utah Oil Refining Co., whose subject was, "Oil Plant Fires," and A. C. Watts, chief engineer of the Utah Fuel Co., who spoke on "Coal Mine Fires."

Toronto Meeting of American Association for the Advancement of Science

Engineers, publicists and educators addressed Section M. of the American Association for the Advancement of Science, which met in Toronto Dec. 27 to 30, inclusive. According to the program recently published by the Federated American Engineering Societies, Sir Clifford Sifton, K. C. M. G., formerly Minister of the Interior, and head of the Conservation Commission of the Dominion of Canada, will open the sessions on Tuesday with an address on "Views on the Development of the Natural Resources of Canada."

Wednesday's speakers, morning session, will include: J. E. Hardman, Montreal, "Fifty Years of Progress in Mining in Canada."

Speakers at the afternoon session on Wednesday will be: Thomas W. Gibson, Deputy Minister of Mines, Ontario, "Recent Progress in Metal Mining in Ontario;" A. F. Brigham, general manager, the Hollinger Mines, Ontario, "Gold Mining in Ontario;" W. L. Dethloff, chief engineer, The Mond Nickel Co., Ontario, "Nickel Mining and Smelting."

"Toronto Harbor Development" will be discussed at Thursday's session by E. L. Cousins, chief engineer and manager of the Toronto Harbor Commission. Other speakers will be: R. A. Ross, [illegible], Honorary Advisory Council for Scientific and Industrial Research, Canada, "Industrial Research;" H. E. W[illegible], [illegible] engineer, Canadian [illegible], "Railway Development in Canada;" A. M. McQueen, [illegible], the Imperial Oil Co., Toronto, "[illegible] Oil in Western

Canada"; James McEvoy, Toronto, "Coal Mining in Alberta;" D. B. Dowling, Geological Survey of Canada, "Oil Resources of the Valley of the Mackenzie River;" Sir Adam Beck, chairman, Hydro-Electric Power Commission of Ontario, "Hydro-electric Development in Ontario."

Geological Survey's Work in Utah

The Salt Lake City offices of the U. S. Geological Survey are in need of a local geological attaché, according to the annual report received by V. C. Heikes, statistician of the survey at Salt Lake City. The appointment of a geologist in such a position would be a help toward meeting numerous demands for information received regarding non-metallic minerals, especially oils, and would make it possible to handle the work in connection with the various industries with more dispatch. During the fiscal year ended June 30, 1920, profile surveys were made by the survey of a number of streams in the Utah Lake Basin, in Summit, Wasatch, Morgan, Utah, and Juab counties. Also there was done 124 sq. miles of mapping of territory in the state and of 283 sq. miles of river traverse for the land classification board. Reports and professional papers compiled in Utah during the year were: "Report on the Mining Geology of the Cottonwood District," by B. S. Butler; "Report on Manganese Deposits of Utah," J. T. Pardee; "General Reconnaissance of Local Structures in Kane and Garfield Counties; Description of Paleozoic Sections in Southwestern Utah," J. B. Reeside, Jr., and Harvey Bassler; "Phases of the Carboniferous and Triassic of Southern Utah," J. B. Reeside, Jr.; "Stratigraphy and Petroleum Resources of Washington County," Reeside and Bassler; "Paleozoic Fossils of Utah," G. T. Girty; "Cretaceous Invertebrates," T. W. Stanton; and a report on the coal resources of the Wasatch plateau by a party headed by E. M. Spiker.

Other work for the year included the mapping of a part of Book Cliffs and Huntington Canon regions; investigation of the geology in connection with the Colorado and San Juan River dam-sites at Green River; Lee's Ferry and Bluffs by H. D. Miser, Kirk Bryan, and C. R. Langwell; a report on oil-impregnated sandstones in the lower part of the Green River formation east of Jensen, by David White and K. C. Heald, and a report on oil shales of the Rocky Mountain region by D. E. Winchester.

MEN YOU SHOULD KNOW ABOUT

A. R. Baldwin has been appointed general manager of the Utah Fuel Co., to succeed Alexander H. Cowie.

Walter R. Vedler is engaged in petroleum engineering and production in northwest Texas and Oklahoma fields.

S. F. Shaw is examining mines in Santa Barbara, Sombrerete, San Luis Potasi, Monterey, and Sierra Mojada, Mexico.

James P. Porteus of the Bonney mine, Lordsburg, N. M., is visiting Los Angeles and San Francisco on mining business.

J. A. McDougall, master mechanic for the Phelps Dodge Corporation at Tyrone, N. M., has been transferred to Bisbee, Ariz.

W. G. Mather, president of the Cleveland-Cliffs Iron Co., has concluded a visit to the properties of the company on the Marquette Range.

Frank M. Smith, of Spokane, smelter director of Bunker Hill Mining & Concentrating Co., is spending the Christmas holidays at his old home in the East.

W. L. Zeigler, mill designer, Spokane, was recently injured in an automobile accident near Coeur d'Alene City, Idaho. At the time of the accident, Mr. Zeigler was on his way to Coeur d'Alene City, where he was one of the technical witnesses for the plaintiffs in the Star-Federal accounting case.

Sir **John Cadman**, formerly the British Petroleum Director, was entertained recently at luncheon at the Cosmos Club in Washington by **George Otis Smith**, director of the U. S. Geological Survey. There were present to meet Sir John, First Assistant Secretary **E. C. Finney**, and Assistant Secretary **F. M. Goodwin**, of the Department of the Interior, Director **H. F. Bain, E. A. Holbrook**, and **A. W. Ambrose** of the Bureau of Mines, **David White, Philip S. Smith, A. H. Brooks, W. C. Mendenhall and K. C. Heald**, of the U. S. Geological Survey.

Clarence E. Allen will retire on Jan. 1 as general manager of the intermountain department of the United States Smelting Refining and Mining Co. Mr. Allen is succeeded by **Downy Davidson Muir, Jr.**, who has been manager of mines, stationed at Salt Lake City. Mr. Allen has been connected with the United States Co. for many years, coming to Utah forty years ago. In his earlier association with the company, Mr. Allen was in charge of the Centennial Eureka mine in the Tintic district, later becoming manager of mines. Mr. Allen has been a public-spirited citizen, and was for several terms a member of the territorial assembly before the days of Utah's statehood. In 1895 he was elected United States Congressman.

The Utah chapter of the American Mining Congress, following the notice of Mr. Allen's coming retirement from active work, has elected him an honorary member for life of the organization. He is a charter member of the chapter and has advanced the affairs of the organization as one of the local directorate from the beginning, and he is the first member to be honored in this way.

Mining and metallurgical engineers visiting New York City last week included: Elmer Bird, Little Rock, Ark.; **J. T. Smoody**, Uniontown, Pa.; **R. G. Knickerbocker**, Rolla, Mo.; **W. E. Hopper**, Shreveport, La.; **Walter H. Hill**, Stanley, Idaho; **F. G. Lasier**, Detroit, Mich.

SOCIETY MEETINGS ANNOUNCED

The next annual meeting of the **British Columbia Division of the Canadian Institute of Mining and Metallurgy** will be held at Vancouver during the first week of February, 1922.

The next annual convention of the **American Association of Engineers** will be held in Salt Lake City June 5, 6, and 7, 1922. C. J. Ullrich has been appointed chairman of the convention committee in Salt Lake City. Other members of the local committee are C. E. Painter and H. A. Harmon.

The **College of Mines, University of Washington**, will hold its twenty-sixth Annual Winter Mining Session during the twelve weeks from Jan. 5 to March 22. This session is open to any interested man who can read and write English. The expenses will be limited to a tuition fee of $15, laboratory deposits to cover materials actually used and the cost of the necessary textbooks. The training consists of lectures with laboratory practice, for which the laboratories of the College of Mines are thoroughly equipped.

OBITUARY

Tingley S. Wood, mining engineer of Denver, died suddenly on Dec. 11. He was seventy-five years old.

Donald G. Campbell, a member of the firm of Campbell, Wells and Elmendorf, of Seattle, was drowned Dec. 18. Mr. Campbell graduated from the Columbia School of Mines in 1914.

C. L. Van Derlip, metallurgist with the American Smelting & Refining Co., died at Monterey, Mexico, on Nov. 30. Mr. Van Derlip was twenty-nine years old, and was a graduate of the University of Kansas.

John C. Pennie, senior member of Pennie, Davis, Marvin & Edmonds, patent attorneys, died on Dec. 23. Mr. Pennie was born at Albany, N. Y., in 1858. He graduated from Union College in 1877, later studied in Gottingen and Heidelberg, and in 1880 entered the Patent Office as examiner. In 1883 he commenced the practice of patent law in Washington and New York. Mr. Pennie acted as patent attorney for most of the large mining companies.

THE MINING NEWS

The Mining News of ENGINEERING AND MINING JOURNAL is obtained exclusively from its own staff and correspondents both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Leading Events

Full details of the proposal to purchase control of the American Brass Co. have been put before the stockholders of the Anaconda Copper Mining Co. in a circular issued by the company. Earlier reports are verified. It is rumored in Butte that Anaconda is to resume at an early date.

Secretary of Commerce Hoover has been appointed Federal chairman of the Colorado River Power Commission.

The New York State Board of Engineer Examiners, following its recent meeting at Albany, has issued its first licenses to engineers to practice in the state.

A petition to sell the property of the Consolidated Arizona Smelting Co. has been made by the receiver.

Custom shippers in British Columbia have been informed that the Trail smelter will settle for ore hereafter on a cash basis instead of at ninety days.

Operations of the Colorado Fuel & Iron Co. at the Pueblo steel mills are to be increased early in 1922. The ore and coal mines of the company will be affected.

Consolidated Arizona Receiver Seeks To Sell Property

Southwest Metals Co. Hopes To Buy In Holdings With Proceeds of Bond Issue

A petition by the receiver for an order to sell the property of the Consolidated Arizona Smelting Co. is now before the United States court at Tucson, Ariz. The hearing has been continued until Jan. 16. The Southwest Metals Co., which is undertaking to reorganize the smelting corporation, has required actual ownership of about 98 per cent of the unsecured claims and of about $650,000 of the first mortgage bonds, leaving about $300,000 of the bonds as yet not acquired, but under option. It is reported to have under option also practically all the lien claims. The Southwest Metals Co. is now offering a bond issue of $600,000 for subscription, to be secured by first mortgage on the properties of the Consolidated Arizona Smelting Co., when the same shall have been acquired by the Southwest Metals, which expects to become the purchaser of the property at receiver's sale. From a representative of the company it is learned that should the Southwest Metals Co. be successful in floating the bond issue it will be able to become the purchaser of the property for the amount of the claims against the Consolidated Arizona Smelting Co. and will be provided with a sufficient capital to operate the property when conditions of the copper market will justify operation.

Anaconda To Resume Soon?

The Anaconda Copper Mining Co. is reported to be making preparation to resume at a very early date which, it is said, has been fixed. The announcement is being held until wage schedules are decided upon by the company, according to such information as can be had.

Trail Smelter To Settle on Cash Basis

Circulars have been sent out by the Consolidated Mining & Smelting Co. of Canada, Ltd., notifying custom ore shippers of a change in method of payment for ores, effective Jan. 1. The new basis of settlement provides for practically a cash settlement for ore, instead of the ninety-day settlement in effect for some time. The new arrangement will be an aid to operators in the Slocan and Ainsworth districts, who have been handicapped for several months past because of inability to market their product under the old terms.

El Salvador Mines Without Funds, Directors Declare

El Salvador Silver Mines Co., of Pine St., New York, and having properties in El Salvador, has announced to its stockholders that its general manager, Frank M. Estes, reports that the company's Divisadero mines must be considered as worked out. Mr. Estes also describes the situation at certain other properties operated by the company and concludes by recommending "that all the properties be put on a permanent non-producing basis and that the company's attention be turned to more attractive fields." The company possesses considerable equipment, it is said, which, however, the directors think is of little cash value because of its remote location. The directors declare the company is without funds to carry on its business and that steps should be taken to protect its assets until they can be liquidated.

Bankruptcy proceedings were recently begun against the property of T. H. Frothingham, one of the company's directors. The *Evening Sun* on Dec. 14 stated that forty El Salvador stockholders charged that Frothingham transferred about $1,300,000 in securities and personal property to his wife and preferred creditors.

Anaconda Informs Stockholders As to American Brass

Details of Proposal Announced—Study of Manufacturing Situation Showed Domination by Brass Company

Details of its proposal to acquire control of the American Brass Co. have been put before stockholders of the Anaconda Copper Mining Co. in a circular issued by the latter. The circular states that a definite offer was made on Dec. 15 to American Brass shareholders to acquire not less than 51 per cent of the stock of their company at a price per share of $150 cash and three shares of Anaconda stock, par value $50 per share. This proposal resulted in the organization of a stockholders' committee, which will represent the stockholders of the Brass company.

The procedure to be followed is outlined as follows: Of Anaconda's authorized capital of 3,000,000 shares, 668,750 shares remain unissued. Of these, 233,125 shares will be offered to stockholders of record Jan. 3, 1922, for subscription in the ratio of one share of new stock for every ten shares of stock then owned by the stockholders, this to provide part of the payment that will be required to be made for the American Brass stock. Such subscriptions and the payment for them will have to be made before the close of business Jan. 25, 1922.

It is stated that the plan could not be carried into effect without the assistance of a syndicate to underwrite at $50 per share the 233,125 shares of stock that will be offered to the Anaconda stockholders as stated above, and also to furnish the additional cash that will be needed to pay the Brass stockholders for such of their shares as will be acquired. The maximum obligation thus imposed upon the syndicate is therefore [illegible].

If the amount of Brass shares which may be acquired by Anaconda shall require a payment in cash in excess of the $11,656,250, which will be realized upon the underwritten offer of stock to shareholders of the company, the United Metals Selling Co. will assume an obligation to reimburse the syndicate for the excess to be furnished by Feb. 1, 1923, with interest, and the selling company will receive from Anaconda an equivalent of such obligation in shares of Brass company acquired by Anaconda, valued at $300 per share, or other securities of equal value.

It was last February when the Anaconda company began to study the manufacturing and fabricating situation in the United States. It found that there were then manufacturing and fabricating copper products about thirty-two concerns of sufficient importance to be taken into consideration. The annual output of these exceeded 1,800,000,000 lb. of copper. This capacity was more than twice the prewar domestic demand and probably 80 per cent more than required in the United States in 1919 and 1920 respectively. It thus became evident to the company that it was inadvisable to build another plant. The Anaconda company also learnede from its study that the American Brass Co. dominated the manufacturing and fabricating situation in copper and brass.

Control of American Brass Co. A Constructive Step

Houghton—Opinion in the Michigan copper district is that control of the American Brass Co. by the Anaconda company would be a most constructive step. In the Lake and other districts outside of Montana the deal would have no immediate effect, it is believed. Though mines other than those controlled by Anaconda would be deprived of the American Brass market, Anaconda necessarily would relinquish other domestic markets and foreign metal business as well, leaving these open to the competition of the mines of the Lake and other fields. By putting Anaconda in a position to undersell competitors in fabricated products, which is considered here to be a likely development, control by Anaconda of the largest consumer of copper in the United States would ultimately force other companies, either independently or in groups, to enter the manufacturing field, in the opinion of leading mining men of the Lake district. This would close the breach between producer and fabricator and put the mining and marketing of copper and the manufacturing and marketing of copper and brass products in better balance as regards prices and products, establishing reasonable prices for such products and giving to the producer his rightful share of the profits of the business throughout its various stages. It is considered here that Anaconda is leading the way to a condition of affairs which will stabilize the copper market and give the producers better control of it, to the mutual advantage of the producers and the consuming public. Such a consolidation of interests is regarded as inevitable.

Iron Cap-Arizona Commercial Suit in Progress

Numerous Witnesses Called for Both Sides—H. V. Winchell for Plaintiff

The Iron Cap-Arizona Commercial apex suit now before the Superior Court of Gila County, Ariz., has developed complications that have to do with whether a faulted orebody shall be considered as continuous, without respect to the faulting. Witnesses called for Arizona Commercial included Guy N. Bjorge, for several years geologist of the Old Dominion, near by; W. S. Sultan and Pat Rose, respectively superintendent and foreman of the company during the Amster administration; R. H. Boyd, former superintendent of the mine and now with the Copper Queen at Bisbee; and H. V. Snell, of Globe. On the Iron Cap side the witnesses included Horace V. Winchell, W. H. Wiley, of San Francisco, and R. H. Hunt, of Los Angeles. John P. Gray, of Coeur d'Alene, and Burton E. Eames, of Boston, are special counsel for the Iron Cap, with Morris & Mallot as local representatives. In charge for the Arizona Commercial is Edward F. McClennan, of Boston, assisted by Ellingwood & Ross, of Bisbee, general counsel for the Phelps Dodge Corporation, and C. L. Rawlins.

The suit on trial is one brought by the Iron Cap Copper Co. to quiet title to a group of patented lode claims known as the Iron Cap, Columbus, Olympia, Marjorie and Free America, within which are orebodies claimed to apex on Iron Cap ground. The Arizona Commercial Mining Co. has filed suit in Massachusetts, seeking to enjoin the Iron Cap from taking ores from these claims, wherein from bodies claimed to apex on Arizona Commercial ground, allegation is made that the defendant company has taken 200,000 tons of ore, valued at $3,000,000. Charles S. Smith of Lincoln, Mass., president of the Arizona Commercial has been present.

Jerome Verde Transfer Time Extended

The time within which Jerome-Verde stockholders may exchange their shares for certificates in the Jerome-Verde Development Co. has been extended until March 10. About 90 per cent of exchanges have been made thus far. All who do not exchange will be given cash in accordance with the terms of the agreement between the old corporation and the United Verde Extension, which controls the new organization.

Finnish Iron Ore Investigated

By Cable From Reuters to "Engineering and Mining Journal"

Helsingfors, Dec. 20—An investigation recently made of the iron ore deposits in the Island of Jussaroe in the Gulf of Finland is said to show that the deposits cover a large area and run 40 per cent iron. Steps are being taken for commercial exploitation

Colorado Fuel & Iron To Expand at Pueblo

Increased Scale of Operations at Steel Mills To Be Reflected at Iron and Coal Mines

The Colorado Fuel & Iron Co. announces that on Jan. 1 it will commence the expansion of operations at the Pueblo steel mills, which will result in the employment during January of approximately 2,000 more men at the plant.

The increased operations at the steel plant will also necessitate the employment of a larger number of men at the company's coal mines in Las Animas and Huerfano counties, the reopening of the lime quarries at Lime, and the iron mines at Sunrise, Wyo.

Operations at the steel plant have been at a minimum since August of this year, when the plant was practically closed down on account of the high price of coal and other operating costs. During November a 30-per cent wage reduction was put in effect at the coal mines, and a 10-per cent reduction in wages at the steel mills, commencing Jan. 1, has been agreed upon.

The resumption of operations means that an annual payroll of at least $10,000,000 will be started, and that the railroads serving the plant will benefit to the extent of an equal amount in freight receipts during the coming year.

Next Mining Congress Convention at Cleveland

Arrangements have been completed by the American Mining Congress to hold its 1922 convention in Cleveland, Oct. 9 to 15. The convention will be held in the new Exposition Hall which is being built by the City of Cleveland at a cost of $6,000,000.

Hoover Heads Colorado River Commission

President Harding has appointed Secretary Hoover as Federal Chairman of the Colorado River Commission, recently created jointly by Congress and the seven states traversed by the river, according to an announcement by the Department of Commerce. The appointment has been made with the approval of the governors of the states concerned. The creation of this commission is a step in what promises to become a great national improvement involving over a term of years an expenditure of several hundred millions of either public or private funds. Each of the states of California, Arizona, Nevada, Utah, Colorado, Wyoming, and Montana is interested in the irrigation and power to be derived from the river, and considerable conflict has already developed. The department says that unless the river problems are considered as a whole there is likely to be a great waste both in water and power, through private or public grabbing or ill-considered plans, with much conflict both between the states and with private interests.

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

I. C. C. To Hear Ore Shippers on Freight Rates

Dates Set for Hearings for Coal, Iron Ore and Petroleum Representatives Before Commission

Since the mining industry furnishes more tonnage to the railroads than any other class of activity, representatives of that industry are following very closely the inquiry which the Interstate Commerce Commission is making into the matter of railroad rates. The railroads already have presented a part of their case and have been allotted four days, beginning Jan. 11, to complete their testimony before the Commission. Three days then will be allowed for the cross-examination of the carriers' witnesses. On Jan. 19 and 20 the representatives of the coal and coke industry will present their views as to the advisability of reducing railroad rates on those commodities. On Jan. 21, 22 and 23 representatives of the iron ore industry will appear. No specific allotment of time has been made for other metal-mining activities, but representatives of those industries will have a chance to appear during the week of Jan. 30, all of which has been allotted to general testimony from shippers and the public. Petroleum and petroleum products is given a day's time to present the case for that industry. This testimony will be taken on Feb. 11. Other mining activities also will have an opportunity to be heard on Feb. 21 and 22 which have been assigned to "other commodities." Arrangements to be heard, however, must be made in advance.

Dolbear War Mineral Case Settled

Final settlement has been made under the liberalized War Minerals Relief Act of the widely known Dolbear case. Under the amended act the Comptroller of the Treasury no longer felt called upon to withhold payment and Mr. Dolbear has received his money.

Navy To Sell Metal

The Navy Department was to have opened bids Dec. 30 covering the sale of 215,020 lb. of surplus brass, copper, bronze and aluminum. The material is at the Norfolk Navy Yard.

NEWS BY MINING DISTRICTS

Johannesburg Letter

Transvaal's October Output of Gold Greater Than September's — New Modder Holds Annual Meeting —Joint Committee To Study Labor Problems

By JOHN WATSON

Johannesburg, Nov. 15—The Transvaal's gold output for October, declared on Nov. 10, shows an increase of 16,729 fine ounces, as compared with that of September. The value, however, decreased £155,729, owing to a fall of 7s. per oz. in the price of fine gold as compared with September. Forty-two properties sent in returns, and of these two-thirds have registered increases, the most notable being that of Van Ryn Deep, an increase of 3,148 oz., New Modder, 2,284 oz. increase, and Government Areas, 2,061 oz. increase. The only notable decrease was that Randfontein, which declined 1,758 fine ounces. The increased output was probably attributable to the increased native labor returns, which show 3,100 more natives at work than in September.

The New Modder's annual meeting was held recently. The mine has had a record year, both as regards the scale of operations and the profit earned. The total profit was £[illegible], of which £[illegible] was obtained from the gold premium. Sir Evelyn Wallers, the chairman, showed that of the mine's 1,264 total claims, 361 (or about 28 per cent) are worked out, 178 are developed and [illegible] claims still remain to be developed.

Reference was made, in a recent letter, to the conference of mine workers addressed by the Premier (General Smuts). A second conference was held on Nov. 10. at Johannesburg, with a view to increasing the efficiency of native underground labor. Representatives of the government mining department, the Transvaal Chamber of Mines, and the various mine workers' unions were present. General Smuts presided. It was decided that a sub-committee should consider the question of the ratio of white to colored labor underground, also the matter of getting a better day's work out of the underground native. The subcommittee agreed upon is to be composed of two representatives from the government, two from the Chamber of Mines, two from the Mine Workers' Union, and two representatives from the Industrial Federation. The committee was to start work today (Nov. 15).

MEXICO

Chihuahua

Torreon Smelter To Resume Operations Immediately

Torreon—The Cia. Metalurgica de Torreon will resume operations on Jan. 2, when it is expected that two of the furnaces will be blown in. This plant is owned by the Cia. Minera de Peñoles and has been under course of repairs for the last six months. The capacity of the furnaces has been increased by [illegible] the old ones with those taken from the big Mapimi smelter, which has been dismantled.

CANADA

British Columbia

Britannia Mining & Smelting Co.'s New Mill—Amber Discovered at Coalmont

Victoria—The time for the receipt of tenders for the steel work of the Britannia Mining & Smelting Co.'s new mill building, which will replace the wooden building destroyed by fire last February, closed Dec. 14. The new mill building will be constructed of fabricated steel and reinforced concrete. It is estimated that the steel work will cost between $[illegible] and $[illegible] and the completed building about $500,000.

The crushing machinery, which will consist of one set of 20 x 72-in. rolls, four sets of [illegible] rolls, and eighteen 7 x 10-ft. tube mills, has been ordered from the Taylor Engineering & Manufacturing Co. of Allentown, Pa. The construction of the new mill, which will have a capacity of [illegible] tons of ore per day, will be supervised by Bradley, Bruff & Labarthe of San Francisco. The town of Britannia Beach, which was destroyed by flood recently, will be rebuilt on higher ground, where it will be impossible for such a disaster to recur.

The result of the verdict of criminal negligence found against the Britannia company by the coroner's jury that passed upon the recent disaster by flood at Britannia Beach has been that the Attorney General of British Columbia has [illegible] against the [illegible] and [illegible] of the Britannia company for criminal negligence, and Wilfred Dion, who lost a wife, a child, and his household effects in the disaster, is suing the company for damages. This is a test case. Other writs have been issued, but will not be pressed until this case is decided.

The Granby Consolidated has entered suit in the Supreme Court against the Attorney General of British Columbia, asking for a declaration of its rights and liabilities under the British Columbia Taxation Act.

Actual mining done during 1921 in the Nanaimo Mineral Survey district, which takes in Vancouver Island and a considerable section of the British Columbia lower mainland, has not been equal to average years, though a report prepared by William M. Brewer, resident mining engineer, indicates that there has been considerable development work and a tendency has been displayed by operators to prepare for better market conditions.

Hazelton — All the vast territory known as the Omineca, the Peace River district, and the Cariboo are included in the area over which John D. Galloway, resident mining engineer, has jurisdiction. As to mining conditions in 1921, Mr. Galloway reports that there was little lode-mineral production, but that the placer gold output increased substantially. Many properties were under development and considerable prospecting was done. There are now in the northeastern district, according to Mr. Galloway, a number of prospects, which should prove attractive to those who are looking for prospects. Placer mining was vigorously pushed in the Cariboo in 1921. The old Bullion mine, at Quesnel Forks, once the most important hydraulic mine in British Columbia, was reopened. The Silver Standard mine and concentrator at Hazelton, were closed all of the year, but it is expected that operations will be resumed in the spring of 1922. Development of a promising coal property on the Telkwa River was started during the year. This property is known as the Betty mine.

As far as known, the only ore shipments made this year were a carload of concentrates from the Silver Standard (clean-up of mill bins), a shipment from the Hazleton View, and a few tons as test shipments from different properties. The production of placer gold was estimated at $80,000, as compared with $69,000 in 1920.

Alice Arm—Considerable road work has been done in the Alice Arm district in the last few months. There is now a good trail up the Illiance River Valley, and the Provincial Mines Department has assisted in trail construction on the northeast fork of the Kitsault River as well as in other parts of the district. This is facilitating actual mining as well as prospecting. The Moose group, in the Kitsault River section, has considerable ore in the bunkers awaiting shipment. Development work is said to have disclosed a large body of ore.

Stewart—The Bear River Bridge, which was washed out recently, is being replaced by the provincial government. The Salvator group, on the south side of the Marmot River, will be worked all winter.

Coalmont—It is stated that a discovery of amber has been made on the property of the Coalmont Collieries, in the Coalmont district. The favorable opinion of Edwin S. Oliver, of the Oliver Chemical Processes Syndicate, as to this respect, is said to have been confirmed by reports made on samples forwarded to Ottawa and New York chemists.

Trail—The Consolidated smelter received 5,756 tons of ore from Dec. 15 to Dec. 21 inclusive. Of this the Josie mine at Rossland shipped 102 tons and company mines the rest.

Nelson—Organization of the newly-formed Mining Association of Eastern British Columbia has been completed, and the following officers named: President, R. Randolph Bruce, Windermere; vice president, J. P. McFadden, New Denver; secretary-treasurer, W. H. Burgess, Kaslo; executive, W. A. Cameron, New Denver; James Anderson, Kaslo; E. G. Montgomery, Kimberley; W. T. McDowell, Ymir; Douglas Lay, Rossland; S. S. Fowler, Riondel; L. H. Biggar, Slocan City; Clarence Cunningham, Alamo; T. W. Bingay, Trail; S. G. Blaylock, Trail; J. H. Turner, Nelson. The organization's activities, it is expected, will be largely directed towards securing of legislation favorable to the mining industry.

TEXAS

Sulphur Beginning To Move on Gulf Coast

Gulf—It is reported in Galveston that three British steamships will load at once with crude sulphur, from the Texas Gulf Sulphur Co., for Australia. Large quantities of sulphur also have been sold to European countries. Movement of this sulphur will begin about Jan. 1, it is expected, shipments being made from Galveston, Texas City, and Freeport.

During the reconstruction period, European stocks of brimstone have become nearly depleted, and the outlook for renewed exports is bright. Another sign of an impending improvement in this industry is the construction at Galveston by the Texas Gulf Sulphur Co. of concrete storage bins and loading equipment that will make it possible to load a ship in eight hours, and will insure a large stock on hand for immediate export. It has been stated in Houston that the Union Sulphur Co., of Sulphur, Louisiana, has recently purchased the sulphur rights at Damon Mound, Brazoria County, Tex., and acreage in Liberty County.

KOREA

Unsankinko—The October clean-up of the Oriental Consolidated Mining Co. was $92,870, compared with $83,773 in September.

MICHIGAN

The Copper Country

Refined Copper Output for 1921 39 Per Cent of Normal—Material and Labor Costs Lower in 1922

By M. W. Youngs

Houghton — Only seven properties have been in operation in the Lake district throughout the year, the Calumet & Hecla and subsidiary mines having suspended on April 1. Refinery production for the year in the district is estimated at 39 per cent of normal, including the output of the Calumet smelters. Of the seven properties in operation, only four are producers, Copper Range, Quincy, Mohawk and Wolverine. The Seneca, Mayflower and Arcadian are engaged in development work.

Production of refined copper in 1921 is estimated at 107,000,000 lb. Of this, 45,000,000 lb. was produced the first three months, leaving 62,000,000 for the remaining nine months' period of curtailment. The average per month for the nine months was 6,890,000, as compared with 22,500,000 normally.

Refined copper production fell off somewhat in December in the Michigan Lake district, the output being estimated at 7,500,000 lb. or 33 per cent of normal. Throughout the greater part of the month there were eleven furnaces in blast, against fifteen in November. Calumet & Hecla had seven, Copper Range (Michigan) three, and Quincy one. Both Copper Range and Quincy continued to add a few men to their underground forces.

Copper Range, Quincy and the Stanton mines will finish the year with no more than normal stocks of metal on hand. Calumet & Hecla, however, still has a considerable surplus in spite of a large volume of sales throughout the year. These stocks are at least sufficient to prolong the period of suspension of mining operations until spring and when production is resumed it probably will be on a basis of not more than 50 per cent at the start.

Quincy, it is estimated, will finish the year with a production close to 15,000,000 lb., as compared with 19,216,070 in 1920. Quincy started to curtail in 1920 owing to depressed conditions and on April 1 of this year made a more drastic curtailment, working on a four-day schedule instead of six. In November there was a return to almost a full-time basis but forces were not materially increased. The tenor of Quincy rock shows no falling off with depth.

Copper Range will produce upwards of 30,000,000 lb. this year. A particularly pleasing development at the Copper Range mines has been the steady improvement in the character of the ground opened in Trimountain, where a heavy program of drifting has been in progress throughout the year. The rock in the Champion mine continues rich and though Baltic has shown no improvement the average yield for the three mines for the year should be close to 40 lb. of copper per ton of rock stamped.

Mohawk's production for the year was approximately 14,000,000 lb., and Wolverine's about 4,000,000. Mohawk is carrying on a normal program of development work and producing to the capacity of its mill.

Of the properties under development, Seneca is the most advanced and should become a regular producer on a fairly large scale in the latter part of 1922. Before this stage is reached a new hoist must be installed at the Seneca shaft.

Arcadian Consolidated has resumed sinking in the New Baltic shaft, which will be sunk to a depth of 1,060 ft., from which level a drift will be driven south to connect with the 1,050 level of the New Arcadian shaft. This drift will parallel the south drift from the ninth level.

Mayflower, in its new operation on the 1,450 level, is getting into fairly good looking ground to the north, although considerable trap is in evidence.

Calumet & Hecla is still aggressively pushing its geological research work in an effort to establish certain rules for the location of copper deposits. Some interesting theories are being put to practical test and there is a good deal of encouragement in progress to date.

Material and labor costs will be about normal in 1922 and will have a favorable effect on mining costs. High freight rates still continue, however, and this will be the biggest abnormal factor in cost items.

Gogebic Range

Overwinding Accident at Pabst Mine—Mild Weather Aids Stripping

Ironwood—An overwinding accident occurred recently with the electric hoist at "H" shaft of the Pabst mine, with some damage to the equipment but no other serious results. It is thought that one of the skips, which are run in balance with a single drum, was lowered a hundred feet or so below the dump when the other was rung up from the bottom to the next level to be filled. This was far enough to release the lock on the reverse gear of the hoist and permit the engineer to reverse the hoist, which he evidently did when he next started up. The empty skip was pulled up to the sheave, the 1⅛-in. rope was broken and the skip dropped 2,000 ft. to the bottom of the shaft. The shaft was was not damaged except at the bottom, and the safety devices, of which the hoist had two independent systems, stopped the hoist before the rope was in the engine house. There must have been some error in the setting of the safety stops although they were checked at frequent intervals. The safety stops used were of the most modern type.

Mild weather has continued surprisingly long this winter and been a great aid to the stripping operations under way at the open pits. Past the middle of December the thermometer did not drop below 15 deg. and was often above 25 deg. above zero.

Marquette and Menominee Ranges

Three Mines Resume on Menominee Range—Cleveland-Cliffs Unwatering North Lake—Imperial Mine Hoisting Ore

By William N. Newett

Ishpeming—The Fogarty and Baltic mines of the Verona Mining Co. and the Balkan mine of the Balkan Mining Co., on the Menominee Range, have resumed mining operations. Both companies are subsidiaries of Pickands, Mather & Co. The Balkan has been closed since June; the other two since August. About 350 men have been given employment on a full-time basis. The wage scale varies from $2.10 on surface to $2.75 underground and is far below the scale which was in effect when the properties were shut down.

Rapid progress is being made with the construction of the blast furnace which is to be operated in connection with the West Chapin Mining Co. and a large part of the material is now on the site. It is planned to erect a chemical plant later. The furnace will produce charcoal iron and will be the fifth furnace of this type in the Lake Superior region. None of these furnaces is being operated at present, but the one at Marquette, belonging to the Pioneer Iron Co., will be blown in as soon as repairs now being made to the stack are completed.

The Cleveland-Cliffs Iron Co. has started the task of unwatering North Lake, which is a short distance from the company's Barnes-Hecker mine on the Marquette Range. Considerable water was encountered underground and it was thought that the lake water was finding its way into the workings. There are 368,000,000 gal. of water and silt to be removed from the lake. About one-half is silt. Electric-driven centrifugal pumps will be used in the work. It is estimated that five months will be required to unwater. The water will be sent to the Carp River. This is the second instance where the Cleveland-Cliffs Iron Co. has unwatered a lake. Some years ago Lake Angeline, in Ishpeming, was pumped out. About 800,000,000 gal. was handled.

The Imperial mine is now hoisting ore, the skips having been placed in commission a few days ago. This is the first iron mine to be opened by Henry Ford. About 160 men are employed. All ore will be placed in stock for shipment to the River Rouge furnaces next season. Ford's wage scale is $4.80 a day for the first thirty days, then $6 a day. The scale applies to all alike.

MINNESOTA

Riverton — Extensive surface plant improvements have been made during the last two months at the Sagamore mine of the Lake & Savage Co. Foundations were laid for a screening and drying plant which it is believed will be the largest and most modern structure of its kind in the Superior district.

COLORADO

Shutdown of Moffat Road Postponed—Mine Executives To Meet at Denver—C. F. & I. Co. To Increase Operations at Pueblo

(From Our Special Correspondent)

Denver—Court proceedings which threatened the immediate closing down of the Moffat railroad have been postponed, pending adjustments which it is hoped will bring the revenues of the company to a level approximating operating costs. In granting an extension, Judge Johnson scored residents and business men in the territory served by the road for their failure to co-operate with the company by diverting business legitimately belonging to this line, to other carriers. The road serves the northwestern part of the state, and a territory rich in agricultural and mineral resources, but, owing to its heavy grades over the Continental Divide, is expensive to operate.

The response to an inquiry sent out by the Colorado Metal Mining Association has been so general, that the executive committee has decided to arrange for a conference meeting of mine managers and superintendents to convene during the annual meeting of the association in January. The conference will be held on Jan. 16, at the State Capitol Building in Denver, and will consider problems directly connected with mine operations.

Telluride—Shipments of concentrate during November were as follows: Smuggler-Union, 60 cars; Tomboy, 45 cars; total 105 cars.

Cripple Creek—The Moonlight Gold Mining Co. has developed a shoot of $15 ore in territory west of the old shaft.

Alma—The Queen company, operating on Mt. Bross, has started its air compressor and is cutting a station at the breast of its main tunnel to instal a diamond drill. Present plans call for about 2,000 ft. of drilling, the holes to be run at about 45 deg. to the course of the main tunnel to prospect the lateral veins.

The application of the Colorado & Southern to reduce service on the South Park branch to tri-weekly, does not seem to be warranted, as the company is failing to make prompt deliveries of freight sent over the line under the [illegible] service.

The Louisiana & Colorado Mining Co. has reduced its force for the winter, and is cleaning up and shipping the high-grade silver ore mined to the A. V. smelter at Leadville.

The new buildings being erected at the [illegible] property are ready for machinery. The [illegible] has been [illegible] and is now working two shifts on the new lower tunnel, which when completed will cut the [illegible] at a greater depth and [illegible] of the old workings.

The [illegible] Investment, Mining & [illegible] Co. is [illegible] on Pen sylvania Mt. from the Mosquito side, is building a new concentrating and flotation mill to treat the low-grade ore which it is developing. The orebody at present is about 24-ft. wide and carries gold, silver, lead and zinc. Connections are being made with the lines of the Colorado Power Co. All units of the mill and mine are to be operated by electricity.

The recent gold strike on the Hard To Beat property is holding up well, Buildings have been erected and a crew of eight men is employed on development. One car of high-grade gold quartz has been shipped to the smelter.

The London Co. is working two shifts on the new raise which is being driven from the 2200-ft. point in its new lower tunnel to connect with the working of the old Extension property.

Several sets of lessees are working on the South London and are maintaining a monthly output of four to five cars of gold ore, assaying 6 to 8 oz. gold per ton.

The engineers who have been examining the North London workings completed the sampling and geological work the first of the month. If this examination proves satisfactory a new mill will be installed in the early spring.

SOUTH DAKOTA

Cutting Company Resumes—Golden Feather Mill Nearly Completed—Golden Crest Preparing for Work—State Mine Inspector's Report Out

Lead—According to the annual report of Otto Ellerman, State Mine Inspector, for the year ended June 30, 1921, the gold mines treated 1,572,989 tons of ore having a value of $5,712,853. This was distributed as follows: Homestake, 1,484,391 tons valued at $5,354,038; Trojan, 88,598 tons valued at $358,815. Placers, $1,000. The Refinite Company used 1,000 tons of aluminum silicate in the manufacture of water softener. The U. S. Gypsum Co. mined 8,223 tons of gypsum. The Dakota Plaster Co. treated 3,933 tons of gypsite. The King Mica Co. shipped one car of mica and Dennis Henault shipped 6 tons of the same material. The Maywood Chemical Co. shipped 950 tons of lithia ore to its refining plant in New Jersey. The quarries were active with an increased production of limestone and structural materials. The coal mines produced 9,000 tons of coal.

There were employed in the metal mines during the period covered an average of 1,717 persons. The coal mines employed thirty-three and the quarries 158.

There occurred 565 accidents, classified as follows: Fatal, three; serious (time lost more than fourteen days), 86; and slight, 476.

The general mining conditions show an improvement. The labor situation has been relieved and there is a tendency towards a return to normal with increased activity in all branches of the industry.

Deadwood—The Cutting Mining Co., has resumed work at its property and the shaft is being unwatered. New pumps are being installed and development work will be started at the 500 level as soon as the water is removed.

The Golden Crest property is being put in shape for continued work. The force will be increased after Jan. 1 and it is probable that the cyanide plant will be placed in commission this coming year.

The Golden Feather mill is nearing completion. Ten stamps are being installed and will be ready for operation during January. Amalgamation will be used at the start but a cyanide annex will be added soon. This company has taken over the Monarch mine and will work it along with its own property.

At the Eagle Bird the tunnel is being continued and has reached a distance of over 900 ft. There remains 600 ft. to drive and this will be completed early in 1922.

NEW MEXICO

Mining in the State Reviewed—Eighty-five Mine Principal Shipper—Mogollon Active

By James P. Porteus

Lordsburg—The salient features of mining in New Mexico during 1921 were the comatose condition prevailing in the copper industry, the steady production of gold and silver in the Mongollon district, a decrease in zinc, lead, silver, iron, manganese, and fluorspar production generally with the closing of many mines, and, more specifically, the blocking out of a large quantity of siliceous copper ores in the Calumet & Arizona's Eighty-five mine, in the Lordsburg district. The big copper properties with plants at Santa Rita, Hurley, and Tyrone were affected like all others in the Southwest, and are still marking time. The Fierro-Hanover camp became inactive when the zinc and iron mines shut down about Oct. 1.

A reduction of freight rates on zinc ores to the Kansas smelters from this field, recently made, looks favorable, but a corresponding reduction in iron and manganese rates must also be made before these commodities can move. Copper ores were shipped continuously from the Lordsburg district until Nov. 1. The ore shipments from this district for the last twelve months from Dec. 1, 1920, to Dec. 1, 1921, amounted to 355 carloads, a total of 17,222 tons of copper and silver-lead ores. The approximate value was $275,555. The bulk of this tonnage has come from the Calumet & Arizona's Eighty-five, which was a steady shipper up to Nov. 1 when the smelter stockpiles were reported full. Ores extracted since then have been stored in pockets, bins, and dumps at the mine. No stoping was done during this period; only ores mined in course of development were moved. It is estimated that the ores blocked out in the last year would more than pay the purchase price of the property, which was bought about eighteen months ago for over a million dollars.

The Co-operative mine has shipped during the year a total of about 600 tons of lead-silver ores to the El Paso smelter. The total value was $34,200, an average of $57 per ton. The Last Chance mine was taken over early in the year by John H. White and associates, and work was started in April. Since that time about 30,000 tons of straight silver ore, averaging 15 oz. or better, has been blocked out. A fifty-ton mill and a power house are being built.

The Mogollon Mines Company at Mogollon, continued working steadily throughout the year. Its production for eleven months up to Dec. 1 has been 5,544 oz. gold and 280,000 oz. silver, compared with 5,400 oz. gold and 289,000 oz. for the same period last year. Ore milled by the company has amounted to 44,915 dry tons in eleven months this year, compared with 37,979 dry tons in the same period last year. This ore came from the Last Chance, Confidence, and Deadwood mines. Lump fluorspar ores from Lordsburg and a milled product from Las Cruces were shipped intermittently.

ARIZONA

Tom Reed Mill To Handle Custom Ores

By James H. McClintock

Kingman—The Tom Reed Gold Mines Co., at a directors' meeting in Los Angeles, gave W. B. Phelps, superintendent, authority to contract with mine owners of the Oatman section for the milling of custom ore, the contracts to be based on the percentage of recovery shown in compiling the results of a two-weeks' experimental run recently completed. The mill has been making as high as a 98 per cent saving on Tom Reed ore, in gold and silver. There is little in the Tom Reed ore save silica and the precious metals. The mill is expected to care for about 125 tons a day.

About 50 tons a day of Big Jim ore, brought by tramway, are being handled in the United Eastern mill. The main shaft of Big Jim is being carried down to the 750 level.

The mill of the C.O.D. Mines Co. has resumed operation, with W. Rith in immediate charge. About fifty miners are taking out ore. The main shaft is 500 ft. deep.

Globe—E. G. Deane, manager of the Superior & Boston, states that the company within a short time will be employing its full crew of 125 men. Miners are now being employed for stoping on the 400 and 600 levels of the Footwall vein. Medium-grade copper-silver ores are to be sent to the International smelter at Miami, the higher grade being held until resumption of copper smelting at El Paso. This better ore samples about 8 per cent copper and 30 oz. silver.

CALIFORNIA

Central Eureka Gets New Option on South Eureka

San Francisco — According to local reports the blue sky law of California has begun to show its teeth. In connection with the Silver Hills of Nevada fiasco, it is alleged that Don C. Aldridge, a stock broker, manipulated the prices for this stock by a system of "cross sales." Aldridge's license has been revoked by the commissioner of corporations. It will be remembered that W. J. Loring, president of the company, issued a statement in September, 1921, to the effect that the Silver Hills property was practically worthless and that the company would endeavor to find another mine. (*Eng. and Min. Jour.*, Oct. 29, 1921, p. 714.)

Grass Valley—The North Star Mines Co. is increasing its activity in development work, particularly upon its lowest levels.

Control of the "Bullion" property by the Intermountain Development Co., of Salt Lake City, is announced in local reports which intimate that work on the property may be resumed.

Sutter Creek — Central Eureka has secured a new option on the South Eureka. This amounts to practically a renewal of the old one and gives Central Eureka until Feb. 1, 1923, for further development of South Eureka's ground. A new 85-ft. steel headframe and electric hoist are almost completed and the physical appurtenances of this mine are in excellent condition for further development at depth.

Redding—The wire rope tram from the Hornet mine of the Mountain Copper Co. to Mathewson on the Southern Pacific will be put in commission Jan. 15, 1922, it is reported.

Downieville — The Wheeler mine in the Downieville district is reported to be milling gold ore from a promising vein.

NEVADA

Simon Silver-Lead Flotation Plant Increasing Tonnage—Rochester Silver's November Output Above Normal

Rochester—November production by the Rochester Silver Corporation was 5,071 tons, recovered value $68,000, and operating profit $21,440. This is above normal for this company, although October was also a good month, production being 4,780 tons and recovered value $63,000. Mine conditions are said to be good, with ore of excellent grade being mined from a lens opened up in October in the foot wall section of the east vein on the 100 level.

Mina—The flotation plant of the Simon Silver-Lead Mines Co. is now being operated two shifts and tonnage gradually increased. The plant was shut down for four days during the second week in December owing to discontinuance of electric power during that time. The first car of silver-lead concentrates has been shipped to the smelter at Midvale, Utah, and there is a car of zinc concentrates ready for shipment to the company plant at Harbor City, Cal. At the Mabel mine, operated under option by the West End Consolidated Mining Co., of Tonopah, the shaft has reached a depth of 100 ft. below the tunnel level and a station is being cut preparatory to crosscutting to the veins and drifting.

Divide—The Tonopah Divide mine's production for November was 1,741 tons, average value per ton being $29.12, and the gross value $50,697. This is approximately the same as for the previous month. A new double-drum hoist was installed in December, and production was curtailed for nine days. The usual development footage is maintained, with no new developments of importance. Shaft sinking will not be resumed until the 1,200 stations are completed.

Royston—Many leases are being operated in this district, and claim owners are busy. Some ore is being saved from development work, but the district is hardly on a self-sustaining basis as yet. In the Betts, or original strike, the incline shaft passed into the foot wall of the ore at a depth of 40 ft. The shaft was continued to a depth of 53 ft. and a crosscut has been started from the bottom toward the west to cut the ore on its dip. The Hudson Mining Co., owner of the principal portion of the district where the development is actually being done, is preparing to continue sinking its 300-ft. incline shaft to the 600 level.

Tonopah—Production continues normal in this district. Bullion shipments for November totaled about $650,000. The Tonopah Belmont has reported favorable developments on new orebodies from 1,100 level. Wages were reduced at the West End on Dec. 16 to conform to the scale paid by other Tonopah companies. General conditions throughout the district were about as usual, with no new discoveries of importance reported. Labor conditions are good.

Pioche—Ore shipments from the Pioche district for the week ended Dec. 23 were confined to the Bristol and Black Metal properties which continue to ship an average of 60 tons each daily to the Salt Lake smelters. The Bristol production is largely a silver-lead-copper ore which fluxes satisfactorily, and that from the Black Metals mine carries an average of 14 ounces silver and only 1 per cent of insoluble, the ore being limestone impregnated with argentiferous manganese and iron.

Leasers' ore is going out from an increased number of small properties, a recent car coming from [illegible]. The total tonnage shipped for the week was estimated at [illegible] tons.

Ely—A shipment of copper, consisting of 35 cars, was dispatched from McGill Dec. 10. This represents the final clean-up of the copper stored at the smelter of the Nevada Consolidated Copper Co.

UTAH

Tintic Shipments Decrease—To Unwater Lower Levels in Gemini and Ridge Valley

Eureka—The Tintic Standard has declared a dividend of 5c. a share. This company's new mill is producing 3,000 ounces of silver and 1,000 lb. of copper daily. Reserves of mill ore in the mine are estimated at 511,000 tons, and reserves of shipping ore at 343,000 tons. Recoverable metal from the low-grade ore is placed at $12.08 and from the high-grade at $34.05 a ton.

Shipments from the Tintic district for the week ended Dec. 19 amount to 156 cars as compared with 176 cars the week preceding. Shippers were: Tintic Standard, 49 cars; Chief Consolidated, 39; Chief Consolidated, 13; Victoria, 12; Iron Blossom, 10; Eagle & Blue Bell, 9; Centennial-Eureka, 9; Dragon, 8; Colorada, 5; Mammoth, 3; Empire Mines, 3; Swansea, 3; Gemini, 3; Bullion Beck, 2; Alaska, 1.

Water is receding in the lower workings of the Gemini and Ridge Valley mines and it is proposed by the management to further lower the level by pumping, which it is thought possible with the present equipment. The water will be pumped into open fissures. With the lower levels unwatered leasing in these properties is likely to be greatly stimulated.

Park City—Shipments for the week ended Dec. 19 were 2,430 tons of ore. Shippers were: Judge allied companies, 1,128 tons; Silver King Coalition, 867; and Ontario, 435.

IDAHO

Coeur d'Alene District

Proposed Revision of Mining Law Not Popular

Wallace—At a recent meeting of the Wallace Board of Trade the proposed revision of the mining laws was referred to a standing committee for investigation and report. The chairman of the committee is L. E. Hanley, mining engineer and secretary of the Hecla Mining Co. The following special committee was appointed to act with the standing committee: J. F. Gyde, attorney for the Bunker Hill & Sullivan company; Rush J. White, mining engineer and chairman of the Columbia section of the A. I. M. E.; Thomas H. [illegible], assistant manager of the Federal Mining & Smelting Co.; J. J. Day, president and manager of the Tamarack & Custer Consolidated Mining Co.; and F. W. [illegible], general engineer of the Callahan Zinc-Lead Co. The committee recommended that protest be made against the bill as a whole for the reason that many of its provisions were regarded impractical and that any radical changes in the mining laws, which are now generally well understood, would result in much confusion and prove detrimental to the mining industry. The committee was instructed to prepare a formal resolution embodying this view and forward the same to the chairman of the house committee on mines and mining and to the Idaho delegation in congress.

A strike of unusual interest has been made by the Cedar Creek Mining & Development Co. on Granite Creek, about four miles from Murray. A crosscut from drift on the original to a parallel vein picked up three stringers of ore which have merged into a solid shoot of lead-silver ore, 22 in. thick.

The strike made on Lookout Mountain a few months ago is promising. Since crosscutting the vein, drifting has proved an ore shoot 75 ft. long that will average for a width of 6 ft. 30 per cent lead and 20 ounces silver. Where the vein was intersected the main ore showing was galena, but this soon disappeared and for the past 60 ft. the drift has been in a body of cerussite with streaks and bunches of dark crystals carrying 80 per cent lead. The company plans to put in a tramway in the spring which will deliver the ore to the wagon road, where it will be loaded on trucks for shipment to the Bunker Hill smelter at Kellogg. It will require a tram about 1,800 ft. long. Control of the property is owned in Kellogg.

Other Districts

Warren—Los Angeles, Cal., capital has taken a lease upon the Thomas Creek placers. Investigations are being made for a number of other concerns, particularly with regard to the monazite sands found in this section.

Featherville—The Hammon Engineering Co., of San Francisco, has shipped fifty carloads of dredging material and supplies. The company plans to invest about $1,000,000 and two new $150,000 dredges are being put in.

Rocky Bar—The Idaho Gold Corporation, of Salt Lake City, headed by Earl McIntyre, principal owner of the Mammoth mine, in Utah, and James Ivens, a director of the Silver King Coalition at Park City, is preparing for active operations in and around Rocky Bar. Rocky Bar figured largely in gold production in the early days. The company has acquired a considerable area.

At Atlanta, 15 miles east of Rocky Bar, interests affiliated with the St. Joseph Lead Co. are said to be doing some work.

Hailey—As a result of increased acitvity in Blaine County, that section will take second or third place among the mineral-producing areas of Idaho this year, according to a preliminary estimate of Stewart Campbell, state mine inspector, who states the county's increase in mineral output over 1920 will be in the neighborhood of $200,000. Considerable attention has been directed to the region because of the activities of Bunker Hill & Sullivan with regard to deep development, having in view the picking up of commercial ore below a series of faults. Federal Mining & Smelting Co.'s production from its Independence property has averaged about 20 cars monthly, and the Golden Glow re-entered the producing class with an output of 10 cars, netting approximately $250,000.

OREGON

Bay Horse Mine Expected To Resume Shipments Soon

Huntington—After negotiations extending over a considerable period, the United States Metals Co. has concluded arrangements with the Oregon-Washington R. & N. Co. for putting in a side-track just below the Bay Horse mine. The ore will be dropped from the mine to the loading bins by a gravity tram, and it is anticipated shipments will be underway to Tacoma smelter early in 1922.

MONTANA

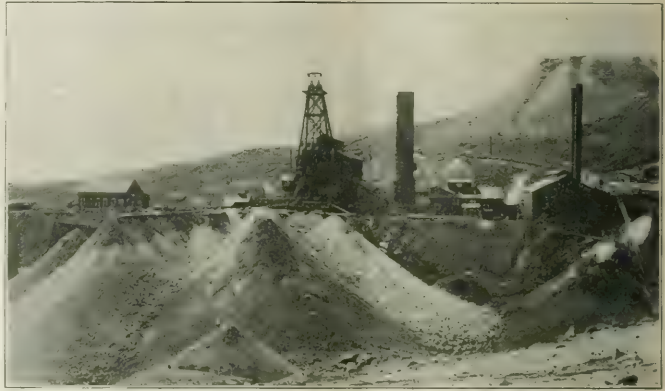
Anaconda Reported To Have Made Contract With Silica Gel Corporation —Hibernia Crosscut Near Vein

By A. B. Keith

Butte—In unofficial circles at Anaconda gossip has it that if the Anaconda Copper Mining Co. has closed a contract with the Davidson Chemical Co., as reported in all probability it has to do with the use of the new substance known as "silica gel," the patents covering the manufacture of which are held by the Davidson company. This substance enters materially into a simplified process of making sulphuric acid, in which the Anaconda company is greatly concerned in view of its proposed entry into the fertilizer manufacturing field. Silica gel because of its peculiar properties facilitates the making of high-grade sulphuric acid by a process hitherto regarded as too expensive for general use. The product is handled by the Silica Gel Corporation, which is a subsidiary of the Davidson Chemical Co.

The copper ore developed by Butte & Superior on the 2,200 level of the Black Rock mine is reported to be looking much more promising. The orebody is said to be from 8 to 12 ft. wide and to carry 8 per cent copper and considerable silver. Drifting is continuing on this level and a fair tonnage is already indicated. Crosscutting is being pushed on the 2,600 level and although good speed is being made it will require two months more, it is believed, before the copper is reached at this depth.

The Tuolumne Copper Mining Co. has started sinking its Main Range shaft from the 1,600 to the 2,400 level, and in view of the fact that the zone of commercial ore has been located on the 1,600 level, it is believed, that no time will be lost in crosscutting directly to a point corresponding to this zone on the lower levels, or to drift to it, for it is considered possible that the Spread Delight vein may be cut on dip by the shaft. The ore on the 1,600 level has been continuous for some distance, it has been found.


Schoettner Studio, Butte

A SHAFT OF THE TUOLUMNE COPPER MINING CO., BUTTE, MONT.

The crosscut on the 750 level of the Hibernia is believed to be close to the vein, according to miners, who are cutting stringers and finding other evidence of the proximity of the fissures. The Hibernia is owned by the Davis-Daly Copper Co., and at present is the only property of the company in operation.

Elkhorn—Shipments of concentrates from the Elkhorn mill of the Boston & Montana Development Co. have commenced. Recovery is reported to be about 90 per cent.

MEXICO

Sonora

Mexican Corporation Gets Silla Mines

Nogales—The Silla mines, about 60 miles east of Mazatlan, Sinaloa, are reported to have been transferred to the Mexican Corporation, a holding company for the National Mining Corporation of London. The deal was made through W. J. Mitchell and Harold S. Gay, of Nogales, Ariz.

The old quartz mill at Planchas de Plata, 20 miles southwest of Nogales, has been sold as junk and will be torn down.

THE MARKET REPORT

Daily Prices of Metals

Dec.	Copper, N. Y., net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
22	13.625	32.125	32.50	4.70	4.35@4.40	4.85@4.90
23	13.625	32.125	32.50	4.70	4.35@4.40	4.85@4.90
24	13.625	32.125	32.50	4.70	4.35@4.40	4.85
26	......	....	......	....	.....	......
27	13.625	32.375	32.75	4.70	4.35@4.40	4.80@4.85
28	13.625	32.75	33.125	4.70	4.375@4.40	4.80@4.85

*These prices correspond to the following quotations for copper delivered: 13.875c. for the week.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York, cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Tin is quoted on the basis of spot American tin, 99 per cent grade, and spot Straits tin.

London

Dec.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3 M		Spot	3 M	Spot	3 M	Spot	3 M
22	66¼	67¼	74½	170¾	172⅝	25¼	24⅝	27⅜	27⅜
23	66¼	67¼	74½	171	172¾	25	24⅜	27⅝	27⅜
24	...	...	...	....	..	...	...	...	...
26	.	...	...	....	...	...	...	...	...
27	..	..	...	....	.	..	..	..	..
28	66¼	67¼	74	172¼	174¼	24$\frac{7}{16}$	24¼	27⅛	27⅜

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver and Sterling Exchange

Dec.	Sterling Exchange "Checks"	Silver			Dec.	Sterling Exchange "Checks"	Silver		
		New York Domestic Origin	New York Foreign Origin	London			New York Domestic Origin	New York Foreign Origin	London
22	420	99⅝	65¼	35⅛	26				
23	417¾	99⅝	64¼	34¾	27	41[illegible]	99⅝	64⅜	
24	418⅜	99⅝	64¼	34⅞	28	418¾	99⅝	[illegible]	35⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one half cent premium.

Metal Markets

New York, Dec. 28, 1921

The extreme quietness which has characterized the metal markets during the last week was expected, and will no doubt continue until the first week of January. Although orders have been few, prices have been well maintained, **which is most encouraging. In the dull** periods early in the year, prices would **usually be shaded in an attempt to at**tract business, but this is no longer the **case. The reasons are that producers** are in a better financial condition, and also feel that prices are likely to ad**vance rather than go lower.**

Copper

The larger producers continue to ask 14c. for first quarter deliveries, but, as was true last week, have been unable to secure domestic orders at that price. Several interests have been willing to take orders at 13.875c., delivered, and in the last day or two, two or three million pounds could have been obtained for January delivery at nearby points for 13.75c. Practically no business has been done at any level. Export orders have also declined but not to the extent that domestic business has. Prices have **been firm; in fact, producers have prob**ably netted slightly more on export business than last week. European quotations are generally 14.125@14.25c., c.i.f.

Lead

The official contract price of the American Smelting & Refining Co. continues at 4.70c. There is some disposition to quote 5 or 10 points above this, especially for desilverized lead, but practically all of the business has been done at the lower level. It has been small. In the Middle West the market has also been quiet. Chemical lead was obtainable early in the week and possibly still is, at 4.35c. in at least one quarter, but other producers are quoting as high as 4.425c. Desilverized is selling at from 10 to 15 points premium, and good corroding lead has sold as high as 4.60c., Chicago, in the last two or three days. Some producers are entirely sold out up to February. Reports are current of American lead going to Europe. A small amount has been sold, but it is hardly a paying business yet. The London spot price fell off markedly today, the quotation incidentally being split closer than has been the case since pre-war days.

Zinc

Business has been exceedingly dull with many producers quoting nominal prices above the market. There is no pressure to sell, and with ore at present prices there is little or no more profit than was obtainable when the price of zinc was 4.25c. High-grade is in somewhat better demand at unchanged prices of 6c. with freight allowed.

Tin

Tin has also been quiet over the Christmas holiday, the absence of London quotations yesterday being an added reason for lack of interest in the local market. Electrolytic is available in small amounts at approximately the same prices as are asked for Straits. The 99 per cent grade is in somewhat freer supply, but nearly all of the tin now being handled is of the Straits variety. Tin for forward delivery is generally quoted at the same price as for spot.

Arrivals of tin, in long tons: Dec. 17th, Straits [illegible] 22nd, Straits [illegible] 24th, [illegible] 27th, Liverpool, [illegible]

Gold

Gold in London: Dec. [illegible]

Foreign Exchange

The exchange market has been ex[illegible]. Any [illegible] demand [illegible] doubt [illegible] crease quotations, for the market has an upward tendency. On Tuesday, Dec. 27th, francs were 8.045c.; lire, 4.405c.; and marks, 0.545c. New York funds in Montreal again declined to new low levels and yesterday were quoted at 6$\frac{11}{16}$ per cent premium.

Silver

The market has been featureless, with practically no business doing over the Christmas holidays, and these conditions are likely to continue until after the New Year.

The market closes dull, with tendency uncertain.

Mexican Dollars—Dec. 22d, 49⅞; 23d, 49¾; 24th, 49¾; 27th, 49¾; 28th, 49⅜.

Other Metals

Quotations cover wholesale lots unless otherwise specified.

Aluminum—20c. per lb. for 99 per cent grade; 19c. for 98@99 per cent; 18c. for 94@98 per cent. Outside market nominal at 17@18c. for 98@99 per cent virgin grades.

Antimony—Chinese and Japanese brands, 4.50c.; W. C. C. brand, 5.25@5.75c. per lb. Cookson's "C" grade, spot, 9c. per lb. Chinese needle antimony, lump, nominal at 4c. per lb.

Iridium—Nominal, $150@$170 per oz.

Palladium—Nominal, $55@$60 per oz.

Platinum—$80@$84 per oz. Market quiet.

Quicksilver—$49@$50 per 75-lb. flask. San Francisco wires $49.50. Market better.

The prices of the following metals remain unchanged from the figures published in these columns on Dec. 3: Bismuth, Cadmium, Cobalt, Molybdenum, Monel Metal, Nickel, Osmium, Rhodium, Selenium, Thallium and Tungsten.

Metallic Ores

Manganese Ore—23@24c. per unit, seaport; chemical ore, $55@$60 per gross ton, lump; $75 per net ton, powdered. Nominal.

The market is generally exceedingly quiet, and prices on the following ores remain unchanged from the figures published in the Market Report in the Dec. 3 issue: Chrome, Iron, Magnetite, Molybdenum, Tantalum, Titanium, Tungsten, Uranium, Vanadium, Zircon, and Zirkite ores.

Zinc and Lead Ore Markets

Joplin, Mo., Dec. 24—Zinc blende per ton, high, $29.10; basis 60 per cent zinc, premium, $29; Prime Western, $28; fines and slimes, $26@$24; average settling price, all grades of zinc, $25.67.

Lead, high, $59.90; basis 80 per cent lead, $57; average settling price, all grades of lead, $58.09 per ton.

Shipments for the week were: Blende 11,142; lead, 2,498 tons. Value, all ores, for the week, $431,190.

Around 2,500 tons of 56 per cent zinc ore was purchased on a basis of $30, considered, with the present market conditions, a better buy by the purchaser than 60 per cent zinc ore on the prevailing basis of $28. With four points off, at one dollar per point, the ore brought about $24 per ton.

Platteville., Wis. Dec. 24—Blende, basis 60 per cent zinc, $30. Lead ore, basis 80 per cent lead, $58 per ton. Shipments for the week: Blende, 84 tons. Shipments for the year: Blende, 10,896; lead ore, 1,793 tons. Shipped during the week to separating plants, 623 tons blende.

Non-Metallic Minerals

Feldspar—No. 1 pottery grade, $6.50 per long ton; soap grade, $7.50, f.o.b. North Carolina points. No. 1 Canadian, ground, $23, f.o.b. Ohio points.

Fluorspar—Gravel, guaranteed 85 per cent CaF_2 and not over 6 per cent silica, $20 to $22.50 per ton, f.o.b. Kentucky. Enamel grades, $32.50 to $50. F.o.b. New Mexico points, 85 per cent grade, $12.50 per ton; 95 per cent, $25; 97 per cent, $30.

Fuller's Earth—16 to 30 mesh, $20 per ton; 30 to 60 mesh, $20; 60 to 100 mesh, $17; 100 mesh and over, $15, f.o.b. Pennsylvania points. Market quiet.

Graphite—Ceylon lump, first quality, 5½@6½c. per lb.; chip, 4@5c.; dust, 2½@3¾c.; No. 1 flake, 5@7c.; amorphous crude, $15@$42.50 per ton. All f.o.b. New York.

Talc—20 to 200 mesh, $7@$12 per ton, f.o.b. Vermont; $8.25@$13, f.o.b. points in Georgia.

Generally dull markets exist for the non-metallic minerals, and there is no quotable change in the following from the prices published in our Dec. 3 issue: Asbestos, Barytes, Bauxite, Borax, Chalk, China Clay, Emery, Gypsum, Kaolin, Limestone, Magnesite, Mica, Monazite, Phosphate Rock, Pumice Stone, Pyrites, Silica and Sulphur.

Mineral Products

Arsenic—7@7¼c. per lb., f.o.b. New York; 6½@7c. for imports.

Potassium Sulphate—Powder, domestic, 90c.@$1 per unit, basis 90 per cent, f.o.b. New York.

Sodium Nitrate—$2.30 per cwt. ex vessel, Atlantic ports.

Copper Sulphate — Large crystals, 5.65c. per lb.; small crystals, 5.55c., f.o.b. New York.

The price of Sodium Sulphate is unchanged from the quotations published Dec. 3.

Ferro-Alloys

Ferrochrome—Carload lots, spot and contract, 60 to 70 per cent chromium, 6 to 8 per cent carbon, 12c. per lb. of chromium contained; 4 to 6 per cent carbon, 13c., f.o.b. works.

Ferromanganese—English and German, $58.35@$54, c.i.f. Atlantic seaports. Other quotations unchanged.

No quotable changes have taken place in the following ferro-alloys from the prices quoted in the Dec. 3 issue: Ferrotitanium, Ferrocerium, Ferromolybdenum, Ferrosilicon, Ferrotungsten, Ferro-Uranium, and Ferrovanadium.

Metal Products

Copper Sheets — Current New York list price, 21.25c. per lb.; wire, 15@15.25c.

Yellow Metal — Dimension sheets, 17.75c.; sheathing, 16.25c.; rods ⅜ to 3 in., 14.75c.

Zinc Sheets—$8.50 per 100 lb. less 8 per cent on carload lots, f.o.b. works.

Lead Sheets and Nickel Silver, unchanged from Dec. 3 quotations.

Refractories

Chrome Brick—$43@$45 per net ton.

Fire Brick — First quality, 9-in. shapes, $28 per 1,000, Pennsylvania, Ohio, and Kentucky.

Magnesite Brick—9 in. straights, $52@$55 per net ton, f.o.b. works.

Silica Brick—9 in., per 1,000, $28@$40 in carload lots, f.o.b. shipping points.

Prices on the following are unchanged from the figures published in the Dec. 3 issue: Bauxite Brick, Chrome Cement.

The Iron Trade

Pittsburgh, Dec. 27, 1921

The Steel Corporation's reduction in its prices of tubular goods of $5 to $6 a ton on Dec. 15, was followed on Dec. 21 by a reduction in wire products to $5 a ton under the prices ruling before the advance of Sept. 12, which held for a while and then slipped away. In the cases of both tubular goods and wire products the reductions were made on account of shading by independent producers. New prices are 2.25c. for plain wire, 2.50c. for nails, and 3.15c. for galvanized barb wire.

The finished steel markets generally have been quiet in the past week, as is invariably the case at this holiday time. Buying is likely to increase gradually during January, substantially restoring the degree of activity that has prevailed in the past few months.

Steel prices are likely to remain practically stationary while general conditions remain as at present. Should buyers show a disposition to take hold in a free manner, particularly if they are willing to contract for forward deliveries, competition would probably carry prices down a trifle farther, but only by a very few dollars a ton. A thorough liquidation has already occurred.

Pig Iron—The quietness that has prevailed in the market for three months past is natural at this time of the year. Old contracts are now well worked out and buyers have extremely small stocks, so that a moderate volume of buying is to be expected in January. The market is quotable at $20 for bessemer, $19 for basic and $19.50@$20 for foundry, Valley, freight to Pittsburgh being $1.96.

Coke

Connellsville—Furnace, $3.35@$3.50 foundry, $4.25@$4.75 per ton.

Anaconda Copper Shares as an Investment

By Harry J. Wolf

Written for Engineering and Mining Journal

IN A RECENT DISCUSSION of the copper situation from the investor's viewpoint (*Engineering and Mining Journal*, Oct. 22, 1921), attention was called to the fact that most of the large copper mining companies were shut down, were temporarily maintaining their properties at a loss, and were not paying dividends, so that commitments in their shares could not be called investments according to the strict definition of the term. However, it was pointed out that a logical interpretation of current industrial developments indicated that numerous copper mining companies, now idle, would certainly resume operations in due time, and again earn profits and pay dividends. Consequently, the purchase of their shares, although speculative according to the technical meaning of the word, could be regarded with assurance as "investment for profit."

One of the best examples of this type of mining company is Anaconda, whose stock is frequently referred to as our premier mining security, on account of its established earning ability, and its consequent popularity among investors and speculators. There are good reasons for this popularity, as all consistent readers of the *Engineering and Mining Journal* must know. Well-informed mining men are aware that Anaconda is a powerful, successful, and progressive corporation, with a broad charter, an able operating staff, and a most efficient technical organization.

In its numerous mines, Anaconda maintains large reserves of ore of all grades, and recent deep-level development has opened strong veins of high-grade copper ore at a depth several hundred feet below any of its other underground workings. These discoveries indicate the downward extension of some of the company's best veins, and justify reasonable expectation of the availability of an immense tonnage of payable ore throughout extensive vein areas for future exploitation.

Anaconda is the greatest copper producing company in the world, having produced during recent years one-third of the copper output of the United States, and one-sixth of the world's production. Its metal production is not limited to copper, for it is also one of the greatest silver producers. Its output of gold is substantial, and during certain months prior to its shut-down it produced more zinc than copper.

It operates its own great metallurgical plants at Anaconda and Great Falls, Montana, and controls numerous important and successful subsidiaries. It is developing and equipping large copper properties in Chile, and these will eventually become heavy producers of low-cost copper.

The company's interests are rapidly becoming more diversified, and it is steadily advancing its power in the manufacturing field by increasing the number of its finished products. Its electrolytic zinc commands a premium over the market price for ordinary brands of the metal. Its copper rod and wire mill at Great Falls is the most modern and efficient plant of its kind in the United States, and its wire can find a profitable market from Pennsylvania to California.

In connection with its metallurgical operations it recovers or manufactures numerous byproducts at a substantial profit, including sulphuric acid, arsenic, and the highest quality of white lead. It has produced ferromanganese at a profit, and may develop an important industry in this alloy whenever market conditions therefor will permit. Last year it completed an initial plant for the manufacture of fertilizer having about three times the strength of any fertilizer produced elsewhere, and this new product will in all probability be marketable at a profit as far east as Indiana, and possibly Ohio. Anaconda's fertilizer industry bids fair to expand into one of great importance and permanence.

The Anaconda Copper Mining Co. was incorporated in 1895, as successor to the Anaconda Mining Co., with a charter of forty years duration. In 1910 its capital stock was increased from 1,200,000 shares to 6,000,000 shares, of a par value of $25, for the purpose of acquiring properties of other mining companies operating in the Butte district. Under this plan it acquired, in exchange for its stock, the property and assets of the Boston & Montana Consolidated Copper & Silver Mining Co., Red Metal Mining Co., Washoe Copper Co., Butte & Boston Consolidated Mining Co., Big Blackfoot Lumber Co., Trenton Mining & Development Co., Parrot Silver & Copper Co., Alice Gold & Silver Mining Co., and Diamond Coal & Coke Co. During the same year it acquired from the Amalgamated Copper Co., in exchange for stock, the Original Consolidated Mining Co., Colusa-Parrot Mining & Smelting Co., and the Clark Montana Realty Co.

In 1914 Anaconda purchased the assets of the International Smelting & Refining Co., which in turn owned the entire capital stock of the Tooele Valley Railway Co., International Lead Refining Co., and Raritan Copper Works. In 1915 the Amalgamated Copper Co. was absorbed through an exchange of stock. In 1916 it purchased the Pilot Butte Mining Co.

At the present time, the Anaconda Copper Mining Co. controls, directly or indirectly, the Butte, Anaconda & Pacific Railway, International Lead Refining Co., International Smelting Co., Mountain Trading Co., Raritan Copper Works, Raritan Terminal & Transportation Co., Tooele Valley Railway Co., United Metals Selling Co., Diamond Coal & Coke Co., Anaconda Lead Products Co., Andes Copper Co., Andes Copper Mining Co., Potrerillos Railway Co., Santiago Mining Co., and Walker Mining Co. Its importance and power as a holding company is further illustrated by the fact that on December 31, 1920, it owned 285,300 shares of Inspiration Consolidated Copper Co., 59,600 shares of Greene Cananea Copper Co., 217,040 shares of Butte Copper & Zinc Co., and half the stock of the Arizona Oil Co., the other half being owned by Inspiration.

Enough has been said to show the importance and scope of the company's operations. From the standpoint of investment or speculation it is necessary also to inquire into its capitalization and financial condition. On July 25, 1915, the par value of the company's stock was changed from $25 to $50. The authorized capitalization is $[illegible], of which $116,562,500, represented by 2,331,250 common shares, is outstanding. Ahead of this stock there is a funded debt in the amount of $50,000,000 in the form of [illegible] secured gold bonds, due Jan. 1, 1929, half of which bear 6 per cent and the other half 7 per cent interest. These bonds are a direct obligation of the company, [illegible] secured by [illegible] stocks of [illegible] companies valued in excess of $[illegible]. An additional obligation is the company's guarantee [illegible], principal and interest, of $[illegible] Andes [illegible] 8 per cent notes.

According to the balance sheet as of Dec. 31, 1920, the total assets were valued at $[illegible], of which $[illegible] represented current assets. The current liabilities were $17,[illegible], thus leaving the working capital at $[illegible], as compared to $[illegible] in 1919 and $[illegible] in 1918. The profit and loss surplus was $[illegible]. Net assets behind the common stock amounted to $[illegible], or $86.36 a share.

Anaconda's earning ability is illustrated in the following figures from the income account for the past eight years:

Year	Operating Revenue	Net Income	Dividends	Earned Per Share	Paid Per Share
1913	$44,433,856	$11,323,499	$12,997,500	$2.61	$3.00
1914	37,130,550	8,789,588	9,077,500	1.88	2 00
1915	68,256,381	16,695,807	9,325,000	7 16	4 00
1916	110,964,242	57,941,834	17,484,375	21.80	7 50
1917	123,238,568	39,721,188	19,815,625	14.73	8.50
1918	119,753,535	26,907,055	17,484,375	8 92	7.50
1919	72,008,124	8,031,879	9,325,000	2.19	4 00
1920	67,758,984	6,992,010	6,993,750	1.15	3.00

The last dividend disbursement was made in November, 1920, when $1 a share was paid. During the copper boom of 1916, the shares sold up to 105⅜, and within a period of about four months dropped to a little above 70 during February, 1917. After rising to 87 in May, 1917, they fell to 51⅛ during November of the same year. The shares then went up to 74¼ in October, 1918, down as low as 54⅝ in February, 1919, up to 77⅜ in July, 1919, and then steadily downward to 30 in December, 1920. Since the extreme low, following the passing of the dividend for the first time since 1896, the shares have worked up and down between 43½ and 31¾. During this period the stock has been accumulated by investors and speculators who were confident that sooner or later the market price must begin to discount the period of prosperity towards which the copper industry was surely advancing, in view of the decrease in unsold stocks of metal, and the gradual improvement in demand. On October 19, 1921, the shares began a steady advance from 38½ to 50, which was reached on December 15. At any price below 50, the shares would yield over 10 per cent with a $5 dividend, or over 8 per cent with a $4 dividend. During the past six weeks the shares have been in the process of advancing, after a period of accumulation extending over about ten months. Under such circumstances the stock will be purchased by "investors for profit," who desire to profit from the discounting of future more favorable conditions, and who are willing to await future dividends with patience; and also by the large army of speculators and traders who ignore dividends for the most part, but who are very much alive to the discounting process referred to, and the accompanying rallies and reactions due to the usually-present lack of balance between supply and demand for the shares. The proposed merger with the American Brass Co. has also stimulated interest in the stock. This merger will be a definite step in advance in the marketing of copper and its possibilities are great. The financial details of the transaction have received wide publicity recently in the press. Anaconda will offer 223,125 unissued shares to present stockholders to provide additional cash required to pay American Brass shareholders for such of their holdings as will be required under Anaconda's offer to purchase.

From almost any angle, interest in Anaconda shares appears to be justified at this time, especially in view of the possibility that the company may resume operating and be running as usual before the middle of 1922.

Ontario's Metal Production for First Nine Months of 1921

Returns received by the Ontario Department of Mines from the metalliferous mines, smelters, and refining works of the province for the nine months ending Sept. 30, 1921, are tabulated below, and for purposes of comparison the quantities and values are given for the corresponding period in 1920. Tons throughout are short tons of 2,000 lb.

ONTARIO'S METALLIFEROUS PRODUCTION, FIRST NINE MONTHS 1921

Product	Quantity 1920	Quantity 1921	Value 1920	Value 1921
Gold, oz	424,297	474,956	$8,735,768	$9,818,073
Silver, oz	7,831,143	6,586,910	8,435,088	4,382,520
Platinum metals, oz	214	915	13,917	41,060
Nickel (metallic), lb	7,060,078	4,521,407	2,440,303	1,542,607
Nickel oxide, lb	4,886,712	975,310	1,146,768	197,812
Other nickel compounds, lb	159,725	169,885	15,362	15,936
Nickel in matte exported tons (*a*)	17,446	2,908	8,723,000	1,454,000
Cobalt (metallic), lb	159,151	30,564	373,168	91,786
Cobalt oxide, lb	509,043	162,364	1,015,696	330,914
Other cobalt compounds, lb	1,717	......	1,629	......
Cobalt-nickel oxides and residues, lb	......	366,581	......	116,948
Lead, pig, lb	1,290,726	2,539,551	117,122	134,871
Copper sulphate, lb	98,918	99,553	4,946	5,973
Copper (metallic) lb	4,853,495	2,926,407	795,423	330,084
Copper in matte exported tons (*a*)	9,497	2,886	2,659,160	451,760
Iron ore, tons (*b*)	5,468	22	47,120	99
Iron pig, tons (*c*)	49,422	82,318	1,395,948	2,079,729
Tons			$35,920,418	$20,994,172

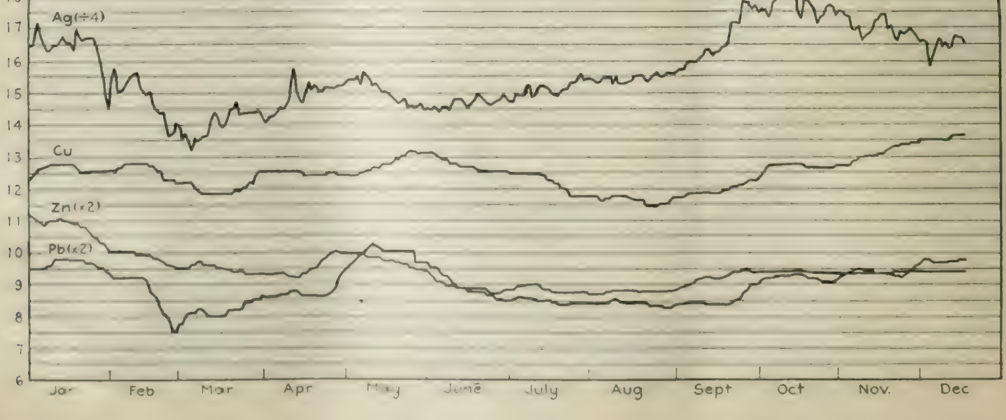
(*a*) Copper in matte was valued at 14c. per lb. in 1920, 8c. in 1921, and nickel in matte at 25c. per lb. in both years. Total matte produced was 17,013 tons, of which 7,011 tons was exported.

(*b*) Shipments of iron ore totaled 27,775 short tons, valued at $119,262. The figures in the table cover shipments to points other than Ontario blast furnaces.

(*c*) Total output of pig iron from both domestic and imported ore was 393,303 tons, worth $9,936,597. Figures in the table represent proportional product from Ontario ore.

The outstanding feature in connection with Ontario's metalliferous production is the growing importance of her gold-mining industry. Provided the output for the last quarter of the year equals that of the third quarter, Ontario's gold production for the full year 1921 will be approximately $13,870,000, and, with the premium added, $15,870,000. Fortunately the success or failure of Ontario's gold industry does not depend on the exchange premium.

1921 Prices of New York Copper, Silver and Lead and St. Louis Zinc



COMPANY REPORTS

Tonopah Mining Co. Has Profitable Year

A report of operations of the Tonopah Mining Co. of Nevada for the year ended Dec. 31, 1920, states that 56,587 dry tons of ore was produced, averaging 0.142 oz. of gold and 13.21 oz. of silver, value $16.93 per ton, on which a profit of $238,822.92 was made. There was also treated 6,979 tons of dump ore of an average content of 0.065 oz. of gold and 6.40 oz. of silver, valued at $7.83, on which a profit of $13,449.14 was made. Income and surplus account follows:

Surplus Dec. 31, 1919		$4,381,247.11
Deduct:		
Interest due from subsidiary companies, previously credited to surplus but not as yet collected	$73,475.47	
Portion of dividend received from Tonopah Placers Co. in 1916, withdrawn from surplus and applied to reduction of value of stock held	40,000.00	
	$113,475.47	
Less amount charged into operations in 1919 for Internal Revenue Tax, not used, restored to surplus	30,000.00	83,475.47
		$4,297,771.64
Net earnings and income for 1920	$410,399.92	
Dividend paid. No. 56, Oct. 21, 1920, 5 per cent	50,000.00	
Net increase in surplus		360,399.92
		$4,658,171.56
Charges against profit and loss account:		
Additional reserve for depreciation on bonds in treasury		16,039.95
Surplus, Dec. 31, 1920		$4,642,131.61

Receipts and disbursements follow:

RECEIPTS

American Smelters Securities Co., mill products	$237,164.60
U. S. Mint, mill products	529,825.68
Tonopah Belmont Development Co., ore shipped	46,970.61
Commercial Bank of Spanish America, sale of silver bullion	42,062.83
Interest on bank balances	891.56
Interest on loans and investments	85,301.60
Dividend, Tonopah & Goldfield R. R. Co.	89,047.00
Dividend, Esmeralda Power Co.	10,875.00
Dividend, Tonopah Banking Corporation	120.00
Real estate rentals	2,066.55
Administration expense from subsidiary companies	30,000.00
Demand loans from bank	25,000.00
Loans from subsidiary companies	159,951.58
Demand loans returned	210,000.00
Sale of $82,850 United States First Liberty Loan 3½ per cent bonds	80,877.60
Draft in transit, end of year 1920	10,000.00
Accounts collected	17,275.65
Total receipts	$1,577,430.26
Cash on hand Jan. 1, 1920	18,588.97
	$1,596,019.23

DISBURSEMENTS

Labor, supplies, freight, salaries and general expense	$616,688.85
Power purchased	49,434.61
Industrial insurance	12,475.38
Fire insurance	8,241.68
Taxes paid	[illegible]
Exploration expense	[illegible]
Demand loans paid	[illegible]
Loans to subsidiary companies	[illegible]
Loans on [illegible]	[illegible]
Securities purchased	[illegible]
Sundry investments	[illegible]
Custom ore purchased	74,66[illegible]
Dividend No. 56, 5 per cent	[illegible]
Total disbursements	[illegible]
Cash on hand Dec. 31, 1920	$35,563.35

Mining costs for 1920 were $5.945 per ton, compared with $6.370 for 1919. Milling costs were $4.077 per ton in 1920.

The company is capitalized at $1,000,000, with shares of $1 par value.

Broken and unbroken ore is in sight to maintain a production of 150 tons per day for about four months.

Tonopah Placers Co.

A report of operations of the Tonopah Placers Co., a subsidiary of the Tonopah Mining Co. of Nevada, for 1920, states that Dredge No. 1 continued operating during the year on the Magnum Bonum Placer. This dredge handled 1,340,876 cu.yd. of material during the year, giving a total production of $169,121.57, or an average value of 12.6c. per yd., with a net operating profit of $66,280.15, or 5c. per cu.yd. It is probable that this dredge will have about four or five years more operation. During 1920 the company acquired a parcel of the Magnum Bonum Placer and the Rankin Placer, adding about twenty-seven acres of available dredging ground for this dredge. The operation of No. 2 dredge was suspended in December of 1919 and continued closed down during all of 1920. Dredge No. 3 operated during 1920 upon ground leased from the Long Island Mining Co. Its operation was suspended in the early part of December, 1920. Income statement follows:

Surplus, Dec. 31, 1919		$[illegible]
Deduct cost of leasehold right to dredge property of Long Island Mining Co., chargeable to net income for 1920		10,000.00
		$[illegible]
Net earnings and income for year 1920		
Gross value of bullion shipped to mint	$[illegible]	
Cost of operations	181,[illegible]	
Profit from operations	$52,[illegible]	
Other income:		
Earnings from electric lighting plant	$[illegible]	
Interest on bank balances	[illegible]	
Interest on Liberty Bonds	237.50	
Rental of company cottages	[illegible]	
Miscellaneous	1,505.22	
	$3,328.71	
Net income for year 1920		$[illegible]
		$[illegible]
Charges against profit and loss account:		
Reserve for depletion, 10 per cent on cost of property, and [illegible] per cent on plant and equipment for year 1920		177,484.39
Excess of depletion for 1920, over surplus, written off against capital stock		$32,[illegible]
Cubic yards dredged		[illegible]
Gold produced, ounces		[illegible]
Silver produced, ounces		[illegible]
Value per yard		$0.13

Capital stock authorized and issued amounts to $1,000,000, of which the Tonopah Mining Co. of Nevada owns 83⅓ per cent.

Mandy Mining Co.

A report of operation of Mandy Mining Co., a subsidary of the Tonopah Mining Co., of Nevada, for 1920, states that mine operations were suspended in March, 1919, as all of the high-grade ore had been taken out at that time and stored at Sturgeon Lake. Income statement follows:

Surplus Dec. 31, 1919			$[illegible]
Less adjustments for the year 1919			
Additional income tax paid		$[illegible]	
Ore settlements with smelter		[illegible]	[illegible]
			$[illegible]
Net earnings and income for year 1920			
Gross value of 2,310 dry tons ore shipped to smelter		$[illegible]	
Interest on bank balances		[illegible]	
Interest on [illegible] bonds		[illegible]	
Sale of equipment		[illegible]	
Miscellaneous		[illegible]	
		$[illegible]	
Cost of operations			
Freight and treatment	$[illegible]		
[illegible]	[illegible]		
Interest on loans	[illegible]		
[illegible]	[illegible]		
General expense	[illegible]	[illegible]	
Net income for year 1920			$[illegible]
			$[illegible]
Charges against profit and loss account:			
[illegible]		[illegible]	
[illegible]		[illegible]	[illegible]
Surplus, Dec. 31, 1920			$[illegible]

MINING STOCKS

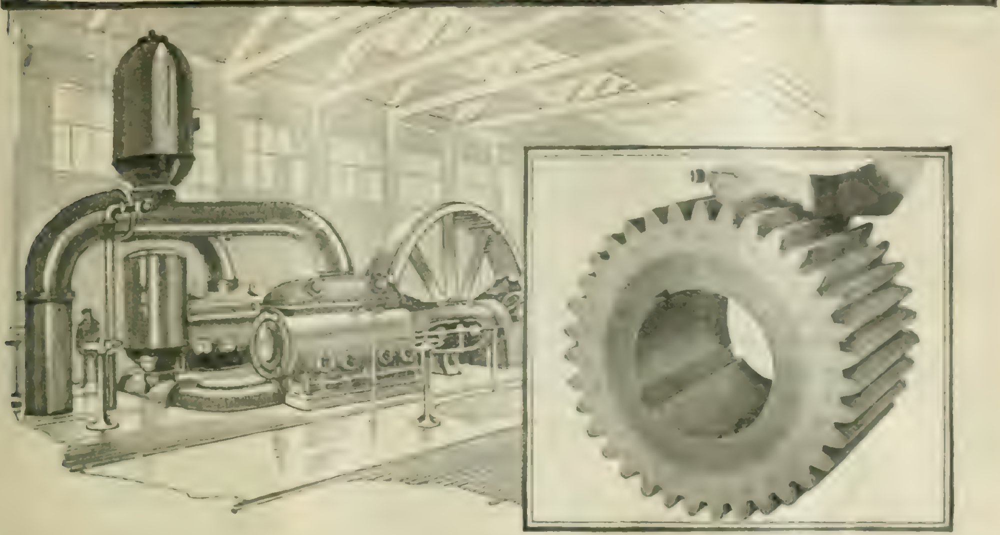
Week Ended December 24, 1921

Stock	Exch.	High	Low	Last	Last Div.	
		COPPER				
Ahmeek	Boston	60½	58½	58½	Sept. '20, Q	$0 50
Alaska-Br. Col. new.	N. Y. Curb	2⅜	2¼	2¼		
Allouez	Boston	24	22½	23	Mar. '19	1 00
Anaconda	New York	49½	47⅞	49½	Nov. '20, Q	1.00
Arcadian Consol.	Boston	3¼	3	3		
Ariz. Com'l	Boston	9	9	9	Oct. '18, Q	.50
Big Ledge	N. Y. Curb	*29	*26	*28		
Bingham Mines	Boston	13	12½	12½	Sept. '19, Q	.25
Calumet & Arizona	Boston	...	...	58	Dec.'21 Q	.50
Calumet & Hecla	Boston	280	269	269	June '20, Q	5.00
Canada Copper	N. Y. Curb	*37	*35	*37		
Centennial	Boston	10	10	10	Dec. '18, SA	1.00
Cerro de Pasco	New York	35½	33⅛	34⅞	Mar. '21, Q	.50
Chile Copper	New York	16	14½	15⅜		
Chino	New York	28	26½	28	Sept. '20, Q	.37½
Columbus Rexall	Salt Lake	*11½	*10½	11½		
Con. Arizona	N. Y. Curb	*4	*4	*4	Dec. '18, Q	.05
Con. Copper Mines	N. Y. Curb	1 13/16	1 5/16	1 9/16		
Copper Range	Boston	40	37½	37½	Sept. '20, Q	.50
Crystal Copper	Boston Curb	*56	*53	*56		
Davis-Daly	Boston	6¾	6⅜	6⅜	Mar. '20, Q	.25
East Butte	Boston	11½	10	10	Dec. '19, A	.50
First National	Boston Curb	*85	*75	*75	Feb. '19, SA	.15
Franklin	Boston	2	1¾	1¾		
Gadsden Copper	Boston Curb	†*50	†*40	*49		
Granby Consol.	New York	28	25½	28	May '19, Q	1.25
Greene-Cananea	New York	28	27	27¼	Nov. '20, Q	.50
Hancock	Boston	3	3	3		
Howe Sound	N. Y. Curb	2¼	2⅛	2⅛	Jan. '21, Q	.05
Inspiration Consol.	New York	41½	37⅝	40	Oct. '20, Q	1.00
Iron Cap	Boston Curb	8	7½	7½	Sept. '20, K	.25
Isle Royale	Boston	23	23	23	Sept. '19, SA	.50
Kennecott	New York	26⅞	24⅜	26⅞	Dec. '20, Q	.50
Keweenaw	Boston	1½	1½	1½		
Lake Copper	Boston	2¼	2¼	2¼		
La Salle	Boston	†2½	†1¾	2		
Magma Chief	N. Y. Curb	....	....	*8		
Magma Copper	N. Y. Curb	25½	23	25½	Jan. '19, Q	.50
Majestic	Boston Curb	....	....	*5		
Mason Valley	Boston	1¾	1½	1¾		
Mass Consolidated	Boston	2½	2½	2½	Nov. '17, Q	1.00
Miami Copper	New York	27⅛	25⅞	26⅞	Nov. '21, Q	.50
Michigan	Boston	2⅜	2	2		
Mohawk	Boston	58	54	55	Nov. '20, Q	1.00
Mother Lode Coa.	N. Y. Curb	5⅜	5⅛	5⅜		
Nevada Consol.	New York	15⅛	14⅞	15	Sept. '20, Q	.25
New Cornelia	Boston	18¼	16½	16½	Aug. '20, K	.25
North Butte	Boston	13⅜	12	12¼	Oct. '18, Q	.25
North Lake	Boston	†*40	†*20	*24		
Ohio Copper	N. Y. Curb	*11	*11	*11		
Old Dominion	Boston	25	23	23	Dec. '18, Q	1.00
Osceola	Boston	34½	32¼	32¼	June '20, Q	.50
Phelps Dodge	Open Mar.	†185	†175	....	Oct. '21, Q	1.00
Quincy	Boston	45½	41½	41½	Mar. '20, Q	1.00
Ray Consolidated	New York	15⅛	14⅞	15	Dec. '20, Q	.25
Ray Hercules	N. Y. Curb	*18	*15	*15		
St. Mary's Min. Ld.	Boston	44½	42	44	Dec. '21, K	1.00
Seneca Copper	Boston	....	....	24½		
Shannon	Boston	1¼	1	1	Nov. '17, Q	.25
Shattuck Arizona	New York	9	8½	8½	Jan. '20, Q	.25
South Lake	Boston	†1	†*50	*60		
Superior & Boston	Boston	1¼	1¼	1¼		
Tenn. C. & C. cfs.	New York	10⅛	9¼	10½	May '18, I	1.00
Tuolumne	Boston	*68	*60	*63	May '13	.10
United Verde Ex.	Boston Curb	30	28½	29	Nov. 21, Q	.25
Utah Consol.	Boston	1½	1¼	1¼	Sept. '18.	.25
Utah Copper	New York	64	61	64	June '21 Q	.50
Utah Metal & T.	Boston	1 3/16	1⅛	1⅛	Dec. '17.	.30
Victoria	Boston	1⅝	1½	1½		
Winona	Boston	*50	*45	*45		
Wolverine	Boston	11½	10½	11		
		NICKEL-COPPER				
Internat. Nickel	New York	12⅝	11¾	12¼	Mar. '19.	50
Internat. Nickel, pf.	New York	69	69	69	Nov. '21, Q	1 50
		LEAD				
National Lead	New York	84	83	83	Sept. '21, Q	1 50
National Lead, pfd.	New York	108½	108½	108½	Dec. '21, Q	1 75
St. Joseph Lead	New York	13	12½	12½	Dec. '21, Q	25
		QUICKSILVER				
New Idria	Boston	2	1½	1½		
		ZINC				
Am. Z. L. & S.	New York	13½	12½	12½	May '20	1.00
Am. Z. L. & S. pfd.	New York	39	37	37	[illegible] '20, Q	1 50
Butte C. & Z.	New York	5¼	5⅛	[illegible]	[illegible] '18	.50
Butte & Superior	New York	21	17¾	19¼	Sept. '20	1.25
Callahan Zn-Ld	New York	6½	5¾	6	[illegible]	.50
New Jersey Zn.	N. Y. Curb	124½	123	124½	[illegible] '21, Q	2 00
Yellow Pine	Los Angeles ††			*45	Sept. [illegible]	03
		GOLD				
Alaska Gold	New York	⅜	¼	¼		
Alaska Juneau	New York	¾	⅝	⅝		
Carson Hill	New York	11½	11	11½		
Cresson Consol. G.	N. Y. Curb	2⅛	2 1/16	2⅛	June '20, Q	$0.10
Dome Extension	Toronto	*69	*69	*69		
Dome Mines	New York	18½	18½	18½	Oct. '21, Q	.25
Florence Goldfield	N.Y. Curb	*30	*28	*30		
Golden Cycle	Colo. Springs	*71	*70	*70	June '21, Q	.02
Goldfield Consol.	N. Y. Curb	*4	*3	*3	Dec. '19,	.05
Hollinger Consol.	Toronto	7.79	7.75	7.76	Dec.'21, 4 wks.	.05
Homestake Mining	New York	53½	53½	53½	Nov.'21, M	.25
Kirkland Lake	Toronto	*30	*24	*30		
Lake Shore	Toronto	1.27	1.20	1.27	Nov. '21, K	.02
McIntyre-Porcupine	Toronto	2.04	1.97	2.04	Sept.'21, K	.05
Porcupine Crown	Toronto	*12	*11	*12	July '17,	.03
Porcupine V. N. T.	Toronto	*18½	*17	*18		
Portland	Colo. Springs	*42	*41	*41	Oct. '20, Q	.01
Schumacher	Toronto	*31½	*30	*31		
Silver Pick	N. Y. Curb	....	....	*50		
Teck Hughes	Toronto	*15½	*15	*15½		
Tom Reed	Los Angeles ††	....	....	*40	Dec. '19,	.02
United Eastern	N. Y. Curb	2 3/16	2 1/16	2⅛	Oct. '21, Q	.15
Vindicator Consol.	Colo. Springs	*21	*20½	*21	Jan. '20, Q	.01
White Caps Mining	N. Y. Curb	....	....	*4		
Yukon Gold	N. Y. Curb	1½	1½	1½	June '18,	.02½
		SILVER				
Batopilas Mining	New York	½	½	½	Dec. '07, I	.12½
Beaver Consol.	Toronto	*22	*19½	*19½	May '20, K	.03
Coniagas	Toronto	1.50	1.30	1.50	May '21, Q	.12½
Crown Reserve	Toronto	*10	*8½	*10	Jan. '17,	.05
Kerr Lake	N. Y. Curb	3⅜	3⅜	3⅜	Oct. '21, Q	.12½
La Rose	Toronto	*34	*32	*33½	Apr. '18,	.02
McKinley-Dar.-Sav.	Toronto	*17	*14	*17	Oct. '20, Q	.03
Mining Corp. Can.	Toronto	1.10	1.00	1.10	Sept. '20, Q	.12½
Nipissing	N. Y. Curb	7¼	6⅞	7	Oct. '21, Q	.03
Ontario Silver	New York	3⅜	2¾	3	Jan. '19, Q	.50
Ophir Silver	N. Y. Curb	....	....	*12	Jan. '12,	.10
Temiskaming	Toronto	*27	*25	*26	Jan. '20, K	.04
Trethewey	Toronto	*9½	*9	*9½	Jan. '19,	.05
		GOLD AND SILVER				
Boston & Montana	N. Y. Curb	*1⅛	*88	*91		
Cash Boy	N. Y. Curb	*6	*4	*5		
Dolores Esperanza	N. Y. Curb	1¼	*75	1		
El Salvador	N. Y. Curb	*7	*6	*6		
Jim Butler	N. Y. Curb	....	....	*7	Aug. '18, SA	.07
Jumbo Extension	N. Y. Curb	*2	*1	*2	June '16,	.05
Louisiana Con.	N. Y. Curb	....	....	⅛		
MacNamara M.& M.	N. Y. Curb	*10	*9	*10	May '10,	.02½
Tonopah-Belmont	N. Y. Curb	1 3/16	1 1/16	1 1/16	Apr. '21, Q	.05
Tonopah-Divide	N. Y. Curb	*64	*56	*64		
Tonopah-Extension	N. Y. Curb	1⅜	1 5/16	1⅜	Oct. '21, Q	.05
Tonopah Mining	N. Y. Curb	1 7/16	1⅜	1 7/16	Oct. '21, SA	.05
West End Consol.	N. Y. Curb	*83	*75	*80	Dec. '19, SA	.05
		SILVER-LEAD				
Caledonia	N. Y. Curb	*6	*6	*6	Jan. '21, M	.01
Cardiff M. & M.	Salt Lake	†*95	†*87	*92	Dec. '20,	.15
Chief Consol.	Boston Curb	3	3	3	Aug. '21, Q	.05
Consol. M. & S.	Montreal	19	18	18	Oct. '20, Q	.62½
Daly Mining	Salt Lake	†3.00	†1.15	....	July '20, Q	.10
Daly-West	Boston	2	1⅞	1⅞	Dec. '20, Q	.25
Eagle & Blue Bell	Boston Curb	†3	†2¼	2¼	Apr. '21, K	.05
Electric Point	Spokane	*4	*3½	*4	May '20, SA	.03
Federal M. & S.	New York	12	10	10	Jan. '09,	1.50
Federal M. & S., pfd	New York	42½	36½	38	Dec. '21, Q	1.00
Florence Silver	Spokane	*19	*18	*19	Apr. '19,	.01½
Grand Central	Salt Lake	*41	*40	*41	Jan. '21, K	.01
Hecla Mining	N. Y. Curb	4⅜	4⅛	4⅛	Sept. '21, Q	.10
Iron Blossom Con.	N. Y. Curb	*40	*25	*40	Apr. '20, Q	.02½
Judge M. & S.	Salt Lake	†3.00	†2.00	2 50	Sept. '20, Q	.12½
Marsh Mines	N. Y. Curb	*4	*3	*3	June '21, I	.02
Prince Consol.	Salt Lake	*7	*5½	*7	Nov. '17,	.02½
Rambler-Cariboo	Spokane	*4	*3½	*4	Feb. '19,	.01
Rex Consol.	N. Y. Curb	*8	*7	*7		
South Hecla	Salt Lake	....	†*12½	....	Sept. '19, K	.15
Standard Silver-Ld.	N. Y. Curb	*10	*10	*10	Oct. '17,	.05
Stewart Mining	N. Y. Curb	*3	*3	*3	Dec. '15	.05
Tamarack-Custer	Spokane	2.25	2.15	2.25	Jan. '21 K	.04
Tintic Standard	Salt Lake	1.87½	1 77½	1.85	July '21, Q	.05
Utah Apex	Boston	3	2⅝	2¾	Nov. '20, K	.25
Wilbert Mining	N. Y. Curb	....	....	*1	Nov. '17,	.01
		VANADIUM				
Vanadium Corp.	New York	32½	31	31⅛	Jan. '21, Q	1.00
		ASBESTOS				
Asbestos Corp.	Montreal	53	50	52	Oct. '21, Q	1.50
Asbestos Corp., pfd.	Montreal	77	76	77	Oct. '21, Q	1.75
		SULPHUR				
Freeport Texas	New York	15½	13¾	14½	Nov.'19, Q	1.00
Texas Gulf	New York	41½	34½	41	Dec.'21, Q	1.00
		MINING, SMELTING AND REFINING				
Amer. Sm. & Ref.	New York	45¾	42½	45	Mar '21, Q	1.00
Amer. Sm. & Ref. pf	New York	88½	87	87	Dec. '21, Q	1.75
Am. Sm. pf. A	New York	87½	87½	87½	Oct. '21, Q	1.50
U. S. Sm. R. & M.	New York	37½	36½	36½	Jan. '21, Q	.50
U.S. Sm. R. & M. pf.	New York	..		44	Oct. '21, Q	.87½

*Cents per share. †Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. ††Quotations missing.

Toronto quotations courtesy Hamilton B. Wills; Spokane, Pohlman Investment Co.; Salt Lake Stock and Mining Exchange; Los Angeles Chamber of Commerce and Oil, Colorado Springs, The Financial Press, N. Y.

Geared machinery that operates quietly and with very little vibration is sure to have a longer and more useful life



A handful of cotton is used for the smallest Fabroil Gear—about two bales for the largest

Fabroil Gears make pump operation smooth

Used as motor pinions driving duplex, triplex and quadruple pumps, and operating for long periods without shut-down, Fabroil Gears have proved their worth.

Where metal gears, were unequal to the task, the combined strength and elasticity of Fabroil Gears made possible rapid operation without racking. Unaffected by oil, water or change in temperature, and working in the open or in humid fume-filled interior, these gears give satisfactory service.

For a wide range of uses Fabroil Gears are made in any sizes from one inch diameter upward. All sizes are used in the operation of pumps.

Ask the nearest G-E office for complete information

General Electric Company

General Office
Schenectady, NY

Sales Offices in
all large cities

[illegible]

ENGINEERING & MINING JOURNAL

Think "SEARCHLIGHT" First

ADVERTISING RATES

POSITIONS VACANT—Business Opportunities and other undisplayed ads, 8 cents a word, minimum $2.00 an insertion.

POSITIONS WANTED—Evening work wanted, tutoring and other undisplayed ads of individuals looking for employment, 4 cents a word, minimum 75 cents, payable in advance.

ADD 5 WORDS for box number in undisplayed ads if replies are to any of our offices. There is no extra charge for forwarding replies.

DISCOUNT OF 10% if one payment is made in advance for 4 consecutive insertions of undisplayed ad.

ADS IN DISPLAY TYPE—Space is sold by the inch (30 in. to a page), the price depending upon total space used within a year, some space to be used each issue.

RATE PER INCH for ads in display space:

1 to 3 in., $4.50 an in.	15 to 29 in., $3.90 an in.
4 to 7 in., $4.30 an in.	30 to 49 in., $3.80 an in.
8 to 14 in., $4.10 an in.	50 to 99 in., $3.70 an in.

EMPLOYMENT SERVICE

EXECUTIVES qualified for salaries of $2,500 to $25,000 and upward, are invited to communicate confidentially with the undersigned, who will conduct preliminary negotiations for such positions. A procedure is used which places you in the position of being approached, avoids jeopardizing present connections, and conforms to the most exacting personal and ethical requirements. Of particular advantage as a test of conditions, to determine the advisability of changing. Details mailed confidentially on receipt of name and address only, without obligating or committing you in any way. Established 1910. R. W. Bixby, Inc., 308 Lockwood Building, Buffalo, New York.

POSITIONS WANTED

CHIEF chemist and metallurgist, experienced zinc, manganese, steel works, drop forging, heat treatment. PW-311, Eng. & Min. Journal, Old Colony Bldg., Chicago, Ill.

METALLURGICAL chemist and millman desires connection as mill superintendent or assistant; fourteen years' experience in the States and Mexico in mill construction and operation; economical and efficient treatment of low grade gold silver ores in particular; prefer cyanidation or flotation; age 37; fluent Spanish. PW-312, Eng. & Min. Journal,

METALLURGIST and smelter executive available. Technical education. Eleven years in laboratories and plant investigations, ten years metallurgist and superintendent at copper and lead smelteries. Reverberatory and blast furnace experience. PW-510, Eng. & Min. Jour., Old Colony Bldg., Chicago, Ill.

MILL superintendent desires charge of plant; long varied experience milling and cyanidation; graduate, unmarried, Spanish. PW-314, Eng. & Min. Journal, 531 Rialto Bldg., San Francisco, Cal.

MINING Engineer, 20 years' experience as engineer, superintendent and manager in U. S. and Latin-America desires position. Speaks Spanish. PW-309, Eng. & Min. Jour., Real Estate Trust Bldg., Phila., Pa.

REVERBERATORY management wanted by one that knows from practical experience how to get results and make improvements when needed. Record: fireman and skimmer 7 years, foreman 10 years, superintendent 10 years. Speaks Spanish. PW-313, Eng. & Min. Journal, 531 Rialto Bldg., San Francisco, Cal.

YOUNG mining engineer wanted to represent the interest of a corporation engaged in mining enterprises. DeLyon, Howth & Co., 40 Exchange Pl., New York City.

FOR SALE

SILVER MINING PROPERTY

In Austin, Nevada, consisting of approximately 1200 acres, one-half of which are patented. Last owned by Austin-Manhattan Consolidated Mining Co. Includes old mines of the MANHATTAN MINING CO., with record production of over TWENTY MILLION DOLLARS. None of the old mines are deep.

WM. A. MARSHALL
Resident Agent, Austin, Nevada

I will purchase choice mineral specimens crystallized and showy ones. Crystallized gold specimens desired and will pay good premium on same. I sell at $28.50 delivered MINERAL COLLECTION 115 specimens containing every important mineral specie. Pamphlet supplied.

G. S. SCOTT
20 Nassau St., New York

WANTED

Used Carbon (Black Diamond) and Bortz And fragments wanted: Will pay highest prices. D. Dessau, Printing Crafts Bldg., 33d to 34th Sts. and 8th Ave., New York City.

Maurice S. Dessau, 6 Maiden Lane, N. Y. C. Will pay highest prices for carbon (black diamonds), large or small used stones, also fragments. Merchandise purchased

FOR SALE

Gold Mine

I have a mine at Manhattan, Nevada, 1,300 ft. of tunnels, ore free milling; average value $10 a ton; seven claims. Will sell or form company to build mill. Full particulars from J. D. Johnston, Newport, Rhode Island.

Flotation Blowers

28—Connersville Blowers. Double outboard bearing. Capacity, 24-5 cu.-ft. per revolution, 3,200 cu.-ft. per minute at 255 r.p.m. Maximum pressure, 4.58 lb. per sq. in. at 255 r.p.m.

7—Roots Style D High Pressure Type Blowers. Capacity, 890 cu.-ft. per minute at 435 r.p.m. Maximum pressure, 9 lb. per sq. in. at 435 r.p.m.

These blowers were purchased for the Old Hickory Powder plant. Some were never installed and others were used less than 90 days. Practically new machines at used prices.

Nashville Industrial Corporation
Jacksonville, Tenn.

New Rails—Relayers

Cars, Locomotives, Steel Products

Send us your inquiries

MERCHANTS STEEL & SUPPLY CO.
208 S. La Salle St., Chicago, Ill.

PUMPS

From Old Hickory Powder Plant

Motor Driven Centrifugal

8—14-in. Worthington, Class B double suction, 8,500 G.P.M. at 152 feet head, at 1,170 R.P.M. direct connected to 300 hp. G. E., 3 phase, 60 cycle 2,200 volt motors.
4—14-in. Allis-Chalmers, Type S, 7,500 G.P.M. at 130 feet head, at 1,760 R.P.M. direct connected to 300 hp General Electric, 3 phase, 60 cycle, 2,200 volt motors.
2—10-in. Allis-Chalmers, Type S, 3,750 G.P.M. at 130 feet head at 1,765 R.P.M. direct connected to 150 hp. Westinghouse, 3 phase, 60 cycle, 2,200 volt motors.

Steam Turbine Driven Centrifugal

6—16-in. Allis-Chalmers, Type S, 8,500 G.P.M. at 90 feet head, direct connected to Type L, 300 hp. 2,000 R.P.M., G. E. Curtis Steam Turbine.
6—14-in. Allis-Chalmers, Type S, 6,500 G.P.M. at 150 feet head, 8,100 G.P.M. at 90 feet head, direct connected to 300 hp., 2,000 R.P.M., G. E. Curtis Steam Turbine.

Steam Actuated Hydraulic

5—14-in. and 20 x 7- x 18 Worthington Compound Duplex outside packed plunger pot valve, 400-g.p.m. at 300-lb. pressure.
8—25 and 38 x 4½ x 24 Worthington Tandem Compound Duplex, outside packed 3,600 lb. pressure, 150-g.p.m. at 20-r.p.m.
1—20 x 12 x 16 Worthington Duplex Underwriters Fire Pump. 1,500-g.p.m., 100-lb. pressure.
200—New and used Simplex and Duplex, steam driven Worthington Pumps, 4½ x 3¾ x 4, 5¼ x 4¾ x 5, 6 x 4 x 6, 7½ x 4½ x 10, 6 x 2½ x 6.
New and used Belted, 2½, 3, 4, 5 and 6-in.
100—Centrifugal Pumps.

Nashville Industrial Corp.
Jacksonville, Tenn.

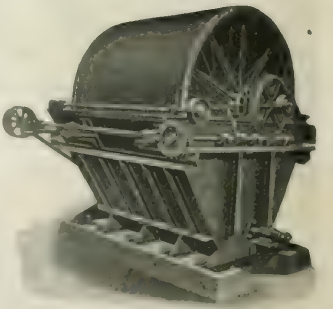
FOR SALE—One 30-in.

Circular Blast Furnace

complete with extra set of jackets, together with No. 5 Sturtevant Rotary pressure blower, same directly connected to 20 hp., 220 volt alternating motor. Price complete $1500.

Goldsmith Bros. Smelting & Refining Co.
Heyworth Building, Chicago, U. S. A.

CONTINUOUS FILTERS



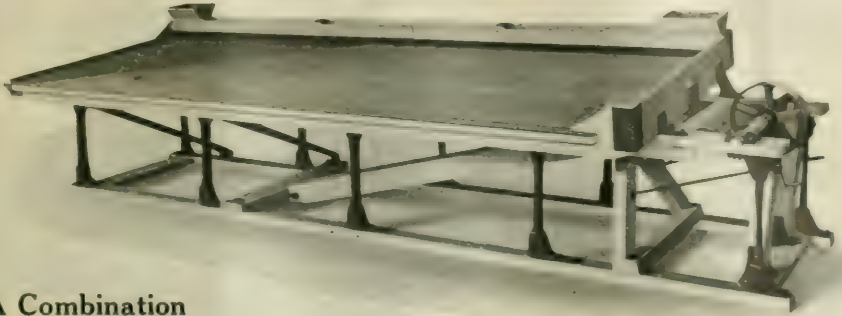
1—12 ft. x 7½ ft. Portland Continuous Filter.
2—12 ft. x 8 ft. Portland Continuous Filters, with steel tanks, 16 in. x 60 in. receiver, moisture trap, 1½-in. centrifugal pump, and 9½ x 8 dry vacuum pump.
4—12 ft. x 9 ft. Portland continuous filters, with steel tanks.
1—14 ft. x 12½ ft. Portland Continuous Filter, with steel tank.
1—14 ft. x 12 ft. Oliver Continuous Filter, with mechanical agitator and air lift.

Write for full specifications.

We are Western Representatives of **NASHVVILLE INDUSTRIAL CORPORATION**, handling the **"OLD HICKORY"** Powder Plant at Jacksonville, Tennessee. Full information, prices, photographs, etc., can be furnished by us.

THE MORSE BROS. MACHINERY & SUPPLY CO.
Denver, Colo.

The UNIVERSAL CONCENTRATING TABLE



A Combination of Simplicity, Capacity and Recovery

Its Complete Head Motion has Only One Operating Part—A weighted pulley.

Its deck swings in the Arc of a Circle—the head end parallel to the length of the deck—the concentrate end away from the tailings discharge side.

The Rifles approximately parallel the motion and curve away from the tailings discharge side, but not as much as the motion.

The Concentrates travel away from the tailings discharge side—uphill and slightly away from the riffles.

The Side Swing at the concentrate end spreads the concentrates and makes a clean separation.

The Proper Tilt of the deck is not dependent upon the amount of concentrates in the ore.

Its Recovery is not affected by changes in the proportion of concentrates in the feed.

Its stroke automatically increases with overload or decreases with underload.

This One Machine handles every feed from ¼ inch to slimes without change in design or construction.

The Combination of the Live Head Motion, Circular Arc Motion and Riffling and a "Dipping" Deck produces a speed of Pulp Travel and an efficiency of Concentration not approached by any other table ever produced.

Sands, Slimes and Coal Washing Types

Send for our bulletins on concentrating and amalgamating machinery

Also Simplex Oil Burner Bulletin

BUNTING IRON WORKS

Manufacturers of Oil Well and Mining Machinery

1215 First National Bank Bldg., San Francisco, Cal., U. S. A.

AMERICAN BRIDGE COMPANY

Hudson Terminal, 30 Church Street
NEW YORK

Manufacturersof Steel Structures
of all classes, particularly

Bridges and Buildings

SALES OFFICES:

NEW YORK, N. Y.
Philadelphia, Pa.
Boston, Mass.
Baltimore, Md.

PITTSBURGH, PA.
Buffalo, N. Y.
Cincinnati, Ohio
Atlanta, Ga.
Cleveland, Ohio
Detroit, Mich.

CHICAGO, ILL.
St. Louis, Mo.
Denver, Colo.
Salt Lake City, Utah
Duluth, Minn.
Minneapolis, Minn.

Pacific Coast Representative:
U. S. Steel Products Co., Pacific Coast Dept.
San Francisco, Cal. Portland, Ore.
Seattle, Wash.

Export Representative:

United States Steel Products Company
30 Church Street, New York

Jenkins Valves

Jenkins Selclo Valve

FIGURE 357 is a valve which is self-closing and is commonly termed the "Selclo" Valve. It can be used on steam, air, or water lines and in factories, shops, and plants where different people use the valve. It is built for extremely severe service. This valve may also be used as a blower valve in railroad round houses. Genuine Jenkins Valves bear the Diamond Mark identification and are sold at supply houses everywhere.

JENKINS BROS.
New York Boston Philadelphia
Chicago Montreal London Havana
FACTORIES: Bridgeport, Conn.; Elizabeth, N. J.; Montreal, Can.

TRADE JENKINS MARK

2306 J

CRANE VALVES

WE-FU-GO AND SCAIFE
WATER PURIFICATION SYSTEMS
SOFTENING & FILTRATION
FOR BOILER FEED AND
ALL INDUSTRIAL USES
WM.B.SCAIFE & SONS CO.PITTSBURGH,PA.

FOSTER SUPERHEATERS

A necessity for turbine protection, engine cylinder economy and utilization of superheat for all its benefits.

POWER SPECIALTY COMPANY, Boston Chicago Philadelphia San Francisco Kansas City Dallas Pittsburgh London, Eng. 111 Broadway, New York

KNOX VALVES & COUPLINGS
For the Economical Preservation of Air
KNOX MFG. CO.
821 Cherry St.
Phila. Pa.

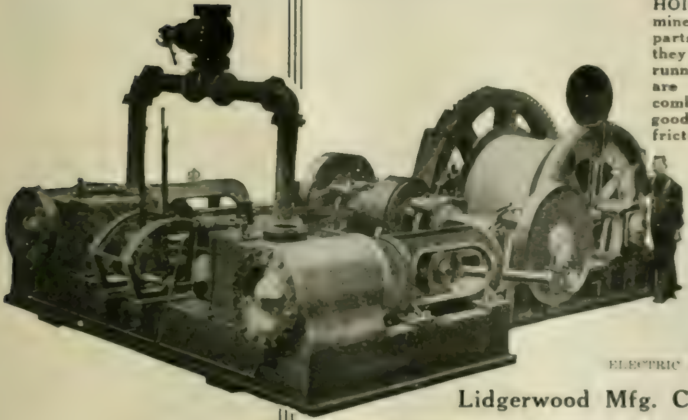
DIAMOND
CORE DRILLING
Accuracy Since 1884 Reliability
Booklet 2122
SULLIVAN MACHINERY CO.
126 S. Michigan Ave., Chicago

Harbison-Walker Refractories Company
MANUFACTURERS OF
High Grade Silica, Chrome,
Magnesia, and Fire Clay Brick,
Dead Burned Magnesia and Furnace Chrome
Chrome Ore.
PITTSBURGH, PA.

CORE DRILLING
H. R. Ameling Prospecting Company, Inc.
DIAMOND DRILL CONTRACTORS
20 Years' Continuous Service—Not a Dissatisfied Customer
Rolla, Missouri
Home: State Geologic Survey, Missouri School of Mines

McKiernan-Terry Drill Co.
Manufacturers of
Rock Drills—Hammer Drills—Core Drills
Pile Hammers—Atlas Jacks
21 Park Row, New York

FILTER BAGS SPECIAL CLOTH FILTER COVERS
FLOTATION POROUS BOTTOMS
The Filter Fabrics Co.
Felt Bldg Salt Lake City Utah



LIDGERWOOD MINE HOISTS

STEAM HOISTS up to 1000 hp. ELECTRIC HOISTS in all sizes

THE DESIGN OF THE LIDGERWOOD HOIST is based upon careful study of mine conditions by our engineers. All parts have ample strength for the work they have to perform when the hoist is running at its full capacity. All parts are properly proportioned, and this combined with proper materials and good workmanship reduces internal friction to the minimum.

There is
STRENGTH
CAPACITY
ECONOMY
in
LIDGERWOOD HOISTS

Send for Catalogs on
ELECTRIC MINE HOISTS—STEAM MINE HOISTS

Lidgerwood Mfg. Co., 96 Liberty Street, New York

Philadelphia Pittsburgh Chicago Detroit Seattle Los Angeles Cleveland London, England

Barrett Standardized Flotation Reagents

The majority of the large flotation operators who have spent thousands of dollars investigating Flotation Oils and Reagents

Now Buy The Barrett Brand

A small trial order will bring you to the same conclusions they have reached

The Barrett Company

40 Rector Street, New York City Salt Lake City, Utah

FLOTATION

PURE PINE OIL PINE TAR OIL
HARDWOOD AND COAL TAR CREOSOTE

Effective Oils of Each Class

General Naval Stores Co., 90 West St., New York

PINE FLOTATION OILS

Standard "350" Crude and other PENTARCO pine flotation oils. Used by leading American operators

Manufactured and distributed by

Pensacola Tar & Turpentine Co.
Gull Point, Florida

Hercules Pine Oil

We desire to co-operate with flotation operators in determining what oils will insure them the largest net earnings.

Efficient flotation can be had only with uniformity in every *shipment* of pine oil. We are prepared to furnish you with Hercules Pine Oil of absolute uniformity produced under strict chemical control.

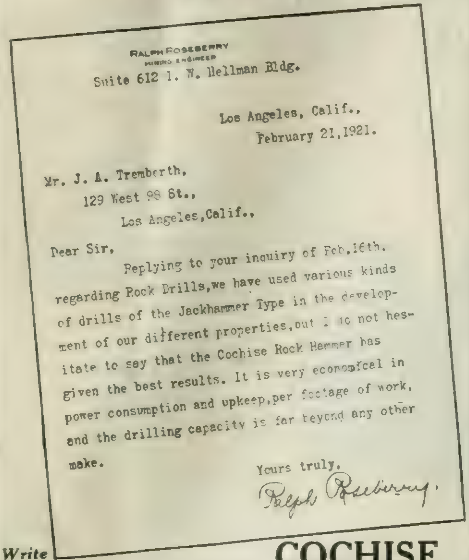
We invite correspondence from anyone interested [illegible] the experience of our technical department in helping you solve your flotation problems.

Naval Stores Division
HERCULES POWDER CO.
Wilmington Delaware

[illegible]

HERCULES
Pine Oil
Produced Under Chemical Control

"FAR BEYOND ANY OTHER MAKE"



RALPH ROSEBERRY
MINING ENGINEER
Suite 612 I. W. Hellman Bldg.

Los Angeles, Calif.,
February 21,1921.

Mr. J. A. Tremberth,
129 West 98 St.,
Los Angeles,Calif.,

Dear Sir,

Replying to your inquiry of Feb.16th, regarding Rock Drills, we have used various kinds of drills of the Jackhammer Type in the development of our different properties, but I do not hesitate to say that the Cochise Rock Hammer has given the best results. It is very economical in power consumption and upkeep, per footage of work, and the drilling capacity is far beyond any other make.

Yours truly,
Ralph Roseberry.

Write
Cochise Machine Co.
Los Angeles

COCHISE DRILLS

What Makes a Good Tank?

It is the *knowing how* to design and construct a tank that will give good long, honest, dependable service year in and year out without a hitch.

Caldwell Steel Tanks are the result. Engineers designed them according to approved engineering principles. A company with over thirty years of tank-building experience produces them.

Caldwell Steel Tanks are made of the finest steel and carefully riveted so that there's no chance for breaks or leaks.

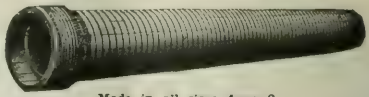
These are but a few of Caldwell characteristics which contribute to the significance of our slogan—"The Tank With a Reputation."

Send for Catalogue

W. E. CALDWELL CO.
Incorporated
2170 Brook St., Louisville, Ky.

Caldwell
TANKS AND TOWERS

PACIFIC REDWOOD AND DOUGLAS FIR PIPE



Made in all sizes from 2 inch to 14 feet in diameter

Write for Catalogue

PACIFIC TANK & PIPE CO.
THE STANDARD SINCE '88

304 MARKET ST., SAN FRANCISCO
6 RECTOR ST., NEW YORK
167 WASHINGTON ST., CHICAGO

DIAMOND DRILLS

Hand Power, Gasoline, Steam, Air, Electricity.

Send for Catalogue No. 6

STANDARD DIAMOND DRILL COMPANY
745 First National Bank Building, Chicago, U. S. A.

ROOT Spiral Riveted Pipe—
Pipe Specialists for 48 Years.
ABENDROTH & ROOT MANUFACTURING COMPANY
Works: Newburgh, N. Y. New York Office: 233 Broadway

Who Looks Into the Earth

We test Coal and Ore land in any part of North or South America

Pennsylvania Drilling Co.
Diamond Drill Contractors

1013 West Carson St., Pittsburgh, Pa.
2033 Whitehall Bldg., New York.

Hydraulic Presses Accumulators
Special Castings
Cast Iron Pipe Fire Hydrants
Hydraulic Operating Valves
R. D. Wood & Co., Philadelphia, Pa.

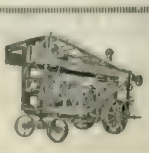
Exploration to Operation

DIAMOND DRILLING

FURNISHES AN ACCURATE RECORD OF ROCK STRUCTURE AT DEPTH. WE DRILL ON CONTRACT. ALSO MANUFACTURE AND SELL DIAMOND DRILLS AND EQUIPMENT. WRITE FOR BULLETIN NO 14

E. J. Longyear Company
Minneapolis, Minnesota, U.S.A.

NATIONAL QUALITY TANKS
DOUGLAS FIR OR CALIFORNIA REDWOOD.
NATIONAL TANK & PIPE CO.
PORTLAND, OREGON



Mineral Prospecting

WELL DRILLS AND EXCAVATORS
TRADE MARK
KEYSTONE

KEYSTONE DRILLER CO. BEAVER FALLS, PA

PORTER LOCOMOTIVES
FOR EVERY PURPOSE
H K PORTER COMPANY
PITTSBURGH, PA.

STORAGE BATTERY LOCOMOTIVES—1 TO 8 TONS ON DRIVE WHEELS

WHITCOMB LOCOMOTIVES

IT WILL PAY YOU TO GET OUR PROPOSITION BEFORE YOU BUY

GEO. D. WHITCOMB CO.
MAIN OFFICE AND WORKS
ROCHELLE, ILLINOIS
U. S. A.

GEAR AND FRICTION DRIVEN GASOLINE LOCOMOTIVES—2½ TO 25 TONS ON DRIVE WHEEL

EASTON CARS

Ruggedly constructed Easton Rocker Dump Cars, cars of all types, standard or special and complete narrow gauge railway equipment from track up—built for enduring service and backed up by thirty years of Easton experience—are available for every car haulage requirement in the metal mining and refining industry

EASTON CAR & CONS'T'N CO.

42 Church St., New York—Works: Easton, Pa.

Atlanta Boston
Chicago Cleveland
Detroit Dallas
Philadelphia Los Angeles
Pittsburgh Salt Lake City

ATLAS
STORAGE
BATTERY
LOCOMOTIVES

*For Main Line,
Surface, and
Gathering Work*

The Atlas Car & Mfg. Co., Cleveland, O.

cars·track·switches

KOPPEL

New York · Pittsburgh
Chicago · Detroit
Philadelphia · San Francisco

Koppel Industrial
Car & Equipment Co
Koppel, Pa.

ROTARY CAR DUMPERS FOR MINE CARS
GRAVITY ELECTRICAL OR PNEUMATIC DRIVE

SOLIDCAR SELF DUMPING CAGES
CAR CONTROL AND CAGING EQUIPMENT

CHICAGO
ILL

CAR-DUMPER & EQUIPMENT CO.

PITTSBURGH
PA

THE MECHANICAL SPRAGGER
AUTOMATIC TRIP CONTROL EQUIPMENT

ROTARY CAR DUMPERS FOR
STANDARD GAUGE RAILROAD CARS

ELECTRIC TRAMMING LOCOMOTIVES
Trolley—Storage Battery—Combination

Narrow or Wide Gauge
Light or Heavy Hauling

Goodman Manufacturing Company, Chicago Illinois
(A)

CARS

CARS

Nothing but cars — that's all we've built for 50 years. Our whole factory devoted to your requirements in this line.

Catalogues on request

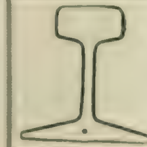
The Watt Mining Car Wheel Co.
Barnesville, Ohio

Denver: Lindrooth, Shubart & Co., Boston, Bldg.
San Francisco: N. D. Phelps, Sheldon Bldg.
Philadelphia: Edelen & Co., 235 Commercial Trust Bldg.

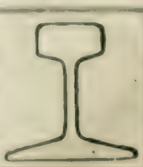
ALBANY GREASE

has been conquering friction for 52 years
Your dealer knows it's good

ADAM COOK'S SONS
708 Washington Street, New York
Established 1868



The
West Virginia Rail Co.
Manufacturers
Light Steel Rails
and Accessories
12 16 20 25 30 35 40 45 lbs. per yd.
Huntington, W. Va.



Sent on Approval. No Money down.

4 New McGraw-Hill Books on Mineralogy

1 *Warren's—*

Manual of Determinative Mineralogy

163 pages, pocket size, flexible, $2.00 net postpaid.

A manual written especially for use in general courses in mineralogy. The authors experience with its use over a period of several years has demonstrated that it gives satisfactory results as an aid in the determination of the more common minerals.

2 *Roger's—*

Introduction to the Study of Minerals and Rocks

Second Edition Completely Revised

527 pages, pocket size, flexible, 578 illustrations, $4.00 net, postpaid

A compact, thorough textbook for use in the field and in the classroom. It covers the whole field of mineralogy including crystallography, blowpipe analysis, descriptive mineralogy, and determinative mineralogy. This second edition includes rocks also, as indicated in the title.

3 *Kraus and Hunt—*

Mineralogy—An Introduction to the Study of Minerals and Crystals

560 pages, 6 x 9, 696 illustrations, $4 50 net, postpaid.

A textbook based on the author's long experience in teaching large classes of beginning students. The book includes all that the student of general mineralogy needs to know.

4 *Davy and Farham—*

Microscopic Determination of the Ore Minerals

15 pages 6 x 9, illustrated, $2 50, net, postpaid.

This book describes the latest methods in use for polishing examining testing, and photographing surfaces of minerals ores and mill or smelter products. The material is presented in such a way as to be of direct service to the engineer in practice and also as a textbook for students of mining and geology.

Free Examination Coupon

McGraw-Hill Book Company, Inc., 370 Seventh Avenue, New York.
You may send me on 10 days' approval—

I agree to pay for the books or return them postpaid within 10 days of receipt.
Member A I M M E ☐ Subscriber to Eng & Min J ☐

Signed

Address

Official Position ...

Name of Company
Books sent on approval to retail purchasers in U. S. and Canada only. [illegible]

JUSTRITE No. 83
with Bail and Hook

Here is a handy, all-'round service lamp—easy to handle—durable—efficient; that's the verdict of the man-on-the-job.

It can be attached to timbers or side of drift. Built substantially to stand up under the hardest kind of slam-bang, day in and day out handling. And like all other Justrites, it gives a clear, steady, brilliant light wherever and whenever it's needed. Write today for prices.

Justrite Mfg. Co.
2080 Southport Ave.
Chicago, Ill.

Automatic
Improved
For All Materials

DRYERS

Economical
Efficient
Great Capacity
American Process Co
68 William St
NEW YORK

BUTCHART

Concentrating Tables, Flotation Apparatus, Classifiers, Screens, etc.

W. A. BUTCHART, Denver, Colo.

Laboratory Apparatus and Glassware

Chemicals for Industrial and Metallurgical Work—Assay Supplies—Commercial and C. P. Acids—J. T. Bakers C. P. Analyzed Chemicals.

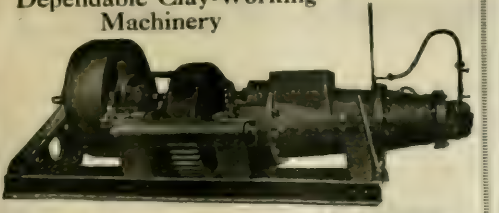
BRAUN-KNECHT-HEIMANN-CO.
Founded 1852

581 Mission St.,
San Francisco, Cal.
Cable address "BRAUNDRUG"
All Codes Used

Los Angeles House
The Braun Corporation

UNITED

UNITED IRON WORKS, INC., Kansas City, Mo
The largest plate shop west of the Mississippi River, also manufacturers of hoists, crushing and smelting machinery, the Pomona Pump and other equipment and supplies



Dependable Clay-Working Machinery

Operated and recommended by the prominent Fire-brick, Building brick, Paving block, Hollow building block, Fire-proofing, Chimney block, Chemical tile, and Zinc Companies of the country.

E. M. FREESE & CO., Galion, Ohio
DEPENDABLE MACHINERY OF PROVEN EFFICIENCY

MITCHELL ELECTRIC VIBRATING SCREEN

Mitchell Electric Vibrating Screen

Less than ⅛ hp is required to operate a Mitchell Screen, yet it is continually establishing records for large tonnage handled and thoroughness of screening. One Mitchell screen operating uninterruptedly over a period of 18 months handled more than a million tons of material at a cost including power, labor and screen cloth expense, of less than one-tenth of a cent per ton.

Write us for full details of Mitchell screens.

STIMPSON EQUIPMENT CO.
Felt Bldg. Salt Lake City — Grand Central Terminal Bldg. New York.

THE STEARNS-ROGER MFG. CO.
ENGINEERS MANUFACTURERS CONTRACTORS
DENVER, COLO.
MINING AND MILLING MACHINERY AND PLANTS

Highest Abrasive Resistance—Longest Wear
Rol-Man Manganese Steel
for
Grizzly Bars, Trommels, Jigs, Revolving or Striking, Shaking or Gravity Screens, Separating Devices in Mills, Mines, Stone and Sand Plants

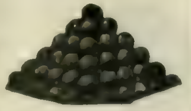
Manganese Steel Forge Co.
2126 Land Title Bldg., Philadelphia, Pa.

TELSMITH CRUSHERS
GYRATORY AND JAW TYPES
Pillar-shaft Gyratory Breakers, Reduction Crushers, Cast Steel Jaw Crushers, Elevators, Screens, Belt Conveyors, Etc.
Write for Catalog 168
SMITH ENGINEERING WORKS
3195 Locust St., Milwaukee, Wis.

The DORR COMPANY, Engineers
New York Denver London Mexico City

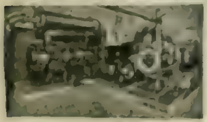
Equipment for the mechanical washing, removal, recovery, classification or treatment of finely divided solids suspended in liquids.

THE MINE & SMELTER SUPPLY COMPANY
DENVER - SALT LAKE CITY - EL PASO - NEW YORK



Duroloid
Grinding Balls and Liners
They Last
LOS ANGELES FDY. CO.
2444 So. Alameda, Los Angeles, Cal

AUSTIN GYRATORY CRUSHERS
Portable and Stationary Plants
Capacities 5 to 500 tons per hour
AUSTIN MANUFACTURING CO.
New York CHICAGO San Francisco



ULTIMATELY A BURY "UNIVERSAL" VARIABLE VOLUME 3-CYLINDER 2-STAGE AIR COMPRESSOR. WHY NOT INSTALL ONE NOW?

Durable as the Pyramids
All Sizes
All Types
All Pressures
For All Requirements

Bury Compressor Co. 1250 West 17th St. Erie, Pa. U.S.A.

BACON'S ORE & ROCK CRUSHING ROLLS
SEND FOR CATALOGUE
EARLE C. BACON, ENGINEER

STROMBERG CARLSON Telephone Mfg. Co. Rochester, N.Y.

Manufacturers of Mine & House Telephone Switchboards, Desk Telephones, Wall Telephones and Associated Equipment

HOLBECK
PULVERIZED COAL SYSTEMS
THE BONNOT COMPANY, CANTON, OHIO

THE NEW HERRESHOFF FURNACE
(Patented)
Temperature Controlled
For Roasting, Calcining and Drying
Air Cooled
Write for Bulletin and state your requirements
GENERAL CHEMICAL COMPANY
Herreshoff Furnace Department, 25 Broad St., New York
PACIFIC FOUNDRY COMPANY
18th and Harrison Streets, San Francisco, California

MONARCH
Crucible Tilting Furnace
May be started or shut off in an instant.
Built in capacities up to 1,500 lbs. per heat.
Oil, gas, coke or coal may be used as fuel. Catalog E. & M. J. describes it.
The Monarch Engineering & Mfg. Co.
1206 American Building
Baltimore, Md., U. S. A.

Ores—Metals—Residues
Aluminum
Sheets & Ingots
FERRO ALLOYS
Charles Hardy & Ruperti, Inc.
115 Broad Street,
New York City

LUFKIN
Improved common pattern Tapes, also Engineers' Patterns and Tapes on reels for mine work. Send for Catalog.
THE LUFKIN RULE CO.

SAGINAW, MICH.
NEW YORK

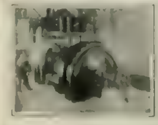
SHEETS
KEYSTONE COPPER STEEL
American Bessemer—Open Hearth—Keystone Copper Steel
Black Sheets, Galvanized Sheets, Special Sheets, Corrugated Sheets, Formed Roofing Products, Tin and Terne Plates, Etc.
AMERICAN SHEET AND TIN PLATE COMPANY, PITTSBURGH, PA.

BERGER
Monitor Transits and Levels
C. L. BERGER & SONS
BOSTON, MASS., U. S. A.

FAIRBANKS-MORSE
MANUFACTURERS CHICAGO
Oil Engines—Pumps—Electric Motors and Generators—Fairbanks Scales—Railway Appliances—Light Plants—Water Systems.

WISCONSIN BRIDGE & IRON CO.,
NORTH MILWAUKEE WISCONSIN
Chicago Detroit Kansas City El Paso

ROEBLING
Wire Rope, Hooks, Clips, Sockets, Welding Wire
JOHN A. ROEBLING'S SONS CO., TRENTON, N. J.



McINTOSH & SEYMOUR CORPORATION
Diesel Type Engines
Auburn, New York

DEISTER-OVERSTROM
DIAGONAL DECK
SAND AND SLIME TABLES
THE
DEISTER CONCENTRATOR COMPANY
FORT WAYNE, INDIANA

AMERICAN ZINC, LEAD & SMELTING CO.

Purchasers of

Zinc and Lead Ores

Address, 1012 Pierce Building, St. Louis, Mo.

Exploration Department for the purchase of

Metal Mines & Metal Mining Companies, 55 Congress Street, Boston, Mass.

Balbach Smelting and Refining Company

Buyers of { Ores / Concentrates / Bullion / Residues } **Containing**

Gold, Silver, Lead and Copper. Electrolytic Copper Refinery

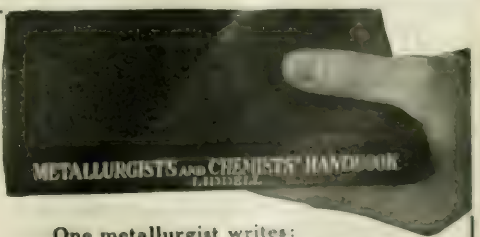
NEWARK
NEW JERSEY

Established 1852

NEW YORK OFFICE
280 BROADWAY

Liddell Never Disappoints

Liddell's Handbook is packed with tables, formulae, constants, methods — the sort of information you need constantly. Get the habit of depending on Liddell. Whatever your problem, go to this book for the answer — it never disappoints.



One metallurgist writes:

"In my frequent [illegible] trips I always take LIDDELL along. It is a great time and trouble saver. The handy book makes it unnecessary for me to carry a lot of bulky data."

Liddell's
METALLURGISTS' and CHEMISTS' HANDBOOK

656 pages, pocket size, flexible binding, $5.00 net postpaid

This useful guide is unquestionably the standard reference manual for the metallurgist and chemist. There is no part of your equipment that will render more efficient service.

It supplies at once information you would otherwise spend hours looking for.

There is no guess work about the material it offers. The information presented has proved its value in actual practice.

Take advantage of our on approval offer. It enables you to see without charge why thousands of chemists and metallurgists keep Liddell handy.

See this book for 10 days FREE

Send no money just the coupon!

McGraw-Hill Book Co., Inc.,
370 Seventh Ave., New York.

[illegible] Liddell's Metallurgists and Chemists' Handbook $5.00 net postpaid [illegible]

Subscriber to E. & M. J.?

Member of A. I. M. E.?

Signed

Address

Official Position

Name of Company

[illegible]

BARTLESVILLE ZINC COMPANY
Bartlesville and Blackwell, Oklahoma

ZINC OXIDE ZINC DUST

ZINC
Prime Western and Brass

Sole Agents:
THE AMERICAN METAL COMPANY, LIMITED
61 Broadway, New York

Irvington Smelting
& Refining Works
Formerly Glorieux Smelting & Refining Works
Buyers, Smelters and Refiners of
Gold, Silver, Lead, Copper and Platinum
Ores, Sweeps and Bullion

Manufacturers of Copper Sulphate

Irvington, New Jersey
Lehigh Valley R. R. connection
New York Office:
CHARLES ENGLEHARD, Hudson Term. Bldg., 30 Church St.

ASSAYERS & REFINERS
Specialists in
Palladium PLATINUM Iridium
Rhodium Ruthenium Osmium
Gold and Silver

PLATINUM SCRAP PURCHASED

BAKER & CO., INC.
Refiners and Workers of Platinum Gold and Silver.
30 Church St. New York 54 Austin St. NEWARK, N. J. 5 S. Wabash Ave. Chicago.

ILLINOIS ZINC CO.
PERU, ILLINOIS
Manufacturers of
SELECTED BRASS, SLAB ZINC
and SULPHURIC ACID

Rollers of SHEETS, PLATES and STRIPS

ZINC in special sizes, squares and circles, cut to order. Etchers', Engravers', Lithographers' and Battery Plates. Paper and Card Makers' Sheets.

EASTERN SALES OFFICE
Tel. Worth 1496 280 Broadway, New York

PLATINUM
in all Standard or Special Forms
REFINING ASSAYING
MANUFACTURING
We are specially equipped for the testing and sampling of any Platinum-bearing materials.

J. Bishop & Co. Platinum Works
MALVERN, PA.

Rosiclare Fluor Spar All Grades
ROGERS, BROWN & CO.
SALES AGENTS
CINCINNATI BUFFALO
NEW YORK ST. LOUIS
CLEVELAND BOSTON
CHICAGO PITTSBURGH
PHILADELPHIA

PHELPS DODGE CORPORATION
99 JOHN STREET, NEW YORK
"C ★ Q" ELECTROLYTIC COPPER "P.D.Co." CASTING

The Hegeler Zinc Company
Danville, Illinois
Smelters of SLAB ZINC
Manufacturers of SULPHURIC ACID

International Smelting Company

New York Office, 25 Broadway

Purchasers of

Gold, Silver, Copper and Lead Ores

Smelting Works
International, Utah
Miami, Arizona

Ore Purchasing Department
618 Kearns Building, Salt Lake City, Utah

Refineries

RARITAN COPPER WORKS, Perth Amboy, N. J.
INTERNATIONAL LEAD REFINING CO., East Chicago, Ind.

United Metals Selling Company

25 Broadway, New York

Electrolytic Copper	N E C & B M
Best Selected Copper	A B S
Pig Lead— Desilvered Common and Corroding	International I. L. R. Co.
Electrolytic Zinc Highest Grade and Purity	Anaconda Electric

Selenium, Arsenic, Nickel Salts, Tellerium
Copper Sulphate

Zenith ARCTIC Zinc

American Zinc & Chemical Company

Works: Langeloth, Pa.

Office: Oliver Bldg. Pittsburgh

Producers of

Zinc

Prime Western and Brass

Zinc Oxide Zinc Sulphate Zinc Dust
Salt Cake Nitre Cake
Sulphuric Acid
Coal

Buyers of Zinc Ores

SOLE AGENTS

The American Metal Co., Ltd.

61 Broadway, New York

Zenith POLAR Zinc

ESTABLISHED 1839
CHEMICALS
ZINC
GRASSELLI
EXPLOSIVES
DYESTUFFS

THE GRASSELLI CHEMICAL CO.
CLEVELAND, OHIO

Guardian Building
NEW YORK, N. Y.
347 Madison Avenue

Buyers of
ZINC ORES
ZINC CONCENTRATES

Producers of
ZINC
(Spelter)
ZINC ANODES
BATTERY ZINC
ZINC DUST
SHERARDIZING ZINC
CADMIUM
C. P. ACIDS
C. P. AMMONIA
HEAVY CHEMICALS
for all purposes

DYES AND COLORS

THE GRASSELLI POWDER CO.

Manufacturers of Explosives
Guardian Building, Cleveland, Ohio

The American Metal Co., Ltd.

61 Broadway
New York

Oliver Bldg.
Pittsburgh, Pa.

Boatman's Bank Bldg.
ST. LOUIS

A. C. Foster Bldg.
DENVER

Buyers of

Gold, Silver, Lead, Zinc, and Copper Ores, Copper Matte, Copper Bullion and Lead Bullion, Molybdenum Concentrates and Tungsten Concentrates

Producers of

Gold, Silver, Copper, Lead and Zinc

Matthiessen & Hegeler Zinc Co.

La Salle, Ill.

Manufacturers of

**Sheet Zinc, Rolled Zinc Plates,
Ribbon Zinc in Coils,
and Sulphuric Acid,
Smelters of Zinc,
Choice Brass Special**

Sheet Zinc for use in the Cyanide Process, perforated so as to meet the requirements of the Mexican Customs Laws.

Eastern Office:
253 Broadway, New York City
Telephone Barclay 5391

Cyanide of Sodium 96-98%

Cyanogen Content 51-52%

"Cyanegg"

Sodium Cyanide 96-98% in egg form, each egg weighing one ounce.

CHEMISTS

The Roessler & Hasslacher Chemical Co.
709-717 Sixth Ave., New York, N. Y.
Works: Perth Amboy, N. J.

American Smelting & Refining Co.

General Office: 120 Broadway, New York

Producers of

- GOLD
- SILVER
- LEAD
- COPPER
- ZINC
- ZINC DUST
- TEST LEAD
- ZINC OXIDE (Columbine Brand)
- CADMIUM
- BISMUTH
- THALLIUM
- SELENIUM
- BLUE VITRIOL
- ARSENIC
- C. P. LITHARGE
- TIN
- CADMIUM SULPHIDE

Sales Office:

EQUITABLE BUILDING, 120 Broadway, New York

United States Smelting
Refining & Mining Company

55 Congress Street, Boston, U. S. A.

Buyers of

Gold, Silver, Lead and Copper Ores; Lead and Zinc Concentrating Ores; Matte and Furnace Products

Refiners of Lead Bullion

Producers and Sellers of

Gold, Silver, Lead, Copper, Arsenic, Insecticides, Fungicides and Cadmium.

OPERATING OFFICES

912 Newhouse Building, Salt Lake City, Utah; Kennett, Cal.; Goldroad, Arizona; Eureka, Colorado (Sunnyside Mining & Milling Co.); Baxter Springs, Kansas; 120 Broadway, New York; Pachuca, Mexico (Real del Monte Co.).

Selling Offices: 120 Broadway, New York

United States Smelting R. and M. Exploration Company
For examination and purchase of Metal Mines, 55 Congress St., Boston, Mass. District Offices 120 Broadway, N. Y.
1504 Hobart Building, San Francisco, Cal., Newhouse Building, Salt Lake City, Utah

Directory of Engineers

ARRANGED GEOGRAPHICALLY

UNITED STATES

Alabama

Hess, R. M.

Arkansas

Fuller, J. T.
Le Vasseur, Charles

Arizona

Botsford, C. W.
Burch, H. Kenyon
Calkins, F. E.
Carpenter, M. M.
Clausen, Carl
Cole & Co.
Dunning, Charles H.
Flagg, Arthur Leonard
Halloran, Will
McGregor, A. G.
Mitke, Charles A.
Mohave Assay and Engineering Office
Osborn, Walter X.
Slak, John
Smith & Ziesemer
Spilsbury, P. G.
Stevens, T. N.
Tomlinson Engineering & Assay Office

California

Anderson, A. P.
Arnold, Ralph
Beaudette, A. J.
Bjorge, Guy N.
Burch, A.
Burns, William
Carpenter, A. B.
Dahl & Wartenweiler
Duncan & Lindley
Emlaw, H. S.
Evans, Burr
Farish, John R.
Gemmill, David B.
Grant, Wilbur H.
Hamilton, Beauchamp, Woolworth, Inc.
Hamilton, E. M.
Hanks, Abbot A.
Hawxhurst, Robt., Jr.
Hoffman, Ross B.
Holland, L. F. S.
Hutchinson, Randolph B.
Jenks, T. H.
Jones, C. C.
Jussen, Edmund
Kepner, R. B.
Kinzie, Robert A.
Lindberg, Carl O.
Locke, Augustus
MacBoyle, E.
Merrill, C. W.
Morris, F. L.
Mudd, S. W.
Myers, Desaix B.
Probert, F. H.
Royer, Frank W.
Short, Frank R.
Sill & Sill
Southwestern Eng'g Co.
Twining Laboratories, The
Wellman-Lewis Co.
Young, E. J.

Colorado

Beam, A. Mills
Bell, Charles N.
Burlingame, Walter E.
Chase, C. A.
Chase, Edwin E.
Chase, R. L.
Collins, George E.
Draper, M. D.
Ermlich, Geo. J., & Co.
Fisher, C. A.
Frost, Oscar J.
Gahl, Rudolf
Garvin, C. J.
Hills, V. G.
Kyle, T. D.
Marsh, Austin G.
McClain & Cary
Patton, Horace B.
Piers, W. L.
Plate, H. R.
Ritter, Etienne A.
Roller, Arthur H.
Root & Simpson
Ward, William F.
Wilfley, Clifford R.
Wood Assaying Co., The Henry E.
Zeigler, Victor

Connecticut

Keeney, Robt. A.

Washington, D. C.

Mulliken, H. S.
Seward, John

Florida

Tanner, W. Lee

Idaho

Burbidge, Frederick
Easton, S. A.
Leonard Engineer'g Co.
Smith, Gordon C.
Van Eman, A. G.
White, Rush J.

Illinois

Ede, J. A.
Hollis, H. L.
Hunt & Co., R. W.
Long, Frederic H.
Schwerin, Martin

Indiana

Indiana Laboratories Co., The

Iowa

Reece, P. P.

Kentucky

Reed, Avery H.
Torbert, James B.

Maryland

Fulton, Chester A.
Holden, Edwin C.

Massachusetts

Brockunier, S. H.
Eustis, F. A.
Hardy, J. Gordon
Hutchinson, W. Spencer
Jones, William F.
Locke, C. E.
Packard, George A.
Richards, R. H.
Richards & Locke
Rogers, A. H.
Rogers, Mayer & Ball
Stevens, F. G.

Michigan

Fesing, Herman W.
Lasier, F. G.
Lawton, N. O.
Royce, Stephen

Minnesota

Collins, E. J.
Dudley, H. C.
Longyear Co., E. J.

Missouri

Copeland, Durward
Kirby, E. B.
Le Vasseur, Charles
Meier & Co., Inc.
Miller, Howard A.
O'Keeffe, Edward C.
Rakowsky, Victor
Waring & Williams Laboratories, The
Wheeler, H. A.

Montana

Indiana Laboratories Co., The
McCarthy & Co., Richard
Stewart, I. E.

Nevada

Adamson, W. G.
Cox, Augustus D.
Lakeman, C. B.
Spencer & Co., L. B.

New Jersey

Ely, E.
Hatfield & Co.

New Hampshire

Lindsey, Thayer
Strain, J. H.

New Mexico

Lidstone & Van Dorp
Wright, Ira L.

New York

Adams, H.
Addicks, Lawrence
Aldridge, W. H.
Arnold, Ralph
Associated Petroleum Engineers
Ball, Sydney H.
Banks & Son, John H.
Bateson, C. E. W.
Beatty, A. Chester
Boise, Charles W.
Botsford, R. S.
Bradt, Harlan H.
Brodie, Walter M.
Burdick, Charles A.
Burrall, Fred'k P.
Callow, J. M.
Channing, J. P.
Clapp, Fred. G.
Clements, J. Morgan
Constant Co., C. L.
Drew, C. V.
Dwight, Arthur S.
Dwight & Lloyd Sintering Co.
Emlaw, H. S.
Erdlets, Jr., Jos. F. B.
Eustis, F. A.
Farish, George E.
Finch, J. W.
Finlay, J. R.
Fohs, F. Julius
General Engineering Co.
Gill, Philip L.
Grugan, Justice
Guess, H. A.
Hager, Dorsey
Hammond, John Hays
Hampton, Wm. H.
Henderson, H. P.
Huntoon, L. D.
Hutchins, J. P.
Jaeger, Frederick
Keene, Amor F.
Klepetko, Frank
Knox & Allen
Krejci, Milo W.
Kunz, G. F.
Ledoux & Co.
Le Fevre, S.
Linton, Robert
Lloyd, R. L.
Loveman, M. H.
Mathewson, E. P.
Mayer, L. W.
Mead, H. L.
Minard, F. H.
Newberry, Andrew W.
Payne, C. Q.
Payne, Henry Mace
Perry, O. B.
Pitkin, Inc., L.
Poillon & Poirier
Richards, Gragg
Ricketts, L. D.
Rogers, A. H.
Rogers, E. M.
Rogers, Mayer & Ball
Rowand, Lewis G.
Rubidge, F. T.
Rutherford, Forest
Schroter, Geo. A.
Sharpless, Fred. F.
Shipp, E. Maltby
Simonds, F. M.
Strain, J. H.
Sussman, O.
Thayer, B. B.
Thomas, M. L.
Thomas, Kirby
Thomson, S. C.
Tuttle, A. L.
Vandegrift, J. A.
Warriner, R. C.
Watson, R. B.
Weeks, Frederic R.
Westervelt, W. Y.
Whitman, Alfred R.
Wilkens & Devereux
Witherell, Chas. S.
Wolf, Harry J.
Wright, Louis A.
Yeatman & Berry

Ohio

Barton, L. A.
Dunster, C. B.

Oklahoma

Bates, Mowry
Fohs, F. Julius
Ladd, D. H.
Rutledge, J. J.

Oregon

Gilles, V. A.
Hodge, Edwin T.

Pennsylvania

Ayres, W. S.
Chance & Co., H. M.
Darlington, W.
Demming, H. C.
Fuller, John T.
Garrey, George H.
Heinz, N. L.
Linton, Robert
Searle, Barry

Tennessee

Newman, M. H.
Southern Minerals Co.
Watson, Ralph A.

Texas

Anderson Engineering Co.
Barry, J. G.
Cameron, George W.
Critchett & Ferguson
Kinnon, Wm. H.

Utah

Bardwell, A. F.
Black & Deason
Callow, J. M.
Crismon & Nichols
Fitch, Walter, Jr.
Frank, Alfred
General Engineering Co.
Hilsdale, Paul
Krumb, Henry
MacViehie, D.
Officer & Co., R. H.
Sears, S. C.
Timmons, Colin
Union Assay Office, Inc.
Van Winkle, C. T.
Zalinski, E. R.

Washington

Campbell, Wells & Elmendorf
Falkenburg & Co.
Greenough, W. Earl
Lachmund, Oscar
Lee, Chester
Levensaler, Lewis A.
Roberts, Milnor

Wisconsin

Royce, Stephen

CUBA

Constant Co., C. L.
Murias, E. R. Suarez

CANADA

British Columbia

Collins, G. A., Engineers
Fowler, S. S.
Hodge, Edwin T.
Munroe, H. S.
Stewart, Robert H.
Van Wagenen, H. R.

Manitoba

Allied Engineers, Ltd.

Ontario

Ferrier, W. F.
Gillis, J. H.
Graham, S. N.
Murphy, Charles J.
Reid, J. A.
Rogers, John C.
Stevens, Frank G.
Tyrrell, J. B.
Whitman, Alfred R.

Quebec

Cohen, Samuel W.
Hersey Co., Ltd., Milton
Spearman, Chas.

Yukon Territory

Burrall, Fredk. P.

MEXICO

Allen, Roy Hutchins
Babb, Percy Andrus
Burr, G. A.
Cruger, J. P.
Eveland, A. J.
Garza-Aldape, J. M.
Halter, Carl P.
Lucke, P. K.
MacDonald, Bernard
Meissner, C. E.
Miller, Hugo W.
Nahl, A. C.
Pickering, J. C.
Saunders, T. S.
Schmidt, H. C.
Shaw, S. F.
Steele, Heath
Tays, Eugene A. H.
Thomas, D. R.

AFRICA

Emery, A. B.
Martin, H. Rose

ASIA

Burma
Hall, R. G.

China
Draper, M. D.
Yung, M. B.

Japan
Mills, Edwin W.
Purington, C. W.

AUSTRALIA

Palmer, T. H.

EUROPE

England
Belmont, Arthur
Botsford, R. S.
Knox, Newton Booth
Ridge Roasting Furnace & Engr. Co., The
Shaler, Millard K.
Tyrell, J. B.
Wilkens & Devereux

France
Rivoiret, M. Raymond

Italy
Wright, Charles Will

Spain
Knox, Newton Booth

CENTRAL AMERICA

Bancroft, H.
Estes, F. M.

SOUTH AMERICA

Bolivia
Ball, C. Leonard
Copeland, Durward
Easley, George A.
Harper, Harry A.

Chile
Lehmann, Charles
Strache, Walter
Strauss, Lester W.

Columbia
Chèdé, L.
Parrish, K. C.
Ward, Wm. F.

Peru
Klepetko, Frank
Neel, C. B.
Semple, C. Carleton

ARRANGED ALPHABETICALLY

A

Adams, Huntington, Mining Engineer. c/o White Weld & Co 14 Wall St. New York City

Adamson, W. G., Mining Engineer and Metallurgist Winnemucca Nev

Addicks, Lawrence, Consulting Engineer 51 Maiden Lane New York City Cable Galic. New York

Aldridge, Walter H., Mining and Metallurgical Engineer 41 E 42nd St New York

Allen, Roy Hutchins, Mining Engineer Care of Cia Union Minera del Refugio. S A Parral. Chih., Mex.

Allied Engineers, Ltd., Mining Engineers and Geologists Examinations Explorations and Management in Manitoba Fields The Pas. Man.

Anderson, A. P., Consulting Mining Engineer. U S Smelting Refining & Mining Company. 1504 Hobart Bldg San Francisco Cal

Anderson, G. E., Engineering Co Geologists. Petroleum Metals 206 Anchor Bldg Fort Worth Texas

Arnold, Ralph, Consulting Geologist and Petroleum Engineer 639 S Spring St Los Angeles Calif 42 Broadway New York City Cable [illegible]

Associated Petroleum Engineers (successors to Assoc Geol Engrs). F G Clapp. Chief Geologist. 30 Church St., New York.

Ayres, W. S., Min and Mech Eng Consultation. Examination Reports Long Experience as Manager of Iron and Coal Mines. Hazelton, Pa.

B

Babb, Percy Andrus, Mining and Metallurgical Engineer Apart No 92 Pachuca Hgo., Mexico

Ball, C. Leonard, General Manager. Cia Huanchaca De Bolivia Pulacayo Bolivia

Ball, Sydney H., Mining Geologist Rogers, Mayer Ball 42 Broadway New York City Cable Address [illegible]

Bancroft, Howland Consulting Mng Geologist Mgr [illegible] Panama Oil Corp Panama City Rep of Panama Cable "Howban" Code Bedford McNeill

Banks & Son, John H., Mining Engineers and Metallurgists 26 John St New York Cable "Metbanks"

Bardwell, A. F. (successor to Bettles & Bardwell) Custom Assayer and Chemist 158 South West Temple St Salt Lake City Utah

Barry, John G., Mining Geologist Mills Building El Paso, Texas

Barton, L. A., Petroleum Engineer Oberlin, Ohio

Bates, Mowry, Petroleum Engineer and Geologist 305 Atco Bldg Tulsa Okla

Bateson, C. E. W., Consulting Mining Engineer and Geologist 68 William Street New York c/o Ricketts & Company Inc., formerly with Ricketts & Banks

Beaudette, A. J., Mining Engineer. 252 Russ Bldg San Francisco Calif

Beam, A. Mills, Metallurgical and Consulting Engineer 807 Central Savings Bank Bldg. Denver Colo

Beatty, A. Chester, Consulting Mining Engineer. 25 Broad St New York Cable Granitic No professional work entertained

Bell, Charles N., Consulting Mining Engineer The [illegible] Exploration Co 301 Fourteenth St Denver Colo

Belmont, Arthur, Consulting Mining Engineer 3 [illegible] Lane London E C 3 England Cable Address [illegible] London

Bjorge, Guy N., Mining Geologist 788 Mills Bldg San Francisco Calif

Black & Deason, Assayers and Chemists 165 South West Temple St Salt Lake City Utah

Boise, Charles W., Mining Engineer Foreign Exploration Room 1507 14 Wall St N Y Cable [illegible]

Botsford, C. W., Consulting Mining Engineer and Geologist Room [illegible] 14 O'Neil Bldg Phoenix Arizona

Botsford, R. S., Mining Engineer Room 2981 No 30 Church St New York City and 2 Drapers Gardens London England

Bradt, Harlan H., Mining Geologist and Engineer [illegible] Avenue [illegible] N Y [illegible]

Brochunier, S. H. 11 Nesmith St Lowell Mass

Brodie, Walter M., Mining Engineer and Metallurgist Room 904 47 Cedar St New York

Burbidge, Frederick, Mining Engineer Wallace Idaho

Burch, Hershey & White, Albert Burch O H Hershey Lloyd C White Consulting Mining Engineers Crocker Bldg San Francisco Cable Address "Burch" San Francisco Usual codes

Burch, H. Kenyon, Consulting Engineer Phelps Dodge Corpn (Address) Copper Queen Branch, Bisbee, Ariz

Burdick, Charles A., Mining Engineer. Equitable Bldg 120 Broadway, New York. Phone Rector 1645

Burlingame, Walter E., Est. 1866. Assayer and Chemist. Bullion Dealer. Ore Shippers' Agent Ore Testing 1916 Lawrence St, Denver Colo

Burns, William, Mining Engineer 788 Mills Bldg., San Francisco, Calif

Burr, Gmo. A., E M C E Geological Surveys and Mine Examinations in Mexico Exclusively San Luis Potosi. S. L. P. and Guachinango. Jalisco

Burrall, Frederick P., Mining Engineer. Dawson. Yukon Territory, Canada. 36th Floor, 233 Broadway, New York

C

Calkins, F. E., Mining Geologist and Engineer. Globe. Arizona

Callow, J. M., Pres. General Engineering Co., Consulting Metallurgical Engineers. Room 3022 No 120 Broadway New York 159 Pierpont St., Salt Lake City. Utah. U. S. A.

Cameron, Geo. W., Assayer and Chemist Representative for shippers to the El Paso Smelter. 205 San Francisco St Box 189, El Paso Tex

Campbell, Wells & Elmendorf, Mining Engineers Chemists. Metallurgists. Mining Examinations and Management, Umpires and Control Assayers, Ore Testing and Metallurgical Processes Prefontaine Bldg., Seattle Wash.

Carpenter, Alvin B., Mining Engineer. Examinations, Consultation, Supervision of Mines. 628 Pacific Finance Bldg Los Angeles, Calif.

Carpenter, Miles Miller, Mining Engineer. U S Mineral Surveyor. Examinations Consultation. Tucson, Ariz.

Chance & Co., H. M., Coal and Iron Consulting Engineers. Drexel Building. Philadelphia, Penn.

Channing, J. Parke, Consulting Engineer. 61 Broadway, New York.

Chase, Charles A., Mining Engineer 825-826 Cooper Building, Denver Colo Liberty Bell G. M. Co., Telluride, Colo.

Chase & Son, Edwin E., Edwin E Chase R L. Chase, Mining and Geological Engineers, 207 Colorado National Bank Bldg., Denver, Colo.

Chédé, L., Ingenieur des Mines. Long experience Colombian properties. Examinations, Reports. Purchases. Cali, Republic of Colombia.

Clapp, Frederick G., Consulting Geologist and Petroleum Engineer, 30 Church St., New York City.

Clausen, Carl, Engineer, Bisbee, Arizona. Design and erection of mills for concentration, amalgamation, cyaniding, etc. Smelters and Power Plants

Clements, J. Morgan, Mining Engineer and Geologist. 20 Broad St., New York. Code: Bedford McNeill.

Cohen, Samuel W., Consulting Min Eng., Dominion Express Bldg., Montreal, Canada.

Cole & Co., Assayers Chemists. Ore Buyers. Box BB, Douglas Ariz

Collins, Edwin James, Mining Engineer and Mining Geologist Examinations and Management. Torrey Bldg., Duluth, Minn

Collins, George E., Min Eng Mine Examinations and Management 30 Boston Bldg Denver, Colo Cable Address: "Colcamac." Denver.

Collins, Glenville A., Engineers, Ltd., Consulting Mining and Civil Engineers 609-10 Credit Foncier Bldg Vancouver B C

Constant Co., C. L., Mining, Metallurgical and Chemical Engineers New York Office 120 Broadway New York N Y Cuban Office [illegible] Havana [illegible] Registered Mining Engineer under Cuban law

Copeland Durward, Metallurgical Engineer Missouri School of Mines Rolla Mo and Llallagua Bolivia South America

Cox, Augustus D., Mining Engineer Clay Peters Bldg Reno Nev

Crismon & Nichols, Assayers and Chemists 231 South West Temple St Salt Lake City [illegible]

Critchett & Ferguson, Assayers and Chemists Agents for Ore Shippers Umpire and Control a Specialty El Paso Texas

Cruger James P., Mining Engineer Twenty years Mexico Examinations anywhere Address Parral Chihuahua Mexico

D

Dahl & Wartenweiler, Engineers Designers and Builders of Mines [illegible] and Industrial Plants Central [illegible] Los Angeles Cal

Darlington, Wayne, Consulting Mining Engineer and Metallurgist [illegible] North [illegible] St [illegible] Penn

Demming, Henry C., [illegible] Geologist [illegible] and Chemist [illegible] Laboratory [illegible] Mulberry St Harrisburg, Penn

Draper, Marshall D., Mining Engineer [illegible] China [illegible] Address [illegible] Bldg Denver Colo

Drew, C. V., E M with Cerro de Pasco Copper Corporation Room [illegible] fifth floor 15 Broad St New York

Dudley, H. C., Mining Engineer 704 Lonsdale Bldg Duluth Minn.

Duncan & Lindley, Mechanical Engineers for Mines and Mills. 649 Mission St San Francisco Cal

Dunning, Charles H., Mining Engineer Prescott Ariz

Dunster, Carl B., Mining Engineer [illegible] Cleveland Ohio

Dwight Arthur S., Mining Engineer and Metallurgist [illegible] Broadway, New York Cable address "Sinterer"

Dwight & Lloyd Sintering Company [illegible] Processes Ore Treatment 29 Broadway New York City Cable address "Sinterer"

E

Easley, Geo. A., M E La Paz Bolivia South America. Cable Address: "Easley," La Paz.

Easton, Stanly A., Mining Engineer. Manager, Bunker Hill & Sullivan Mining and Concentrating Co., Kellogg, Idaho

Ede, J. A., Consulting Mining Engineer La Salle Illinois

Ely, E., Prop. Dover Laboratory Analysts, Assayers Reports Gold Assay [illegible] Iron det. $1.00, Phos. $1.50, Dover, New Jersey.

Emery, A. B., Mining Engineer Messina Transvaal [illegible] Cable Address Alemery Messina, Transvaal

Emlaw, H. S., Mining Engineer 36th Floor 233 Broadway, New York City and Trona Calif.

Erdlets, Jr., Joseph F. B., Mining Engineer 61 Broadway New York Cable Address Branderlet New York

Ermlich, Geo. J., & Co., Assayers and Chemists. Control and Umpire Work Ore Shipper's Agent 1727 Champa St, Denver Colo

Estes, Frank M., Mining Engineer [illegible] El Salvador [illegible] Mines Co., [illegible] de Morazan Salvador C A

Eustis, F. A., Metallurgical and Mining Engineer Research work solicited 131 State St Boston Telephone Main [illegible] St New York City Telephone Rector [illegible]

Evans, Burr Consulting Engineer California Mines and Mining and Hydro-Pneumatic Power Air Mining and Milling Methods Placerville El Dorado Co Calif, U S A

Eveland, A. J., Mining Engineer Geology and Mine Examinations University Club La Bucareli 35 Mexico D. F., Mexico

F

Falkenburg & Co., Chemists Assayers Mill Tests of carload lots of ore Smelter checking 116 Yesler Way Seattle Wash

Farish George E., Mining Engineer [illegible] Broad St., New York Cable "Geargefar" Code Bedford McNeill

Farish John B., Mining Engineer Office 58 Sutter St San Francisco Calif Residence San Mateo Calif Cable Address "Farish"

Ferrier, W. F., Consulting Mining Engineer and Geologist [illegible] Toronto Ont

Fesing Herman W., Mining Engineer [illegible] Copper and Iron Examinations Houghton Mich

Finch, John Wellington, Mining Geologist and Engineer 14 Wall St., New York Telephone Rector [illegible]

Finlay, J. R., Mining Engineer Room 1410 [illegible] Broadway New York

Fisher C. A., Consulting Geologist and Fuel Engineer [illegible] 1st Nat Bank Bldg Denver Colo

Fitch Walter, Jr. Company Shafts and Tunnels [illegible]

Flagg Arthur Leonard, Consulting Engineer [illegible] Phoenix Ariz

Fohs F. Julius, Consulting Oil Geologist [illegible] New York [illegible]

Fowler Samuel S., Mining Engineer and Metallurgist Nelson British Columbia

Frank Alfred, Mining Engineer 1121 Newhouse Bldg Salt Lake City Utah

Frost Oscar J., Assayer & Chemist [illegible]

Fulton John T., Mining Engineer [illegible]

Fulton Charles A., [illegible] Baltimore Md

G

Gahl Rudolf Consulting Metallurgist specializing in [illegible] leaching of [illegible] Bldg., Denver, Colo.

Garrey, George H., Con. Min. Geologist and Eng. Appraisal of Possibilities Outlining Development Work, Geologic Mine Maps. Code: Bedford-McNeill. Bullitt Bldg., Philadelphia Pa.

Garvin, C. J., Mining and Consulting Engineer Management of Metal and Magnesite Mines a Specialty. Arvada, Col.

Garza-Adalpe, J. M., Consulting Mining Engineer Examination, Valuation, Exploration and Engineering management of mining properties. Torreon Coahuila. Mexico.

Gemmill, David B., Mining and Metallurgical Engineer. Specialty Treatment of Complex Ores. 1201 Hibernian Bldg., Los Angeles, Cal.

General Engineering Co., Consulting Metallurgical Engineers. J. M. Callow, President. Salt Lake City, Utah. Eastern and Canadian Offices: 120 Broadway, New York

Gill, Phillip L., Metallurgical Engineer. Specialties: Copper; Industrial Examinations; Reports. 275 Broadway, New York City.

Gillis, Julius H., Metallurgical Engineer. Sudbury, Ontario, Canada.

Gilles, V. A., Mining Engineer. Monitor, Oregon.

Graham, Stanley N., Mining Engineer. Mining and Metallurgical Dept., Queens University. Kingston, Ont., Canada.

Grant, Wilbur H., Geologist and Mining Engineer. Code: Bedford-McNeill. 1213 Hobart Bldg., San Francisco, Calif.

Greenough, W. Earl, Consulting Mining Engineer. Old Nat. Bank Bldg., Spokane, Wash.

Grugan, Justice F., Mining Engineer, 135 Broadway, New York. Cable address: Jusgrugan, New York.

Guess, H. A., Mining Engineer, 120 Broadway, New York City.

H

Hager, Dorsey, Petroleum Geologist and Engineer. 522 Fifth Ave. New York City.

Hall, R. G., Mining and Metallurgical Engineer, Resident Mgr. Burma Corp., Ltd., Namtu, Burma, Codes-Broomhalls, A. B. C. McNeill's.

Halloran, Will, Mining Engineer, Kingman, Ariz.

Halter, Carl P., Mining Engineer, Aptdo. 213, Chihuahua, Chuh, Mexico. Office No 510 Calle Ojinaga, Telegraph. Cdo. Chihuahua. Foreign Club. Cable Address: "Halter."

Hamilton, Beauchamp, Woodworth, Inc., Metallurgical Engineers. Specialy: The treatment of gold and silver ores, by flotation, by cyanide, or by a combination of both processes. Flotation of copper, lead, zinc and other minerals. Tests made on lots of 1 lb. up to 5 tons. Mills designed and constructed. Consulting and expert work undertaken. Laboratory and Office: 419 The Embarcadero, San Francisco, Calif. Telephone, Sutter 5266 Cable Address: "Hambeau." Codes: Western Union. Bedford-McNeill.

Hamilton, E. M. (Hamilton, Beauchamp, Woodworth Inc.) Metallurgist. Specialty: Cyaniding Gold and Silver Ores. 419 The Embarcadero, San Francisco, Calif.

Hammond, John Hays, Consulting Engineer 120 Broadway, New York, Code: Bedford-McNeill.

Hampton, William H., Mining & Civil Engineer; Chemist; Metallurgist; Water Supply; Electric Furnaces; Developments. 1270 Broadway, N. Y. City.

Hanks, Abbot A., Control and Umpire Assays. Ore Shippers' Agent, Analyses of Ores, Minerals, etc. 624 Sacramento St., San Francitsco, Calif.

Hardy, J. Gordon, Mining Engineer, 15 Brewster Terrace, Brookline, Mass.

Harper, Harry A., Mining Engineer. Manager Harper Co., Engineers and Importers, La Paz, Bolivia. Cable: Harper, Bentley's Code.

Hatfield & Co., Engineers, Specialists on the mechanical side of mining and ore dressing. 207 Market St., Newark, N. J.

Hawxhurst, Robert, Jr., Mining Engineer 234 Holbrook Bldg., San Francisco, Cal. Cable: Hawxhurst. Usual Codes.

Heinz, N. L., Engineer Rolling Mills for sheet zinc. commercial gages and sizes. 1519 Oliver Bldg., Pittsburgh, Pa.

Henderson, H. P., Mining Engineer. 60 Broadway, New York.

Hersey Co., Ltd., Milton, Mining Engineers. Consultation, Examination and Management. 84 St. Antoine St., Montreal, Can. Cable: "Milhersey"—Bedford McNeill Code.

Hess, Rush M., Mining Engineer. Examination. Consultation, Supervision. 807 Brown-Marx Bldg., Birmingham, Ala. Cable: "Rumiho, Code Bedford-McNeill."

Hilsdale, Paul, Mining Engineer, 821 Newhouse Bldg., Salt Lake City, Utah.

Hills, Victor G., Mining Engineer. McPhee Bldg., Denver, Colo.

Hodge, Edwin T., Consulting Geological and Mining Engineer, Standard Bank Bldg., Vancouver B. C. and Department of Geology Uitversity of Oregon, Eugene, Oregon.

Hoffmann, Ross B., Mining Engineers 228 Perry St., Oakland Calif. Cable Address "Silberhof."

Holden, Edwin C., Consulting Mining Engineer. 1100 Garrett Bldg. Baltimore Md. Code: Bedford-McNeill. Cable: "Nedioh." Baltimore.

Holland, L. F. S., Mining Engineer, 1718 La Brea Avenue, Hollywood, Cal.

Hollis, H. L., Consulting Mining Engineer and Metallurgist. 1025 Peoples Gas Building, Chicago, Ill.

Huntoon & Van Arsdale, Louis D. Huntoon, G. D. Van Arsdale, Mining Engineers, 115 Broadway, New York City

Hunt & Co., Robert W., Mining Engineers. Examinations and Reports of Properties and Processes. Development of Properties, Consultation Assayers and Chemists Inspection and Tests Materials, Machinery and Structural Steel for Structures. Chicago, Ill.

Hutchins, J. B., Mining Engineer. 120 Broadway, New York City, N. Y.

Hutchinson, Randolph B., Mining Engineer. 1008 Central Building, Los Angeles, Calif.

Hutchinson, W. Spencer, Mining Engineer. 201 Devonshire St., Boston, Mass.

I

Indiana Laboratories Co., The, Shippers' Representative. Weighing, Sampling, Assaying. Hammond, Ind. Phillipsburg, Mont.

J

Jaeger, Frederick, Chemist and Metallurgist. Specialty: Copper refining and manufacturing of sodium cyanide. 17 Gramercy Park, New York City.

Jenks, T. H., Con. Min. Eng., 1221 Royal Court, Los Angeles, Cal. Codes: Bedford-McNeil, Moreing & Neal.

Jones, C. Colcock, Mining Engineer. 917 Investment Bldg., Los Angeles, Calif. Code: Bedford McNeill.

Jones, William F., Oil and Coal examinations, topographic and geologic mapping. West Indian and Central American explorations. 222 Charles River Road, Cambridge, Mass.

Jüssen, Edmund, Mining Engineer. 2546 Warring St., Berkley, Cal. Code: Bedford-McNeill.

K

Keene, Amor F., Consulting Engineer. 233 Broadway, New York. Cable Address: Kamor, New York.

Keeney, Robert M., Consulting Metallurgical Engineer. Design, Construction and Operation of Electric Smelting Plants. Somersville, Conn.

Kepner, R. B., Consulting Mining Engineer. Examinations supervision of Mining Operations. Wire or Mail Address: Gardena, Calif.

Kinnon, William H., Mining Engineer and Metallurgist 801 Arizona St., El Paso, Texas.

Kinzie, Robert A., Mining Engineer. First National Bank Building, San Francisco, Calif.

Kirby, Edmund B., Mining and Metallurgical Engineer. 918 Security Bldg., St. Louis, Mo.

Klepetko, Frank, Mining and Metallurgical Engineer. 80 Maiden Lane, New York, and Apartado 708, Lima, Peru.

Knox, Newton Booth, 75b Queen Victoria St., London and at Noya, Spain. Cable Address: "Flueblower," London.

Knox & Allen, Henry H. Knox, John H. Allen. Mining and Metal Engineers. 160 Broadway, New York. Cable Address: "Allenox," New York.

Krejci, Milo W., Consulting Metallurgical Engi-
lead. Room 1904. 25 Broadway, N. Y.
neer. Smelting and refining of copper and

Krumb, Henry, Mining Engineer. Felt Building, Salt Lake City, Utah.

Kunz, George F., Gem Expert. Care Tiffany & Co., 401 Fifth Ave., New York.

Kyle, T. D., Assayer and Chemist. Mail samples Get Prompt Attention Mill Tests of All Kinds. Box 626, Leadville, Colo. Telephone 22.

L

Lachmund, Oscar, Mining Engineer and Metallurgist. Room 318 Symons Block, Spokane, Wash.

Ladd, D. H., Mining and Metallurgical Engineer. Eighth Floor, Barnes Bldg., Muskogee, Oklahoma.

Lakenan, C. B., Mining Engineer. McGill, Nev.

Lasier, Frederick G., Mining Engineer Holly, Mich., or care Detroit Club, Detroit, Mich.

Lawton, Nathan O., Mining Engineer. Mining Methods, Management, Examinations and Reports. Years of Experience. Code Bedford McNeill. Res. and Forwarding Address, Lawton, Mich.

Ledoux & Company, Chemists and Assayers, Representatives in all copper smelters, 99 John St. New York, N. Y.

Lee, Chester F., Mining Engineer. 328 Lyon Bldg., Seattle, Wash.

Lehmann, Charles, Mining Engineer. Examination and Management of Properties. Casilla, 1364, Santiago, Chile, S. A.

Le Fevre, S., Consulting Mining Engineer. Magnetic Iron Ore Testing Laboratory Available Forest Glen, Ulster County, N. Y.

Leonard Engineering Co., Mining Engineers, Chemists, Assayers, Metallurgists. P. O. Box 1[illegible], Idaho

LeVasseur, Charles, Cons. Mining Engineer, Examinations, Surveys, Reports, Development and Management of Mines. Yellville, Ark. [illegible]

Levensaler, Lewis A., Mining Engineer. 901 Hoge Bldg., Seattle, Wash.

Lidstone & Van Dorp, Mining and Metallurgical Engineers. Examinations and Management. Silver City, N. M.

Lindberg, Carl O., Mining Engineer, 1218 Pacific Mutual Life Building, Los Angeles, Calif.

Lindsley, Thayer, Mining Geologist. Peterboro, N. H.

Linton, Robert, Mining Engineer, 120 Broadway, New York. Union Arcade, Pittsburgh, Penn. Code: Bedford-McNeill.

Lloyd, R. L., Metallurgical Engineer. Specialty Pyrometallurgy of Copper and Associated Metals. 29 Broadway, New York. Cable Address: "Ricloy, New York." Codes: Bedford-McNeill and Miners & Smelters.

Locke, Augustus, Mining Geologist. 788 Mills Bldg., San Francisco, Calif.

Long, Frederic H., Consulting Mining and Metallurgical Engineer. 38 So. Dearborn St., Chicago, Ill.

Longyear Co., E. J., Exploring Engineers Diamond Core Drilling, Shaft Sinking and mine Development. Diamond Drill Manufacturing. Security Bldg., Minneapolis, Minn. Cable Address: "Longco," Code: Bedford-McNeill.

Loveman, Michael H., Mining Geologist, 36th floor. Telephone Barclay 7583. 233 Broadway, New York.

Lucke, P. K., Consulting Mining Engineer. Avenida Isabel la Catolica 25, Mexico City. Cable Address: Lucke, Mexico City.

M

MacBoyle, Errol, Mining Engineer and Geologist. 1112 Hobart Bldg., San Francisco. Cable: "MacBoyle," San Francisco. Usual Codes.

McClain & Cary, Mining & Metallurgical Engineers, Leadville, Colo.

MacDonald, Bernard, Mining and Metallurgical Engineer. Apto. 54, Parral, Chihuahua, Mexico. Code: Bedford-McNeill.

MacVichie, D., Mining Engineer. 916 Boston Bldg., Salt Lake City, Utah.

McCarthy & Co., Richard, Assayers, Chemists and Metallurgists. 56 East Granite St., Butte, Mont.

McGregor, A. G., Engineer. Design of Metallurgical Plants. Warren, Ariz.

Marsh, Austin G., Mining Engineer and Metallurgist, with the Pueblo Mining & Metallurgical Co., 123 N. Santa Fe Ave., Pueblo, Colo.

Martin, Rose H., Mining Engineer and Metallurgist, 63 Cullinan Bldg., Johannesburg. Telegrams, "Milo." Consultant, Executive, Investigations, Reports. Africa, South of Equator.

Mathewson, E. P., Consulting Engineer. Non-Ferrous Metallurgy. 42 Broadway, New York.

Mayer, Lucius W., Mining Engineer. Rogers, Mayer & Ball, 42 Broadway, New York. Cable Address: Alhasters.

Mead, H. L., Mining Engineer. American Cyanamid Co., 511 Fifth Ave., New York.

Meier & Co., Inc., A. J., Industrial Engineers. Organizing, Reorganizing, Financing. Properties Developed and Operated. 1000 Times Bldg., St. Louis, Mo.

Meissner, C. E., Mining Engineer, Mine Examination and Management. University Club, Bucarelli 35, Mexico City, Mexico.

Merrill Company, The. Chas. W. Merrill, Pres. Merrill Zinc Dust Precipitation Process, Crowe Vacuum Precipitation Process, San Francisco.

Miller, Howard A., Consulting Mining Engineer. Railway Exchange ldg., St. Louis, Mo.

Miller, Hugo W., Mining Engineer. Custom Assay Office. Specialty: Reliable Reports on Mexican Mines. Reasonable Charge.

Mills, Edwin W., Mining Engineer. 75 Yamashita-cho, Yokohama, Japan. Cable: "Edmills." Usual Codes.

Minard, Frederick H., Mining Engineer, 41 East 42nd St. Tel. Murray Hill 9076. Cable: "Frednard," New York. Code: Bedford-McNeill.

Mitke, Charles A., Consulting Mining Engineer. Mining Methods, Mine Ventilation. Bisbee, Ariz.

Mohave Assay and Engineering Office, R. C. Jacobson, I. C. Stricker, Mining Chemists and Engineers. Ore Testing Laboratory. Mining Reports, Mill Design, Mine Management. Kingman, Ariz.

Morris, F. L., Mining Engineer. 1057 Monadnock Bldg., San Francisco, Calif. Cable: "Fredmor." Code: Bedford-McNeill.

Mudd, Seeley W., Mining Engineer 1208 W. I. Hollingsworth Bldg., Los Angeles, Calif Code: Bedford-McNeill.

Mulliken, H. S., Consulting Metallurgist. Address Bureau of Mines, Washington, D. C. No professional engagements undertaker at the present time.

Munroe, H. S., Mining Engineer. Anyox, British Columbia.

Murphy, Chas. J., B. A. Sc. Engineering Service "The World is My Territory." St. Catherines, Ont., Canada.

Murias, E. R. Suarez, Mining Engineer and Geologist. Examinations and reports. Edificio Abreu, No. 414, Reilly & Mercaderes, Havana, Cuba

Myers, Desaix B., Mining Engineer. 433 Merchants National Bank Bldg., Los Angeles, Calif.

N

Nahl, Arthur C., Consulting Engineer. Care of Bocholl Ruffo & Co., La Paz, Baja California, Mexico

Neel, Carr B., Mining Engineer. Mineria 189, Lima Peru S. A. Cable: Carrneel Lima. Bedford McNeill Code.

Newberry, Andrew W., Mining Engineer. 2 Rector St., New York City.

Newman, M. H., Mining Geologist c/o American Zinc, Lead & Smelting Co., Mascot, Tenn.

O

Officer & Co., R. H., Assayers and Chemists. Oils, Hydrocarbons and Oil Shale Analyses. 169 Temple St Salt Lake City, Utah

O'Keeffe, Edward C., Metallurgy and Ore Dressing Test. Flat River Mo

Osborn, Walter X., Consulting Mining Engineer. Gila Bend, Arizona.

P

Packard, George A., Mining Engineer and Metallurgist 50 Congress St., Boston, Mass. Cable Address: "Geopack" Boston

Palmer, T. H., B E Fel Chem Soc etc, Consulting Engineer [illegible] Organizing Technical Advice Mining Metallurgy Flotation and Selective Flotation Processes Collins House Melbourne. Cable: "Remlap" Melbourne

Parrish, K. C., Mining Engineer. Apartado No 6. Baranquilla, Colombia, So. America. Cable Address "Parrish"

Patton, Horace B., Ph.D., Oil and Mining Geologist. 24 years Professor of Geology of Colorado School of Mines. 911 Foster Bldg., Denver Colo

Payne, C. Q., Mining Engineer. 82 Beaver St., New York

Payne, Henry Mace, Consulting Mining Engineer. Machinery Club 50 Church St New York City. Cable Address "[illegible]" N. Y.

Perry, O. B., Mining Engineer 120 Broadway, New York

Pickering, J. C., Consulting Mining Engineer. Avenida Juarez 83 Mexico City. Mexico. Cable Address: "Keringpec"

Piers, W. L., Assayer and Chemist Engineers' work and control. 428 18th St., Denver, Colo

Pitkin, Inc., Lucius, Chemists. Weighers. Samplers and Assayers of Ores and Metals of all descriptions 47 Fulton St., New York, N. Y. Cable Address: "Niktip"

Plate, H. Robinson, Mining Engineer Examinations Development and Management Hobart Bldg., San Francisco, Calif. Code, Bedford-McNeill

Poillon & Poirier, Howard Poillon, C H Poirier Mining Engineers, 42 Broadway, New York

Probert, Frank H., Mining Engineer. University of California Berkeley Calif

Purington, C. W., Mining Engineer c/o L. Birnie, Esq, 15 Naniwamachi, Kobe Japan

R

Rakowsky, Victor, Mining Engineer in the development Miami Zinc Fields, Oklahoma. Address Joplin, Mo Code Bedford McNeill

Reece, F. P., Mining Engineer. Specialty: Coal. Melcher Marion Co Iowa

Reed, Avery H., Mining Engineer Zinc and lead ores. Fluorspar Marion, Ky

Reid, J. A., Mining Engineer. O'Brein Mine. Cobalt, Ont.

Richards, Gragg, Mining Engineer 147 West [illegible] St., New York City.

Richards & Locke, Robert H Richards Charles E Locke Mining Engineers Careful Concentration Tests for Design of Flow Sheets for Difficult Ores 69 Massachusetts Ave., Cambridge 39 Mass

Ricketts, L. D., Consulting Engineer. 42 Broadway New York.

Ridge Roasting Furnace & Engr. Co., The, Mining and Metallurgical Engineers Base Metals and Complex Ores 2 Great Winchester St., London E C Cables "RIDGENZIE"

Ritter, Etienne A., Mining Engineer and Geologist Colorado Springs Colo

Rivoiret, M Raymond, Ingenieur des Mines Mortain Manche France

Roberts, Milnor, Mining Engineer The Pacific Northwest British Columbia and Alaska University Station Seattle Wash

Rogers, Allen Hastings, Consulting E. M 201 [illegible] St Boston Mass 42 Broadway, New York Cable Address [illegible], N Y

Rogers Edwin M., Consulting Mining Engineer. 42 Broadway, New York, N Y

Rogers, John C., Mining Engineer Examination and exploration of mining properties with a view to purchase Copper Cliff Ont

Rogers, Mayer & Ball Allen H Rogers [illegible] W Mayer Sydney H Ball Mining Engrs 42 Broadway N Y 201 Devonshire St, Boston, Mass Cable "Alhastaro"

Roller, Arthur H., Mining and Metallurgical Engineer Mine examinations ore treatments and management 448 Equitable Bldg., Denver Colo

Root & Simpson successors to [illegible] & Root established 1[illegible] Assayers and Metallurgical Chemists 1[illegible] Broadway, Denver Colo

Roward Lewis G., Mechanical Electrical and Metallurgical Engineer [illegible] Wall St New York

Royce Stephen Consulting Mining Engineer and Geologist Exploration Operating Valuation [illegible] [illegible] Wis

Royer Frank W. Mining Engineer 321 [illegible] Realty Bldg Los Angeles Calif [illegible] Code [illegible] Bedford McNeill Office & Residence Crystal Falls Mich

Rubidge, Frederick T., Examinations Development Management 41 [illegible] Street New York City

Rutherford, Forest, Consulting Metallurgist Ore Smelting Contracts investigated. Smelting and Milling of Copper and Lead ores. Designs and Construction 120 Broadway N Y

Rutledge, J. J., Phd., Mining Engineer and Geologist Not Open for Engagement at Present Care of Bureau of Mines, McAlester, Okla.

S

Saunders, T. Skewes, Mining Engineer University Club Bucareli 35, Mexico City Mexico

Schmidt, Henry C., Mining Engineer Estacion San Pedro F. C Nor Oeste de Mexico, Estado de Chihuahua, Mexico

Schroter, Geo. A., Mining Engineer 111 Broadway, New York.

Schwerin, Martin, Mining Engineer. General Manager Spar Mountain Mining Company, Cave-in-Rock, Hardin County, Illinois

Searle, Barry, Chemist and Min Eng Consultation, Examination and Management. Montrose, Penn Codes Bedford McNeill A. B. C

Sears, Stanley C., Mining Engineer Consultation Examination and Management. 705 Walker Bank Bldg., Salt Lake City, Utah. Usual Codes

Semple, C. Carleton, Mining Engineer and Metallurgist Care of Rocca & Miller, Lima, Peru, So. Am.

Seward, John Mining Engineer, Mine Valuation Engineer Income Tax Unit Room 5030 Interior Bldg Washington, D C

Shaler, Millard K., Mining Geologist and Engineer, 6 Rue des Colonies, Brussels, Belgium.

Sharpless, Fred'k F., Soc Am Inst of Mining and Metallurgical Engineers 29 West 39th St New York City Cable Address Fresharp N Y

Shaw, S. F., Mining Engineer Cia Minera La Constancia Sierra Mojada Coahuila Mexico

Shipp, E. Maltby, Consulting Mining Metallurgical Engineer and Timberland Factor 115 Broadway New York City

Short, Frank R., Mining Engineer. 1057 Monadnock Bldg., San Francisco Cable Address: "Muskeg."

Sill & Sill Mining and Metallurgical Engineers Examinations, Management. Geological Surveys. 1011 Figueroa St., Los Angeles, Calif.

Simonds, F. M., Mining Engineer 25 Madison Ave., New York

Sisk, John, Consulting Mining Engineer. Examinations reports management exploration, advice to investors in mining properties. Mayer, Arizona.

Smith, Gordon C., Examinations, Patents Geological Mapping Idaho Bldg, Boise Idaho

Smith & Ziesemer, Franklin W Smith Ralph A Ziesemer, Consulting Mining Engineers Bisbee, Ariz Bedford McNeill Code

Southern Minerals Company, Knoxville Tenn. Geo Blow Mining Engineer A M Blow, Metallurgical Engineer

Southwestern Engineering Co., Consulting Engineers. Specialty Flotation and Concentration Ores tested in any quantity up to 5 tons. Mills designed erected and operated Offices 1221-1223 Hollingsworth Bldg Los Angeles, Calif. Code address, "Southeng."

Spearman, Chas., B Sc M A Min Geologist and Engineer. Testing all Ores: Flow Sheets Specialty: Graphite Concentration. Power Bldg., Montreal, Que.

Spencer, L. B., Mining Engineer. Reports on Nevada Mines Mina Nev

Spilsbury, Persifor G., Mining and Metallurgical Engineer. 214 O Neill Bldg, Phoenix Ariz

Steele, Heath, Mining Engineer c/o Cia Minera de Penoles S A, Monterrey N Leon Mexico

Stevens, Frank G., Mining Engineer 77 Journal Bldg., Boston Mass and 16 Oakmount Road, [illegible]

Stevens, T. N., Engineer U S Mineral Surveyor. Surface and Underground Surveys 108 Scott St., Tucson Ariz

Stewart, Irvine F., Petroleum Geologist 214 Securities Building [illegible] Montana

Stewart, Robert H., Mining and Metallurgical Engineer Vancouver Block Vancouver B C

Strache, Walter, Mining Engineer, Bolsa Cochrane [illegible] Santiago Chile Cable Address: "[illegible]" Santiago

Strain James H, Consulting Engineer Examination of Mines for investors only. With Star Mica Mining Co 42 Broadway N Y., and Canaan N H

Strauss, Lester W., Engineer of Mines Casilla [illegible] Valparaiso Chile Cable Address "Lestra" Valparaiso Code Bedford McNeill (1906)

Sussman, Otto Ph D Mining Engineer 61 Broadway New York

T

Tanner, W L, Mining Engineer and Chemist High Explosives [illegible] Panasoff [illegible]

Taye Eugene A H Mining Engineer San Luis Potosi Mexico

Thayer, B B, Mining Engineer 42 Broadway New York

Thomas, D R, Mining Engineer [illegible] La Motaa Mexico City

Thomas, Kirby Consulting Engineer Examinations Mining Properties [illegible] [illegible] [illegible] Development New York

Thomas Marion L Mining Engineer 1 Rector St New York Code Bedford McNeill Cable Address "Malom"

Thomson, S. C., Consulting Engineer 43 Exchange Place New York Code Bedford-McNeill

Timmons, Colin, Mining Engineer Modena Utah

Tomlinson Engineering Co Engineers Metallurgists Mine Surveys and Development Examinations [illegible] [illegible] Arizona Ariz

Torbert, James B., Mining Engineer 201 Phillips Court Owensboro Ky

Tuttle Arthur L., Mining Engineer and Metallurgist Sulphuric Acid Room 1[illegible] 61 Broadway New York

Twining Laboratories The Assayers and Chemical Engineers Griffith McKenzie Bldg, Fresno Cal

Tyrrell J. B., Consulting Mining Engineer 534 Confederation Life Bldg Toronto Canada and 508 Salisbury House London E C England

U

Union Assay Office, Inc., Assayers and Chemists Box 1446, Salt Lake City Utah

V

Vandergrift, J. A., Consulting Engineer 115 Broadway, New York City Cable Address Javande, N. Y.

Van Emon A. G., Chemist Assayer Metallurgist 1119 Main St Boise Idaho

Van Wagenen, H. R., Mining Engineer General Manager Canada Copper Corporation Princeton, B. C

Van Winkle C. T., Mining Engineer Problems in Development Mining and Milling [illegible] Block, Salt Lake City, Utah

W

Ward, William F., Mining Engineer. Compania Minera [illegible] Pacifico Columbia S A Via Buena Ventura

Waring & Williams, Laboratories Industrial and Analytical Chemists Analyses Tests Metals Ores Zinc Lead Retorts Joplin Mo

Warriner, R. C. Consulting Mining Engineer Room 1804 43 Exchange Place New York

Watson, Ralph A., Mechanical Engineer Chief Engineer Tennessee Copper Company Copperhill, Tenn

Watson, R. B., Con Min Eng 165 Broadway New York Gen Mgr Nipissing Mining Co Ltd., Cobalt

Weekes, Frederic R., Mining Engineer 233 Broadway New York Telephone Barclay 7583

Wellman-Lewis Company, Contracting and Mining Engineers Specializing in mine examination and the supervision of development and operation of mines 900 Hibernian Bldg Los Angeles, Calif

Westervelt, William Young, Consulting Mining Engineer 522 Fifth Ave Cable address "Casewest" N Y Broomhall's Code

Wheeler, H. A., Mining Engineer Reports on Oil and Mining Properties 408 Locust St St. Louis Mo Cable "Wah" St Louis

White, Rush J., Mining Engineer Shoshone Bldg Wallace, Idaho

Whitman, Alfred R., Mining Geologist. Underground Programmes Orebody Problems 43 Exchange Place New York Haileybury Ontario (Cobalt District)

Wilfley, Clifford R., Mining Engineer Examinations and Management Ouray Colo

Wilkens & Devereux, W. B. Devereux, Jr., J. H Devereux Consulting Mining Engineers 120 Broadway New York 7 Victoria Avenue London Cable "Kenwood"

Witherell, Charles S., Metallurgical Engineer [illegible] N Y Phone Beekman 4957 Cable "Metwith"

Wolf, Harry J. Mining Engineer 42 Broadway New York Cable "Minewolf" New York Code Bedford McNeill

Wood Assaying Co., The Henry E., Assayers and Chemists 1[illegible] Arapahoe St Denver Colo P O Box No 1818

Wright, Charles W., Min Eng [illegible]

Wright, Ira L., Mining Engineer Examinations Consultation and Management of Mines Silver City N M

Wright, Louis A., [illegible] Bedford McNeill & [illegible]

Y

Yeatman and Berry [illegible] Mining Engineers Examinations [illegible] way New York [illegible] Code Bedford McNeill

Young, F. J [illegible] and Engineer [illegible] Los Angeles, Cal [illegible] Mexico [illegible] years experience in the [illegible]

Young [illegible]

Z

Zavrski Edward R Mining Engineer 8[illegible] Examinations [illegible] Management

Ziegler Victor [illegible] 415 [illegible] Golden 11[illegible]

WHAT AND WHERE TO BUY

A Classified Index of Advertisers in This Issue

For Alphabetical Index see Last Page

Acids
Grasselli Chemical Co.

Acid, Sulphuric
American Zinc & Chemical Co.
American Zinc, Lead & Smelting Co.
Hegeler Zinc Co.
Illinois Zinc Co.
Matthiessen & Hegeler Zinc Co.

Aerial Tramways
Amer. Steel & Wire Co.
Interstate Equip. Corp.

Agitators
Allis-Chalmers Mfg. Co.
Caldwell Co., Inc., W. B.
Dorr Co., The

Aluminum
Rogers, Brown & Co.

Amalgamators
Allis-Chalmers Mfg. Co.
Bunting Iron Works
Mine & Smelter Supply Co.

Analytical Apparatus
Braun Corporation
Braun-Knecht-Heimann-Co.
Denver Fire Clay Co.

Assaying
Baker & Co., Inc.

Balances
Denver Fire Clay Co.
Mine & Smelter Supply Co.

Belt Fasteners
Conveying Weigher Co.

Belting, Conveyor
Diamond Rubber Co.
Goodrich Rubber Co., The B. F.
Mine & Smelter Supply Co.
Robins Conveying Belt Co.
Stephens-Adamson Mfg. Co.

Belting, Elevator
Diamond Rubber Co.
Goodrich Rubber Co., The B. F.
Schieren Co., Charles A.

Belting, Leather
Schieren Co., Charles A.

Belting, Link Leather
Schieren Co., Charles A.

Belting, Perforated Leather
Schieren Co., Charles A.

Belting, Transmission
Diamond Rubber Co.
Goodrich Rubber Co., The B. F.
Schieren Co., Charles A.

Blasting Supplies
Grasselli Chemical Co.

Blowers
Buckeye Blower Co.
Connersville Blower Co.
General Electric Co.
Hendrie & Bolthoff M. & S. Co.
Mine & Smelter Supply Co.

Boilers
Abendroth & Root Mfg. Co.
Hendrie & Bolthoff M. & S. Co.
Mine & Smelter Supply Co.
United Iron Works, Inc.

Books, Technical
McGraw-Hill Book Co.

Boots and Shoes
Goodrich Rubber Co., The B. F.

Brick and Clay, Fire
Denver Fire Clay Co.

Brick, Fire
Harbison-Walker Refractories Co.

Bridges
Wisconsin Bridge & Iron Co.

Bridges, Ore Handling
Amer. Bridge Co.
Brown Hoisting Mchy. Co.

Bridges, Suspension
Roebling's Sons Co., J. A.

Buckets, Dredging and Excavating
Marion Steam Shovel Co.

Buckets, Elevator
Caldwell & Sons, H. W.
Hendrick Mfg. Co.
Jeffrey Mfg. Co., The
Stephens-Adamson Mfg. Co.

Buckets, Ore
Brown Hoisting Mchy. Co.
Mine & Smelter Supply Co

Cables, Insulated Telephone
Stromberg-Carlson Tel. Mfg. Co.

Cableways
Flory Mfg. Co., S.
Interstate Equipment Corp.
Lidgerwood Mfg. Co.
Roebling's Sons Co., J. A.

Cages, Hoisting
Allis-Chalmers Mfg. Co.
Atlas Car & Mfg. Co.
Car Dumper & Equip. Co.
Hendrie & Bolthoff M. & S. Co.
Mine & Smelter Supply Co.

Cans
Justrite Mfg. Co.,

Car Dumpers, Rotary
Car Dumper & Equip. Co.

Car Hauls
Car Dumper & Equip. Co.
Stephens-Adamson Mfg. Co.

Cars, Gable Bottom
Atlas Car & Mfg. Co.
Koppel Ind. Car & Equip. Co
Watt Mining Car Wheel Co.

Cars, Hopper
Atlas Car & Mfg. Co.
Koppel Ind. Car & Equip. Co.
Watt Mining Car Wheel Co.

Cars, Mine
Koppel Ind. Car & Equip. Co.
United Iron Works, Inc.
Watt Min'g Car Wheel Co.

Cars, Narrow Gauge
Easton Car & Const. Co.

Cars, Ore
Allis-Chalmers Mfg. Co.
Atlas Car & Mfg. Co.
Koppel Ind. Car & Equip. Co.
Mine & Smelter Supply Co.
Watt Min'g Car Wheel Co.

Cars, Quarry
Atlas Car & Mfg. Co.
Austin Mfg. Co.
Koppel Ind. Car & Equip. Co.

Castings, Iron and Steel
Marion Steam Shovel Co.

Cement, Belt
Schieren Co., Charles A.

Chains Transmission
Jeffrey Mfg. Co.
Stephens-Adamson Mfg. Co.

Chemical Apparatus
Braun Corporation
Braun-Knecht-Heimann-Co
Stephens-Adamson Mfg. Co.
Mine & Smelter Supply Co.
Oliver Cont. Filter Co.

Chemicals
Denver Fire Clay Co.
General Chemical Co.
Grasselli Chemical Co.
Nichols Copper Co.
Roessler & Hasslacher Chemical Co.

Circuit Breakers, Electric
General Electric Co.

Classifiers
Allis-Chalmers Mfg. Co.
Butchart, W. A.
Deister Machine Co.
Dorr Co., The
Mine & Smelter Supply Co.

Clay, Fire
Denver Fire Clay Co.

Clutches, Friction
Caldwell Co., Inc., W. B.
Stephens-Adamson Mfg. Co.

Coal Cutters
Goodman Mfg. Co.
Sullivan Machy. Co.

Coal and Ore Handling Machinery
Brown Hoisting Mchy. Co.
Jeffrey Mfg. Co., The
Lidgerwood Mfg. Co.
Stephens-Adamson Mfg. Co.

Coal Systems, Pulverized
Bonnot Co., The

Cocks
Lunkenheimer Co.

Coke
Rogers, Brown & Co.

Compressors, Air
Allis-Chalmers Mfg. Co.
Bury Compressor Co.
Chicago Pneumatic Tool Co.
Hendrie & Bolthoff M. & S. Co.
Oliver Cont. Filter Co.
Sullivan Machinery Co.

Compressors, Air Portable
Sullivan Machy. Co.

Compressors, Gasoline
Sullivan Machy Co.

Concentrators, Magnetic
Dings Magnetic Separator Co.

Concentrators, Table
Allis-Chalmers Mfg. Co.
Bunting Iron Works
Butchart, W. A.
Deister Concentrator Co.
Deister Machine Co.
Hendrie & Bolthoff M. & S. Co.
Mine & Smelter Supply Co.
United Iron Works, Inc.

Condensers
Alberger Pump & Condenser Co.

Contractors, Diamond Drilling
Longyear Co., E. J.
Sullivan Mchy. Co.

Controllers
Goodman Mfg. Co.

Converters, Electric Rotary
General Electric Co.

Converters, Horizontal and Vertical
Allis-Chalmers Mfg. Co.

Conveyor Magnets
Dings Magnetic Separator Co.

Conveyors and Elevators
Allis-Chalmers Mfg. Co.
Caldwell & Sons, H. W.
Jeffrey Mfg. Co., The
Robins Conveying Belt Co.
Stephens-Adamson Mfg. Co.

Conveyors, Belt
Jeffrey Mfg. Co., The
Robins Conveying Belt Co
Stephens-Adamson Mfg. Co.

Coolers
Stearns-Roger Mfg. Co.

Copper
American Metal Co.
American Smlg. & Refg. Co.
Balbach Smlg. & Refg. Co.
Hardy & Ruperti, Inc., Chas.
Nichols Copper Co.
U. S. Smltg. Ref. & Mg. Co.

Copper Steel Sheets
Amer. Sheet & Tin Plate Co.

Copper Sulphate
Nichols Copper Co.

Couplings, Hose, High Pressure
Knox Mfg. Co.

Cranes, Locomotive
Brown Hoisting Machy. Co.
Osgood Co.

Cranes, Traveling
Brown Hoisting Mchy. Co.
Niles-Bement-Pond Co.

Creosote
Barrett Co.

Creosoting Cylinders for Treatment of Timber
Vulcan Iron Works

Crucibles
Denver Fire Clay Co.

Crushers
Allis-Chalmers Mfg. Co.
Austin Mfg. Co.
Bacon, Earle C.
Braun Corporation, The
Braun-Knecht-Heimann-Co.
Jeffrey Mfg. Co., The
Mine & Smelter Supply Co.
Smith Engrg. Works Co.
Stephens-Adamson Mfg. Co.
United Iron Works, Inc.

Crusher Parts
Jeffrey Manufacturing Co.

Cupels
Denver Fire Clay Co.

Cups, Grease (See "Grease Cups")

Cyanide
Roessler & Hasslacher Chemical Co.

Cyanide Plants
National Tank & Pipe Co.

Dealers, Machinery (Rails, Pipe & Misc. Equipment)
Boyle Jr., John
Heineken, W. P.
Merchants Steel & Supply Co.
Morse Bros. Machy. & Supply Co.

Desulphurizers, Ore
Vulcan Iron Works

Dewaterers
Oliver Cont. Filter Co.

Diamonds, Black (See "Carbons and Borts"

Dragline Excavators
Bucyrus Co.

Dredges
Flory Mfg. Co., S.
Marion Steam Shovel Co.
Morris Machine Works
New York Engineering Co.
Osgood Co.
Union Construction Co.
Yuba Manufacturing Co.

Dredges, Dipper and Hydraulic
Bucyrus Co.

Dredges, Elevator
Marion Steam Shovel Co.

Dredges, Placer
Bucyrus Co.

Dredging Machinery
Lidgerwood Mfg. Co.

Drilling, Core
Ameling Prospecting Co.,
Longyear Co., E. J.
McKiernan-Terry Drill Co.
Pennsylvania Drilling Co.
Sullivan Machinery Co.

Drills, Churn
Union Construction Co.

Drills, Core
Longyear Co., E. J.
McKiernan-Terry Drill Co.
Sullivan Machinery Co.

Drills, Diamond
Longyear Co., E. J.
Sullivan Machinery Co.

Drills, Electric
Chicago Pneumatic Tool Co.
General Electric Co.
Jeffrey Mfg. Co., The

Drills, Hammer
Chicago Pneumatic Tool Co.
Cochise Machine Co.
Denver Rock Drill Mfg. Co.
McKiernan-Terry Drill Co.
Sullivan Machinery Co.

Drills, Piston
Cochise Machine Co.
Sullivan Machinery Co.

Drills, Prospecting
Longyear Co., E. J.
New York Engineering Co.
Sullivan Machinery Co.

Drums, Magnetic
Dings Magnetic Separator Co.

Dryers, Ore
American Process Co.
Vulcan Iron Works

Dryers, Sand and Coal
American Process Co.
Vulcan Iron Works

Dumps, Rotary
Car Dumper & Equip. Co

Dust Protectors (See "Respirators")

Dynamite
Hercules Powder Co.

Electrical Supplies
Hendrie & Bolthoff, M. & S. Co.
Mine & Smelter Supply Co.

Elevators
Austin Mfg. Co.

Elevators, Bucket
Jeffrey Mfg. Co., The
Stephens-Adamson Mfg. Co.

Engines, Gas and Gasoline
Allis-Chalmers Mfg. Co.
Chicago Pneu. Tool Co.
Fairbanks, Morse & Co.
Mine & Smelter Supply Co.

Engines, Hoisting
Flory Mfg. Co., S.

Engines, Oil
Allis-Chalmers Mfg. Co.
Chicago Pneu. Tool Co.
Fairbanks, Morse & Co.
Hendrie & Bolthoff M. & S. Co.
McIntosh & Seymour Corp.

Engines, Steam
Allis-Chalmers Mfg. Co.

Excavators, Cableway
Lidgerwood Mfg. Co.

Excavators, Dragline
Bucyrus Co.

Excavating Machinery
Marion Steam Shovel Co.

Exhausters
Connersville Blower Co.

Explosives
Hercules Powder Co.

Extinguishers, Fire
Justrite Mfg. Co.

Fans, Ventilating
Buckeye Blower Co.
General Electric Co.
Jeffrey Mfg. Co., The
United Iron Works, Inc.

Feeders, Ore
Jeffrey Mfg. Co., The
Mine & Smelter Supply Co
Stephens-Adamson Mfg. Co.

Ferro Alloys
Rogers, Brown & Co.

Filter Cloth
Filter Fabrics Co.

Filter Paper
Denver Fire Clay Co.

Filters
Chicago Pneu. Tool Co.
Oliver Cont. Filter Co.

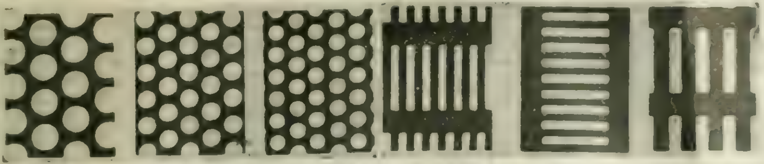
Filters, Cloth Metallic
Oliver Cont. Filter Co.

Filters, Concentrate
Oliver Cont. Filter Co.

Filters, Cyanide
Oliver Cont. Filter Co.

PERFORATED METAL

All sizes and shapes of Holes



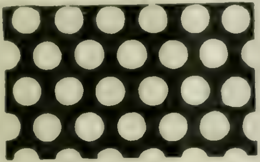
All kinds and thicknesses of Metal

FOR SCREENING ORES—ROCK—GRAVEL—SAND—COAL AND ALL MINERALS

The Harrington & King Perforating Company

620 No. Union Avenue, Chicago, Ill., U. S. A.
New York Office: 114 Liberty Street

"HENDRICK" Perforated Metals
for every purpose



Conveyor Trough and Flights. Buckets (plain and perforated). Stacks and Tanks. General Sheet Iron Work. Light and heavy steel plate construction.

Hendrick Mfg. Co., Carbondale, Pa.
New York Office: 30 Church St.
Pittsburgh Office: 915 916 Union Bank Bldg.

SCREENS
Any Kind, Style or Size for all purposes made from "Perforated Metals."

Pittsburgh Perforating Co.
3221 Spruce Way and A. V. R. R.,
Pittsburgh, Pa.

SCREENS OF ALL KINDS
Chicago Perforating Co.
2443 West 24th Place
Tel. Canal 1459 CHICAGO, ILL.

HERRINGBONE CUT GEARS
FAWCUS
MILL DRIVES
SPEED REDUCERS
SPUR
WORM
BEVEL GEARS
FAWCUS MACHINE CO. PITTSBURGH, PA.

FLORY HOISTS
S. FLORY MFG. CO., BANGOR, PA.
95 Liberty St., New York
House Building, Pittsburgh, Pa.
Monadnock Block, Chicago, Ill.
Chas. T. Lohman, Birmingham, Ala.
Farquhar Machinery Co., Jacksonville, Fla.
A. L. Young Machinery Co., San Francisco, Cal.
Get the Catalog

NICHOLS
Copper Company

Refiners of
COPPER

Consignments of Ore, Mattes and Blister Copper Solicited

Manufacturers of
COPPER SULPHATE
(BLUE VITRIOL)

LAUREL HILL, Borough of Queens, New York
and 25 Broad Street, New York

Wuest Herringbone Gears
Make 20 to 1 Reductions Possible

Herringbone Construction and the Wuest Patent make wonderful single reductions possible. Let us tell you all about it in our descriptive matter. Write.

THE FALK CORPORATION, Milwaukee, Wis.
Successors to *The Falk Co.*

MAAG GEARS
Strongest at the base
Where others are weakest
NILES-BEMENT-POND CO.
111 Broadway, New York City

Filters, Water
Scaife, Wm. B., & Sons Co

Flood Lighting Projecters
General Electric Co.

Flotation Apparatus
Denver Fire Clay Co.

Flotation Cell Bottoms, Cloth
Filter Fabrics Co.

Flotation Machines
Butchart, W. A.
Stimpson Equipment Co.

Flotation Oils
Barrett Co.
General Naval Stores Co.
Hercules Powder Co.
Pensacola Tar & Turpentine Co.

Fluorspar
Rogers, Brown & Co.

Forges
Denver Fire Clay Co.
Monarch Eng. & Mfg. Co.
Sullivan Eng. & Mfg. Co.

Forgings, Manganese Steel
Manganeses Steel Forge Co.

Furnaces, Assay
Braun Corporation, The
Braun-Knecht-Heimann-Co.
Denver Fire Clay Co.
Mine & Smelter Supply Co.

Furnaces, Bullion Melting
Denver Fire Clay Co.
Mine & Smelter Supply Co.
Monarch Eng. & Mfg. Co.

Furnaces, Crucible Tilting and Refining
Mine & Smelter Supply Co.
Monarch Eng. & Mfg. Co.

Furnaces, Crucible, Tilting Metal
Mine & Smelter Supply Co.
Monarch Eng. & Mfg. Co.

Furnances, Electric
Denver Fire Clay Co.
General Electric Co.

Furnace Faces & Linings
Denver Fire Clay Co.

Furnaces, Heat Treatment
Denver Fire Clay Co.

Furnaces, Mechanical Roasting
Allis-Chalmers Mfg. Co.
General Chemical Co.
Mine & Smelter Supply Co.
Wedge Mechanical Furnance Co.

Furnaces, Melting
Denver Fire Clay Co.

Furnaces, Smelting
Allis-Chalmers Mfg. Co.

Fuses, Electric
General Electric Co.

Gage Cocks
Ohio Brass Co.

Gas Producers
Wood & Co., R. D.

Gaskets
Diamond Rubber Co.
Goodrich Rubber Co., The B. F.

Gears
Caldwell & Sons Co., H. W.
Fawcus Machine Co.
General Electric Co.
Jeffrey Mfg Co., The
Niles-Bement-Pond Co.
Philadelphia Gear Wks.
Stephens-Adamson Mfg. Co.

Gears, Bevel
Caldwell & Sons Co., H. W.
Fawcus Machine Co.
Philadelphia Gear Works

Gears, Cut and Worm
United Iron Works, Inc.

Gears, Herringbone
Falk Corporation The
Niles-Bement-Pond Co.
Philadelphia Gear Works

Gears, Spur
Philadelphia Gear Works

Gears, Worm
Philadelphia Gear Works

Generators, Electric
General Electric Co.

Glass Blowing
Denver Fire Clay Co.

Glassware, Chemical
Denver Fire Clay Co.

Gravel Washing Plants
Stephens-Adamson Mfg Co.

Grease
Cook's Sons Adam

Grease Cups
Cook's Sons, Adam
Lunkenheimer Co., The

Grinders, Chemical Ore
Braun Corporation
Braun-Knecht-Heimann-Co.

Grinders, Manganoid Pebble
Jeffrey Mfg. Co., The

Grinders, Ore
Freese & Co., E. M.
Mine & Smelter Supply Co.

Grinders, Sample
Mine & Smelter Supply Co.

Hammers, Forging
Sullivan Machy. Co.

Headframes, Mine
Amer. Bridge Co.

Headlights, Incandescent Mine
General Electric Co.
Goodman Mfg. Co.

Heaters, Feed Water
Alberger Pump & Cond. Co.

Hoists, Compressed Air
Flory Mfg. Co., S.

Hoists, Electric
Allis-Chalmers Mfg. Co.
Brown Hoisting Machy. Co.
Chicago Pneu. Tool Co.
Flory Mfg. Co., S.
Hendrie & Bolthoff Mfg. & Supply Co.
Lidgerwood Mfg. Co.
United Iron Works, Inc.
Vulcan Iron Works.

Hoists, Friction
Austin Mfg. Co.

Hoists, Gasoline
Lidgerwood Mfg. Co.

Hoists, Mine Compressed Air
Lidgerwood Mfg. Co.

Hoists, Mine Steam
Lidgerwood Mfg. Co.

Hoists, Portable
Flory Mfg. Co., S.
Hendrie & Bolthoff Mfg. & Supply Co.
Lidgerwood Mfg. Co.
Mine & Smelter Supply Co.
Sullivan Machy. Co.

Hoists, Skip
Flory Mfg. Co., S.
Lidgerwood Mfg. Co.

Hoists, Steam
Allis-Chalmers Mfg. Co.
Flory Mfg. Co., S.
Hendrie & Bolthoff Mfg. & Supply Co.
Lidgerwood Mfg. Co.
Mine & Smelter Supply Co.
United Iron Works, Inc.
Vulcan Iron Works

Hose
Diamond Rubber Co.
Goodrich Rubber Co., The B. F.

Hose, Air
Denver Rock Drill Mfg. Co.

Hose, Couplings, High
Knox Mfg. Co.

Houses, Steel Shaft
Amer. Bridge Co.

Hydraulic Trip Controls
Car Dumper & Equip. Co.

Idlers, Conveyor
Conveyor Weigher Co.

Injectors
Lunkenheimer Co.

Instruments, Surveying
Berger & Sons Co., C. L.
Buff & Buff Mfg. Co.

Insulating Materials, Electric
General Electric Co.

Jackets, Water
Allis-Chalmers Mfg. Co.

Jigs
Allis-Chalmers Mfg. Co.
Mine & Smelter Supply Co.

Joints, Expansion
Alberger Pump & Cond Co.

Kilns, Rotary
Allis-Chalmers Mfg. Co.
Vulcan Iron Works

Laboratory Machinery
Braun Corporation, The
Braun-Knecht-Heimann-Co.
Denver Fire Clay Co.
Mine & Smelter Supply Co.
Oliver Cont. Filter Co.

Lacing, Leather
Schieren Co., Charles A

Lamps, Electric
General Electric Co.

Lamps, Acetylene
Justrite Mfg. Co.

Lead
American Metal Co.
American Smlg. & Ref. Co.
Am. Zinc, Lead & Smlg. Co.
Hardy & Ruperti, Inc., Chas.

Lightning Arresters
General Electric Co.

Line Material, Overhead
Ohio Brass Co.

Linings, Ball and Tube Mill
Allis-Chalmers Mfg. Co.
Los Angeles Foundry Co.

Loading Booms, Adjustable
Jeffrey Mfg. Co., The

Loaders, Wagon
Jeffrey Mfg. Co., The

Locomotives, Compressed Air
Porter Co., H. K.

Locomotives, Electric
Goodman Mfg. Co.
General Electric Co.
Jeffrey Mfg. Co., The

Locomotives, Electric Storage Battery
Atlas Car & Mfg. Co.
General Electric Co.
Goodman Mfg. Co.
Jeffrey Mfg. Co., The
Koppel Ind. Car & Equip. Co.
Whitcomb Co., Geo. D.

Locomotives, Gasoline
Vulcan Iron Works
Whitcomb Co., Geo. D.

Locomotives, Industrial
General Electric Co.
Goodman Mfg. Co.
Jeffrey Mfg. Co., The
Porter Co., H. K.
Whitcomb Co., Geo. D.

Locomotives, Mine
General Electric Co.
Goodman Mfg. Co.
Jeffrey Mfg. Co., The
Porter Co., H. K.
Whitcomb Co., Geo. D.

Locomotives, Steam
Porter Co., H. K.
Vulcan Iron Works

Log Washers, Magnetic
Dings Magnetic Separator Co.

Lubricators
Lunkenheimer Co.

Machine Tools
Niles-Bement-Pond Co.

Magnetic Pulleys
Dings Magnetic Separator Co.

Magnets, Electro
Dings Magnetic Separator Co.

Magnets, High Intensity
Dings Magnetic Separator Co.

Magnets, Safety
Dings Magnetic Separator Co.

Mechanical Draft Apparatus
Buckeye Blower Co.

Mechanical Lubricators
Lunkenheimer Co.

Metals, Perforated
Allis-Chalmers Mfg. Co.
Harrington & King Perforating Co., The
Hendrick Mfg. Co.
Pittsburgh Perforating Co.

Meters, Electric Current
General Electric Co.

Mills, Ball, Tube and Pebble Rod
Allis-Chalmers Mfg. Co.
Hendrie & Bolthoff Mfg. & Supply Co.
Mine & Smelter Supply Co.

Mills, Stamp
Allis-Chalmers Mfg. Co.
Hendrie & Bolthoff Mfg. & Supply Co.

Mineral Magnetic Separators
Dings Magnetic Separator Co.

Mixers
Smith Eng. Works Co.

Motors
Allis-Chalmers Mfg. Co.
Fairbanks, Morse & Co.
General Electric Co.

Motor Generator Sets
Atlas Car & Mfg. Co.
Fairbanks, Morse & Co.
General Electric Co.

Motor Control
General Electric Co.

Motor Trucks
Chicago Pneu. Tool Co.

Mucking Machines
Myers-Whaley Co.

Netting, Wire
Ludlow-Saylor Wire Co.

Nickel
Nichols Copper Co.

Nodulizers, Ore
Vulcan Iron Works

Oil Cups
Cook's Sons, Adam
Lunkenheimer Co.

Oil, Pine
Hercules Powder Co.

Ore, Buyers and Sellers of
American Metal Co.
Am. Smelting & Refining Co.
Am. Zinc & Chemical Co.
Am. Zinc, Lead & Smlg. Co.
Balbach Smlg. & Ref. Co.
Bartlesville Zinc Co.
Grasselli Chemical Co.
Hardy & Ruperti, Inc., Chas.
Hegeler Zinc Co.
Illinois Zinc Co., The
International Smelting Co.
Irvington Smelting & Refining Works
Matthiessen & Hegeler Zinc Co.
Phelps, Dodge Corp.
United Metals Selling Co.
United States Smelting, Refining & Mining Co.

Overhead Line Material
General Electric Co.

Packing
Diamond Rubber Co.
Jenkins Bros.

Packing, Hydraulic
Schieren Co., Charles A.

Perforated Metals
(See Metals, Perforated)

Pipe Fittings
Crane Co.

Pipe Fittings, Bronze
Lunkenheimer Co.

Pipe, Spiral, Riveted
Abendroth & Root Mfg. Co.

Pipe, Wood
National Tank & Pipe Co.
Pacific Tank & Pipe Co.

Platinum
Baker & Co., Inc.
Bishop & Co., Platinum Works, J.

Powder, Blasting
Grasselli Chemical Co.
Hercules Powder Co.

Power Plant Equipment
Crane Co.
General Electric Co.

Power Transmission, Mchy.
Caldwell Sons Co., H. W.
General Electric Co.
Stephens-Adamson Mfg. Co.

Preservative, Wood
(See Creosote)

Presses, Filter
Oliver Cont. Filter Co.
Shriver & Co., T.

Publishers, Technical Book
McGraw-Hill Book Co.

Pulleys, Magnetic
Dings Magnetic Separator Co.

Pulverizers, Coal
Jeffrey Mfg. Co., The

Pulverized Coal Systems
Bonnot Co., The

Pulverizers, Ore
American Pulverizer Co.
Braun Corporation, The
Braun-Knecht-Heimann-Co.
Jeffrey Mfg. Co., The
Mine & Smelter Supply Co

Pumping Engines
Allis-Chalmers Mfg. Co.
Prescott Co., The

Pumps, Acid
Oliver Cont. Filter Co.

Pumps, Centrifugal
Alberger Pump & Cond. Co.
De Laval Steam Turbine Co.
Fairbanks-Morse & Co.
Krogh Pump & Machy. Co.
Mine & Smelter Supply Co.
Morris Machine Works
Oliver Cont. Filter Co.
United Iron Works, Inc.

Pumps, Deep Well
United Iron Works, Inc.

Pumps, Electric
Alberger Pump & Cond. Co.
Hendrie & Bolthoff Mfg. & Supply Co.
Keystone Driller Co.
Krogh Pump & Mchy. Co.
Oliver Cont. Filter Co.
Prescott Co., The

Pumps, Hydraulic
Prescott Co., The

Pumps, Mill
Krogh Pump & Mchy. Co.
Morris Machine Works
Oliver Cont. Filter Co.
Prescott Co., The

Pumps, Mine
Alberger Pump & Cond. Co
Allis-Chalmers Mfg. Co.
Fairbanks-Morse & Co.
Hendrie & Bolthoff Mfg. & Supply Co.
Krogh Pump & Mchy. Co.
Mine & Smelter Supply Co.
Morris Machine Works
Prescott Co., The
United Iron Works, Inc.

Pumps, Pneumatic Air Lift
Sullivan Machinery Co.

Pumps, Power Plant
Alberger Pump & Cond. Co.
Fairbanks-Morse & Co.
Morris Machine Works
Prescott Co., The

Pumps, Reciprocating
Prescott Co., The

Pumps, Sand, Slime and Tailings
Box Iron Wks., Wm. A.
Dorr Co., The
Krogh Pump & Mchy. Co.
Morris Machine Works

Pumps, Sinking
Krogh Pump & Mchy. Co.
Prescott Co., The

Pumps, Steam
Prescott Co., The

Pumps, Vacuum
Chicago Pneu. Tool Co.
Connersville Blower Co.
Oliver Cont. Filter Co.
Sullivan Machinery Co.

Rail Bonds
General Electric Co.

Rails, Light Steel
West Virginia Rail Co.

Railways, Narrow Gauge
Easton Car & Const. Co.

Refractories
Harbison-Walker Refractories Co.

Respirators
Diamond Rubber Co.
Goodrich Rubber Co., The B. F.

Rheostats, Liquid
General Electric Co.

Riddles, Wire
Ludlow-Saylor Wire Co.

Roasters, Ore
Vulcan Iron Works Co.

Rolls, Crushing
(See "Crushers")

Roofing, Sheet Steel
Amer. Sheet & Tin Plate Co.

Rope, Rawhide
Schieren Co., Charles A.

Rope, Wire
Amer. Steel & Wire Co.
Leschen & Sons Rope Co., A.
Roebling's Sons Co., John A.

Rules, Measuring
Lufkin Rule Co.

Safety Magnets
Dings Magnetic Separator Co.

Samplers, Ore
Allis-Chalmers Mfg. Co.
Hendrie & Bolthoff Mfg. & Supply Co.
Mine & Smelter Supply Co.

Scraper Loaders
Goodman Mfg. Co.

Screens
Allis-Chalmers Mfg. Co.
Austin Mfg. Co.
Butchart, W. A.
Jeffrey Mfg. Co., The
Mine & Smelter Supply Co.
Stephens-Adamson Mfg. Co.
Stimpson Equipment Co.

Leschen Wire Rope Is Dependable

When you buy Leschen Wire Rope you are not experimenting with an untried article, for its ability has been proven by its service record. For heavy mine hoisting and hauling and for use on steam shovels, excavators, etc., we recommend HERCULES (Red-Strand) Wire Rope, because its unusual durability enables it to work with marked economy under such conditions.

Established 1857

A. Leschen & Sons Rope Co.
St. Louis, Mo.
New York Chicago Denver
San Francisco

A. LESCHEN & SONS ROPE CO.
LESCHEN
ST. LOUIS

American Wire Rope
AND
AERIAL WIRE ROPE TRAMWAYS
Send for Illustrated Catalogue
American Steel & Wire Company
Chicago-New York

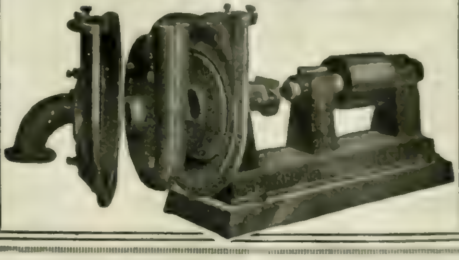
Partial List of Prominent Users
Alaska Juneau Gold Mining Co.
Anaconda Copper Mining Co.
Arizona Copper Co.
Atolia Mining Co.
Beatson Copper Co.
Belmont Milling Co.
Braden Copper Co.
Chas. Butters Co.
Butte & Superior Mining Co.
Cananea Consolidated Mining Co.

KROGH SAND PUMPS

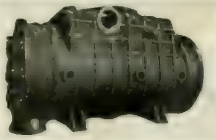
are properly designed and contain the necessary material to make their design practical. Renewable [illegible] and [illegible] of special deep [illegible] steel, [illegible] as hard as [illegible] steel and equally as durable, and their moderate operating speeds are factors of design and construction that you should investigate.

Write for illustrated bulletin No. 79.

Krogh Pump & Machinery Co.
147 Beale Street, San Francisco, Calif.
Sinking Pumps — Centrifugal Pumps
Motor Driven Pumps—Dredge Pumps



RIBLET AERIAL TRAMWAYS
Automatic, High-Speed; Self-Adjusting Positive Grip.
Tell us in detail what you wish to accomplish
Riblet Tramway Co., Spokane, Wash



"ALBERGER"
Surface Condensers and Auxiliaries
Send for Bulletin No. 22
Alberger Pump & Condenser Co.
140 Cedar St. New York City
[illegible]

Automatic Aerial Tramway
Strength
Simplicity
Economy
are achieved in our equipment
INTERSTATE EQUIPMENT CORP.
25 Church Street, New York City

MORRiS Since 1864
CENTRIFUGAL PUMPS
Since 1864 we have been building Centrifugal Pumps, Hydraulic Dredges and Steam Engines. You can depend upon the Morris [illegible].
Morris Machine Works, Baldwinsville, N. Y.
[illegible]
[illegible]

Trolley Supplies, Rail Bonds
Porcelain Insulators
The Ohio Brass Company
MANSFIELD, OHIO

De Laval
Steam Turbine Co., Trenton, N. J.
Builders of TURBINE MACHINERY including Steam Turbines of all capacities for high or low-pressure steam and for direct connection or for belt or gear drive. Complete Turbo-Generator Sets. Centrifugal Pumps for all Heads and capacities. Centrifugal Blowers and Air Compressors.
Write for special bulletins on apparatus in which you are interested.

"The Uniformly good drill Steel"
A. MILNE & CO. New York Boston

S. MORGAN SMITH CO.
York, Pa.
Builders of High-Grade Water Power Equipment
Write Dept. "J" for Bulletin
[illegible] Federal St., BOSTON [illegible] W. Monroe St., CHICAGO [illegible] MONTREAL 461 Market St., SAN FRANCISCO

Screens, Incline, Vibratory
Jeffrey Mfg. Co., The

Screens, Perforated Metal
Allis-Chalmers Mfg. Co.
Chicago Perforating Co.
Harrington & King Perforating Co., The
Hendrick Mfg. Co.
Pittsburgh Perforating Co.
United Iron Works, Inc.

Screens, Revolving
Allis-Chalmers Mfg. Co.
Box Iron Wks., Wm. A.
Harrington & King Perforating Co., The
Hendrie & Bolthoff Mfg. & Supply Co.
Jeffrey Mfg. Co., The
Stephens-Adamson Mfg. Co.

Screens, Rolled Slot
Ludlow-Saylor Wire Co.

Screens, Wire
Ludlow-Saylor Wire Co.

Second-Hand Machinery (See Searchlight Section)
Boyle, John Jr.
Heineken, W. P.
Merchants Steel Supply Co.
Morse Bros. Mach. & Supply Co.

Selenium
Nichols Copper Co.

Separators, Magnetic
Dings Magnetic Separator Co.
Stearns-Roger Mfg. Co.

Separators, Magnetic Wet
Dings Magnetic Separator Co.

Shaft Sinking
Longyear Co., E. J.

Sharpeners, Drill
Sullivan Machinery Co.

Sheet Iron Works
Hendrick Mfg. Co.

Sheet Steel, Black or Galvanized
Amer. Sheet & Tin Plate Co.

Shoveling Machines
Myers-Whaley Co.

Shovels, Electie
Marion Steam Shovel Co.

Shovels, Power
Bucyrus Co.
Myers-Whaley Co.

Shovels, Steam, Gas and Electric
Marion Steam Shovel Co.

Skips
Allis-Chalmers Mfg. Co.
Atlas Car & Mfg. Co.
United Iron Works, Inc.

Skip Hoists
Jeffrey Mfg. Co., The

Slate Working Machinery
Flory Mfg. Co.

Smelters
American Smlg. & Ref. Co.
Am. Zinc, Lead & Smlg. Co.
Balbach Smlg. & Ref. Co.
Grasselli Chemical Co.
Illinois Zinc Co.
International Smelting Co.
Matthiessen & Hegeler Zinc Co.
Nichols Copper Co.

Solders
U. S. Smlg., Ref. & Mg. Co.

Spouts, Magnetic
Dings Magnetic Separator Co.

Steam Specialties
Crane Co.

Steel, Drill
Milne & Co., A.

Steel, Hollow & Solid
Milne & Co., A.

Steel, Manganese, Rolled & Forged
Manganese Steel Forge Co.

Steel, Structural
United Iron Works, Inc.
Wisconsin Bridge & Iron Co.

Steel, Tool
Milne & Co., A.

Superheaters
Power Specialty Co.

Switchboards
Allis-Chalmers Mfg. Co.
General Electric Co.
Hendrie & Bolthoff Mfg. & Supply Co.

Switchboards, Telephone
Stromberg-Carlson Tel. Mfg. Co.

Tanks, Steel
Caldwell Co., Inc., W. E.
United Iron Works, Inc.

Tanks, Wood
Caldwell Co., Inc., W. E.
Mine & Smelter Supply Co.
National Tank & Pipe Co.
Pacific Tank & Pipe Co.

Tapes, Measuring
Lufkin Rule Co.

Telephones, Mine
Stromberg-Carlson Tel. Mfg. Co.

Thickeners
Dorr Co., The

Timbers, Steel Shaft
Amer. Bridge Co.

Tin & Terne Plates
Amer. Sheet & Tin Plate Co.

Track Work, Narrow Gauge
Easton Car & Const. Co.

Tractors
Yuba Manufacturing Co.

Tramways, Wire Rope, Aerial
Interstate Equipment Corp.
Leschen & Sons Rope Co., A.
Riblet Tramway Co.
Roebling's Sons Co., J. A.

Transformers, Electric
Allis-Chalmers Mfg. Co.
General Electric Co.

Trolley Line Material
De Laval Steam Turbine Co.
General Electric Co.
Ohio Brass Co.

Tube Testers, Magnetic
Dings Magnetic Separator Co.

Tungsten
Hardy & Ruperti, Inc., Chas.

Turbines, Hydraulic
Allis-Chalmers Mfg. Co.
Smith Co., S. Morgan

Turbines, Steam
Allis-Chalmers Mfg. Co.
General Electric Co.

Turbines, Water
Allis-Chalmers Mfg. Co.
Smith Co., S. Morgan

Turntables
Easton Car & Const. Co.

Valves
Crane Co.
Jenkins Bros.
Lunkenheimer Co., The
Whitcomb Co., Geo. D.

Valves, Check
Lunkenheimer Co., The

Valves, Globe
Lunkenheimer Co., The

Valves, Blow-off
Lunkenheimer Co., The

Valves, Non-Return
Lunkenheimer Co., The

Valves, Pop Safety
Lunkenheimer Co., The

Valves, Pump
Jenkins Bros.

Valves, Rubber Pump
Diamond Rubber Co.
Goodrich Rubber Co., The B. F.

Valves, Throttle
Knox Mfg. Co.
Lunkenheimer Co., The

Water Columns
Lunkenheimer Co., The

Water Softening & Purifying Apparatus
Scaife & Sons Co., Wm. D.

Water Wheels
Smith Co. ,S. Morgan

Welders, Portable Electric
Ohio Brass Co.

Wheels & Axles, Car
Watt Mining Car Wheel Co.

Wheels, Car
United Iron Works, Inc.
Watt Mining Car Wheel Co.

Whistles
Hendrie & Bolthoff Mfg. & Supply Co.
Lunkenheimer Co., The

Wire Cloth
Ludlow-Saylor Wire Co.

Wire, Flat, Round and Special Shape
Amer. Steel & Wire Co.
Roebling's Sons Co., John A.

Wire, Insulated
General Electric Co.
Goodrich Rubber Co., The B. F.
Roebling's Sons Co., John A.
Stromberg-Carlson Tel. Mfg. Co.

Wire, Magnet
Amer. Steel & Wire Co.
Stromberg-Carlson Tel. Mfg. Co.

Wire Rope Fittings
Roebling's Sons Co., John A.

Wire Rope Slings
Roebling's Sons Co., John A.

Wire Welding
Roebling's Sons Co., John A.

Wood Preservative (See "Creosote")

Wrenches, Alligator
Roebling's Sons Co., John A.

Zinc
American Metal Co.
American Smlg. & Ref. Co.
Am. Zinc, Lead & Smlg. Co.
Grasselli Chemical Co.

Zinc Dust
American Metal Co.
American Smlg. & Ref. Co.
Am. Zinc & Chemical Co.
Bartlesville Zinc Co.
Grasselli Chemical Co.

Zinc Oxide
American Metal Co.
Am. Zinc & Chemical Co.
Bartlesville Zinc Co.

Zinc, Sheet
Grasselli Chemical Co., The
Illinois Zinc Co.
Matthiessen Hegeler Zinc Co.

It's Direct—

THE SHORT WAY between the man with mining equipment to sell, and the buyer, is Engineering & Mining Journal. When you have idle machinery to dispose of advertise it in the Searchlight Section of the Engineering & Mining Journal. No trouble; no delay; very little expense.

"Searchlight" Service
Secures Satisfactory Sales

DUXBAK NUTAN

Steamproof—Leather Belting

The Belt that can stand the boiling test.

Chas. A. Schieren Company

Tanners
Belt Manufacturers
Main Office and Factory:
39 Ferry Street,
New York
Tanneries:
Bristol, Tenn.

Branches and Distributors in all leading cities throughout the World

---

CALDWELL

HALF a million dollars worth of well selected stock constantly maintained, and an organization keyed up to the theory that plant efficiency is measured by the number of orders shipped on the day of receipt, accounts for Caldwell service. Let us figure on your requirements.

H. W. Caldwell & Son Co.
LINK-BELT COMPANY, OWNER
Chicago, 17th St. and Western Ave.
DALLAS, TEXAS, 709 Main Street
NEW YORK, 299 Broadway

ROBINS CONVEYING MACHINERY

Our Handbook of Conveyor Practice describes the successful solution of many materials handling problems. Write for a copy.

ROBINS CONVEYING BELT COMPANY

New York, 13 Park Row **Chicago, Old Colony Building**
Salt Lake City, Newhouse Bldg. **Pittsburgh, Pa., Union Arcade Bldg.**
San Francisco, The Griffin Co. Toronto, Gutta Percha & Rubber Ltd. Birmingham, Ala., C. B. Davis Eng. Co.

Ball Bearing Belt Conveyors

Trump Measuring and Mixing Machines
Merrick Conveyor Weighers for Belt Conveyors

The Conveying Weigher Co. 90 West St., N. Y.

NEW YORK ENGINEERING CO.

2 Rector Street, New York

Gold and Tin

DREDGES

"EMPIRE" PROSPECTING DRILLS
Placer Mining Machinery

Write for the Catalogs

OSGOOD

Steam Shovels

Revolving and Railroad Types
¾–8 cu. yd. capacity

Get full information

THE OSGOOD CO.
Marion, Ohio

Don't Cling to Hand Shoveling

Your request brings the Catalog.

When there is an established and standard shoveling machine completely applicable to your work—the MYERS-WHALEY.

MYERS-WHALEY CO.
Knoxville, Tenn.

BUCYRUS

Steam and Electric Shovels
Dredges, Dragline Excavators
Coal Loaders

BUCYRUS COMPANY

DREDGES FOR GOLD AND TIN

UNION CONSTRUCTION CO.

361 California St., San Francisco, Cal.

Neill Jigs—Union Churn Drills

BROWNHOIST

Locomotive Cranes
Grab Buckets
Drag-Line Buckets
Electric Hoists
Tramrails & Trolleys
Overhead Tr. Cranes
Pillar & Jib Cranes
Heavy Dock Machinery

THE BROWN HOISTING MACHINERY CO.
Cleveland, Ohio

YUBA GOLD DREDGES

Yuba Ball Tread Tractors. Yuba Centrifugal Pumps.

THE YUBA MANUFACTURING COMPANY

Works: Marysville, Cal. Sales Offices: 433 California Street San Francisco, Cal.

"Marion" Quality Maintained With Increased Production

The Marion Steam Shovel Co.
Marion, Ohio, U. S. A.

ALPHABETICAL INDEX TO ADVERTISERS

Page
Abendroth & Root Mfg. Co. 22
Alberger Pump & Condenser Co. 39
Allis-Chalmers Mfg. Co. 14
Ameling Prospecting Co., Inc. 20
American Bridge Co. 20
American Metal Co., Ltd., The 30
American Process Co. 24
American Sheet & Tin Plate Co. 26
American Smelting & Refining Co. 31
American Steel & Wire Co. 39
American Zinc & Chemical Co. 30
American Zinc, Lead & Smelting Co. 27
Atlas Car & Mfg. Co., The 23
Austin Mfg. Co. 25

Bacon, Earle C., Engineer 25
Baker & Co., Inc. 28
Balbach Smelting & Refining Co. 27
Barrett Co., The 21
Bartlesville Zinc Co. 28
Berger & Sons, C. L. 26
Bishop & Co., Platinum Wks. J. 28
Bonnot Co., The 25
Box Iron Wks. Wm. A 42
Braun Corporation, The 24
Braun-Knecht-Heimann Co. 24
Brown Hoisting Mchy. Co., The 41
Buckeye Blower Co. 42
Bucyrus Co. 41
Buff & Buff Mfg. Co. 42
Bunting Iron Works 19
Bury Compressor Co. 25
Butchart, W. A. 24

Caldwell & Son, H. W. 41
Caldwell Co., Inc., W. E. 22
Car Dumper & Equipment Co. 23
Chicago Perforating Co. 37
Chicago Pneumatic Tool Co. 16

Page
Cochise Machine Co. 22
Connersville Blower Co., The 42
Conveying Weigher Co., The 41
Cook's Sons, Adam 23
Crane Co. 20

Deister Concentrator Co., The 26
Deister Machine Co. 5
DeLaval Steam Turbine Co. 39
Denver Fire Clay Co., The 9
Denver Rock Drill Mfg. Co., The 7
Diamond Rubber Co. 4th Cover
Dings Magnetic Separator Co. 3rd Cover
Directory of Engineers 32
Dorr Co., The 25

Easton Car & Construction Co. 23

Fairbanks, Morse & Co. 26
Falk Corporation, The 37
Fawcus Machine Co. 37
Filter Fabrics Co., The 20
Flory Mfg. Co., S. 37
Freese & Co., E. M. 25

General Chemical Co. 26
General Electric Co. 17
General Naval Stores Co. 21
Goodman Mfg. Co. 23
Grasselli Chemical Co., The 30

Harbison-Walker Refractories Co. 20
Hardy & Ruperti, Inc., Chas. 26
Harrington & King Perforating Co., The 37
Hegeler Zinc Co., The 28
Hendrick Mfg. Co. 37
Hendrie & Bolthoff Mfg. & Supply Co. 6
Hercules Powder Co. 21

Illinois Zinc Co. 28
International Smelting Co. 29
Interstate Equipment Corp. 39
Irvington Smelting & Refining Works 28

Page
Jeffrey Mfg. Co., The 4
Jenkins Bros. 20
Justrite Mfg. Co. 24

Keystone Driller Co. 22
Knox Mfg. Co. 20
Koppel Industrial Car & Equipment Co. 23
Krogh Pump & Mchy. Co., The 39

Leschen & Sons Rope Co., A. 39
Lidgerwood Mfg. Co. 21
Longyear Co., E. J. 22
Los Angeles Foundry Co. 25
Ludlow-Saylor Wire Co., The 8
Lufkin Rule Co., The 26
Lunkenheimer Co., The 10

Manganese Steel Forge Co. 25
Marion Steam Shovel Co., The 41
Matthiessen & Hegeler Zinc Co. 30
McGraw-Hill Book Co., Inc. 24, 27
McIntosh & Seymour Corp. 26
McKiernan-Terry Drill Co. 20
Milne & Co., A. 39
Mine & Smelter Supply Co., The 25
Monarch Engineering & Mfg. Co. 26
Morris Machine Works 39
Myers-Whaley Co. 11

National Tank & Pipe Co. 22
New York Engineering Co. 41
Nichols Copper Co. 37
Niles-Bement-Pond Co. 37

Ohio Brass Company, The 39
Oliver Continuous Filter Co. 42
Osgood Co., The 41

Pacific Tank & Pipe Co. 22
Pennsylvania Drilling Co. 22
Pensacola Tar & Turpentine Co. 21

Page
Phelps-Dodge Corporation 28
Philadelphia Gear Works 12
Pittsburgh Perforating Co. 37
Porter Co., H. K. 22
Power Specialty Co. 20
Prescott Co., The 13

Riblet Tramway Co. 39
Robins Conveying Belt Co. 41
Roebling's Sons Co., John A. 26
Roessler & Hasslacher Chemical Co., The 30
Rogers, Brown & Co. 28

Scaife & Sons Co., Wm. B. 20
Schieren Co., Chas. A. 41
Searchlight Section 18
Shriver & Co., T. 42
Smith Co., S. Morgan 39
Smith Engineering Works 25
Standard Diamond Drill Co. 22
Stearns-Roger Mfg. Co., The 25
Stephens-Adamson Mfg. Co. 2nd Cover
Stimpson Equipment Co. 25
Stromberg-Carlson Telephone Mfg. Co. 25
Sullivan Machinery Co. 20

Union Construction Co. 41
United Iron Works, Inc. 24
United Metals Selling Co. 29
United States Smelting, Refining and Mining Co. 31

Vulcan Iron Works 15

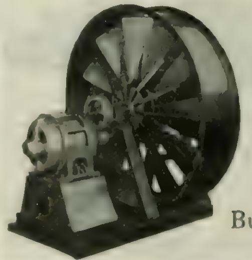
Watt Mining Car Wheel Co., The 23
Wedge Mechanical Furnace Co. 11
West Virginia Rail Co., The 23
What and Where to Buy 36
Whitcomb Co., Geo. D. 23
Wisconsin Bridge & Iron Co. 26
Wood & Co., R. D. 22

Yuba Mfg., The 41

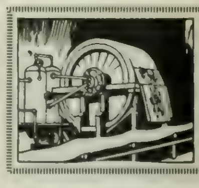
INDEX TO SEARCHLIGHT SECTION

Goldsmith Bros 18
Marshall, Wm A. 18
Merchants Steel & Supply Co. 18
More Bros. Machy & Supply Co. 18
Nashville Industrial Corp. 18
Scott, G. S. 18

TOO MANY
Electric Mine Hoists, Leadville Hoists, Timber Framers, Denver Sirens in stock; the Boss says sell them at about HALF PRICE. Hurry.
The William A. Box Iron Works Co., Denver, Colorado



BUCKEYE
Economical Mine Fans
Correct design and high grade construction are the two big reasons for the economy of Buckeye Disc Mine Fans. They require no attention except occasional oiling. These fans have 12 blades. They run smoothly and quietly at high speeds.
Ask for Bulletins.
Buckeye Blower Co.
Columbus, Ohio



OLIVER FILTERS KEEP RUNNING
insuring
ECONOMY OF OPERATION
Write us for complete information
OLIVER CONTINUOUS FILTER CO.
San Francisco 501 Market St.
New York 33 W. 42d St.
London 11 Southampton Row

SHRIVER FILTER PRESSES
Write for catalogue, stating filtration problems.
T. SHRIVER & CO.
826 Hamilton St., Harrison, N. J.

Blowers Exhausters
The Connersville Blower Co.
Connersville, Ind.
Boosters Pumps

BUFF Mining Transits and Levels
Our Mr. Geo. L. Buff, years ago, made whole transits by contract for Stackpole & Son, who, from 1860 to 1870 held the record for the best.
Send for Catalogue 29.
Buff & Buff Mfg. Co., Jamaica Station, Mass.
Chicago, 231 No. Wells St. 46 Dey St., New York

TA
1
E42
v.112

E/MJ. Engineering and
mining journal

~~Physical &~~
~~Applied Sci.~~
~~Serials~~

Engineering

PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY

ENGIN STORAGE